

Promotion of breastfeeding in Costa Rica: the Puriscal study

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The decline in rate and duration of breastfeeding in urban areas in developing countries seems to have resulted from the transition from extended to nuclear families and exposure of young mothers to influences affecting their breastfeeding attitude and working patterns.^{1,2} Experimental studies have demonstrated that early mother-infant stimulation has a marked promoting effect on breastfeeding and bonding, and that man behaves like many animal species regarding mechanisms governing nursing and rearing behaviour.^{3,4} Breastfeeding is also declining in rural areas in many countries, due to profuse advertising of infant formulas and to 'Westernization' of ways of life.^{1,5} It was not obvious, however, that many failures to breastfeed in urban and rural areas have an origin in practices adopted during pregnancy, childbirth, and its aftermath.¹ Such practices have proliferated as institutionalized delivery increased in the last decades, expanding to rural populations throughout developing countries. In Costa Rica, only 50 per cent of births occurred in maternity wards in 1960, but in 1970 the rate had risen to 70 per cent and to 91 per cent in 1980. The increase in hospital deliveries was not accompanied, until 1977, by promotion of early mother-infant stimulation, bonding, and nursing, since strict separation and formula feeding of infants unfortunately had been established for about 10 years.

This chapter summarizes observations recorded during 1976-83 in all the 77 847 live borns delivered in the San Juan de Dios Hospital, one of the largest and more prestigious institutions of Costa Rica.^{7,9} Observations were also made on neonates from a mountainous rural region, Puriscal, who were born during the period September 1979 to September 1980 primarily in the hospital.^{10,11} Possible effects of hospital practice were expected to influence rates and duration of breastfeeding, and health and growth of Puriscal neonates born after the interventions.

Procedure

Population

The 77 847 live-borns belonged to a large sector of the capital city, Metropolitan San José, and to several countries of the southern mountainous rural areas

which include Puriscal.¹⁰ The population of Spanish and Spanish-Amerindian descent constitute 152 localities dispersed in valleys and hills. Localities are 'rural dispersed' with less than 500 people, or 'rural concentrated' with 500 to 2000 people. Puriscal, like most of rural Costa Rica, is more developed than other rural areas of Latin America.

Interventions in the hospital

From 1966 until August 1977, mothers and newborns were separated after delivery and during the postpartum period. During this pre-intervention period, pre-term and high-risk neonates were fed glucose solution and infant formula. Mothers and infants were only reunited at discharge, generally one to three days afterwards, or later when maternal infections, Caesarean section or illness had occurred. Pre-term and high-risk neonates may have remained separated for weeks. In September 1977 a series of innovations were initiated by two of the authors (MAA and JRA), (Table 9.1).^{7,8}

Rooming-in was initiated in September 1977. Infants born during the day stayed with their mothers. Infants born at night were separated until a neonatologist examined them the following morning. If found normal, they were then given to their mothers during the day. Pre-term, high-risk, and other ill neonates (about 5 per cent of the total) were separated from their mothers and kept in an adjoining room under medical supervision.

Colostrum feeding of all neonates started in 1978 favoured by rooming-in and a milk bank was established in December 1977 adjacent to the rooming-in ward. Donation of colostrum and milk was carried out before or after mothers breastfed their own infants. Neonates with respiratory distress syndrome, congenital abnormalities, birth trauma, infections or other pathology, received about 3-5 ml/kg of body weight/day fresh pooled human colostrum and milk. The pool was collected in sterile plastic bottles with the aid of breast pumps and was kept under refrigeration and used not later than 18 hours after collection.⁷ Colostrum was administered by tube or bottle as early as four hours after birth and generally at eight hours, but some very ill infants received colostrum at a later date. Healthy neonates (about 95 per cent of the total) suckled colostrum from their own mothers.

Early mother-infant stimulation was started in 1979, and covered about one-half of the mother-infant pairs by the end of the year. Newborns were given to their mothers naked or clothed. Eye-to-eye contact, and stimulation of the infant's mouth and maternal nipple were emphasized by nurses in the delivery room, but was not universally practical. This intervention favoured early sucking of colostrum by the infant.

All these interventions have been successful. The hospital environment has improved and a relaxed and optimistic atmosphere prevails in the rooming-in wards.^{8,9} The paediatricians are no longer apprehensive about administration of fresh colostrum to very small and immature neonates. They have also relaxed

Table 9.1. Interventions in the gynaecology and obstetrics service, San Juan de Dios Hospital, 1977-83

Intervention	Date of onset*	Description	Approximate population exposed (%)
Mother-infant separation: formula-feeding	1969-76	Brief visual contact at delivery; total separation during hospitalization Infants fed glucose solution and milk formulas	100
Rooming-in	September 1977	Infants stayed with mothers for about 8 h per day; infants separated at night	66 (in 1977) 95 (in 1978 +)
Colostrum; promotion of breastfeeding	January 1978	Colostrum and milk given to pre-term and high-risk neonates Education of nurses and mothers on lactation practices	50 (mid-1978) 95 (in 1979 +)
Early stimulation	July 1979	Skin-to-skin contact Sucking nipple shortly after birth Physical contact of mothers and pre-term and high-risk neonates	50 (end-1979) 75 (in 1980 +)

*Once started, interventions were maintained up to the present time.

regulations in the ward for high-risk and pre-term babies, demanding less rigid use of clothing and permitting entrance of relatives to the ward. Interventions have been in operation for six years and an additive effect is expected. Other improvements in the hospital have been an increased number of paediatricians, improved diagnostic and therapeutic procedures, and enlarged physical facilities. The possible effect of these changes on early neonatal morbidity and mortality could not be quantified during the observation period (1977-83). A significant improvement in fetal growth was documented in the country as the prevalence of low birth weight fell from 9.2 per cent to 7.5 per cent from 1970 to 1975;⁶ no further improvement in fetal growth has been recorded since 1975.

Analysis of hospital data

The hospital records for 1975-83 were examined by three paediatricians who accurately determined the number of live births, characteristics of newborns, and early neonatal morbidity and mortality. Neonates with pathology were transferred to the neighbouring National Children's Hospital. Care was taken to record the evolution of each neonate being transferred. The data of two years pre-intervention (1975-76) were compared with data of the period 1977-83.

The following definitions were used. *Infection* (acute) comprised diarrhoea, sepsis, bronchopneumonia, and meningitis. *Diarrhoea* is an increased frequency of watery stools and/or the presence of blood and mucus in the stools; diarrhoea may occur in the first 48 hours after birth, but most cases appear after 48 hours; all cases occurring during the time in hospital were included in the tabulation. *Sepsis* is a state accompanied by pallor, impaired sucking, hypothermia, hypotension, shock, hepatosplenomegaly, and altered platelet and leukocyte counts; most cases were diagnosed in the first 48 hours. *Bronchopneumonia* is characterized by respiratory distress confirmed by chest radiography; almost all bronchopneumonia occurred in the first week of life; neonates with aspiration pneumonia were excluded. *Meningitis* is accompanied by pallor, weak sucking, hypothermia, hypotension, tense fontanelle with separation of sutures, convulsions, and a pathognomonic cerebrospinal fluid profile; meningitis is diagnosed during the first week of life; deaths also are observed in the first week. Early neonatal morbidity and mortality rates were expressed as cases or deaths observed in the first week of life per 1000 live births, using as denominator either all live births or live births with less than 38 weeks of gestation.

Breastfeeding in the hospital is defined as the successful sucking at the nipple several times daily making it unnecessary to administer infant formula. *Abandonment of the newborn* is the act of giving the child away, generally in the hospital or upon discharge. Infants abandoned are classified as *well* if they are healthy with adequate gestation and birth weight, or *ill* if they are pre-term, low birth weight, or have birth defects, infections or other pathology.

Interventions in Puriscal

Because Puriscal homes are hard to reach in the widely-dispersed area, most mothers were interviewed in the hospital. Upon discharge, mother-infant dyads were kept under surveillance by personnel stationed at INISA's field station in Puriscal. Co-ordination with health workers from the Ministry of Health was required for coverage of the highly scattered population.

The first yearly cohort comprised 605 infants, distributed in three subcohorts according to type and intensity of intervention and prospective observation^{8,9} (Table 9.2). The rural dispersed districts of Grifo Alto, Barbacoas, and Candelarita (subcohort 1.1) were visited by a field worker within the first 10 days postpartum, and by the physician and health nurse through monthly con-

Table 9.2. Subcohorts of the Puriscal study, 1979-81

Subcohort	Subcohort districts	Type of population	Field interventions*
1.1 (115)†	Grifo Alto Barbacoas Candelarita	Rural dispersed	Visit by INISA's field worker within 10 days postpartum Contact with INISA's physician Monthly visits by INISA's field workers
1.2 (270)	Mercedes Sur Desamparaditos San Antonio San Rafael	Rural dispersed	Monthly visits by health workers from Ministry of Health Occasional contact with INISA's physician
1.3 (220)	Santiago	Rural concentrated and dispersed	Occasional contact with health personnel from Social Security Bureau, Ministry of Health, and INISA

*Infants in all subcohorts were equally stimulated in the hospital (see text).

†Number of infants born into subcohort.

sultations. Visits served to collect data on physical growth, breastfeeding, food intake, and morbidity. Mother-infant pairs of Mercedes Sur, Desamparaditos, San Antonio, and San Rafael (subcohort 1.2), equally rural and dispersed, were visited monthly by the staff of the Ministry of Health in co-ordination with INISA, to collect information on breastfeeding and physical growth. Contact with INISA's physician and field staff was less than for subcohort 1.1. Mother-infant pairs of the control district of Santiago (subcohort 1.3) of rural dispersed and concentrated population, had easy access to Puriscal health resources and those of the capital city. Monthly visits were primarily by the staffs of the Social Security and the Ministry of Health.

Breastfeeding was evaluated until complete weaning, by prospective observation for three years. *Duration of breastfeeding*, with or without supplements, was expressed in months. *Age of weaning* was the month in which the child was definitely separated from the breast.

Results

Breastfeeding in the hospital

The rate of breastfeeding in *well* (healthy) neonates was 95 per cent; exceptions were related to Caesarean section, or to pathology in the mother. Some pre-term

and high-risk (*ill*) neonates separated from the mother were also breastfed. All *ill* neonates received colostrum and milk from the mother or donors.

Abandonment of newborns

A significant decline in the rate of abandoned infants was noted shortly after effecting rooming-in and other interventions (Table 9.3). The reduction was more marked for *well* than for *ill* infants, but the decrease in rate of abandonment of the latter was also clear. The socio-economic crisis hitting the country since 1980 apparently correlated with an increase in rate of abandonment from 4.4 to 6.4 per 10 000, from 1982 to 1983.

Table 9.3. Hospital interventions and abandonment of newborns, San Juan de Dios Hospital, 1976-83

Period (Oct.-Sept.)	No. of live births	Intervention*	Newborns (rate/10 000)		
			<i>Well</i>	<i>Ill</i>	Total
1976-77	8988	A	9(10,0)†	10(10,1)	19(21,1)
1977-78	9143	B	3(3,3)	7(7,7)	10(10,9)
1978-79	8737	B + C	1(1,1)	5(5,7)	6(6,9)
1979-80	8972	B + C + D	1(1,1)	5(5,6)	6(6,7)
1980-81	8837	B + C + D	2(2,3)	2(2,3)	4(4,5)
1981-82	9045	B + C + D	0	4(4,4)	4(4,4)
1982-83	9370	B + C + D	3(3,2)	3(3,2)	6(6,4)††
% reduction in rates, 1976-83			100	60	79

*See Table 9.1.

†Newborns abandoned due to death, mental disorder or retardation of the mother are excluded. *Well*, healthy, adequate birth weight, and gestational age; *Ill*, hospitalized, pre-term or with serious pathology.

††Three cases due to difficult economic conditions, one rejection by families; one alcoholism in mother; one unknown.

Early neonatal infectious morbidity and mortality

Early neonatal morbidity declined abruptly after interventions were established (Table 9.4), particularly for diarrhoea and bronchopneumonia and acute necrotizing enterocolitis disappeared. Evidently, the need for antibiotics decreased sharply. No comparable decrease in congenital defects, immaturity, and asphyxia were observed. The increase in diarrhoea morbidity in 1983 reflected an outbreak related to failure in aseptic technique during preparation of bottles and nipples.

While the number of deaths attributed to infection was already low before the interventions were effected, a marked decline was nevertheless observed (Table 9.5, Fig. 9.1). The most noticeable change was the disappearance of deaths due

Table 9.4. Early neonatal morbidity attributed to infection, and interventions, San Juan de Dios Hospital, Costa Rica, 1975-83

Year	Intervention*	No. of live births†	Number (%) of live births < 38 wk gestation	Cases (rate/1000 live births < 38 weeks)			
				Diarrhoea	Sepsis	Bronchopneumonia	Meningitis
1975	A	7415	497(7.7)	59(118.7)	46(92.6)	42(84.5)	10(20.1)
1976	B	7629	589(7.7)	135(229.2)	41(69.6)	32(54.3)	10(17.0)
1977	B	8852	618(7.2)	72(121.3)	52(84.1)	35(56.6)	5(8.1)
1978	B + C	8931	597(6.7)	62(103.8)	29(48.6)	27(45.2)	12(20.1)
1979	B + C + D	8638	437(5.1)	55(125.8)	28(64.1)	18(41.2)	0
1980	B + C + D	8978	412(4.6)	14(34.0)	32(77.7)	22(53.4)	1(2.4)
1981	B + C + D	8879	541(6.1)	1(1.8)	30(55.4)	13(24.0)	3(5.5)
1982	B + C + D	9271	621(6.7)	1(1.6)	28(45.2)	8(12.9)	1(1.6)
1983	B + C + D	9254	735(7.9)	6(8.2)	29(39.5)	8(10.9)	0
% change in rates, 1976-82			+3	-93	-57	-87	-100
Significance††				< 0.01	< 0.05	< 0.05	< 0.01

*See Table 9.1.

†Excluding those with < 1000 g.

††Test of equality of rates between 1975 and 1982, by approximation to normal distribution.

Table 9.5. Early neonatal mortality attributed to infection, and interventions, San Juan de Dios Hospital, Costa Rica, 1975-83

Year	Intervention*	Deaths (rate/1000 live births < 38 wks gest.)				
		<i>Diarrhoea</i>	<i>Sepsis</i>	<i>Bronchopneumonia</i>	<i>Meningitis</i>	Total
1975	A	3(6.0)	9(18.1)	6(12.1)	2(4.0)	20(40.2)
1976	A	3(5.1)	7(11.9)	4(6.8)	2(3.4)	16(27.2)
1977	B	1(1.6)	9(14.6)	6(9.7)	2(3.2)	18(29.1)
1978	B + C	0	4(6.7)	1(1.7)	4(6.7)	9(15.1)
1979	B + C + D	0	4(9.1)	0	0	4(9.1)
1980	B + C + D	0	4(9.7)	0	0	4(9.7)
1981	B + C + D	0	4(7.4)	2(3.7)	0	6(11.1)
1982	B + C + D	0	4(6.4)	2(3.2)	1(1.6)	6(9.7)
1983	B + C + D	0	4(5.4)	1(1.4)	0	5(6.8)
% change in rates 1975-82		- 100	- 70	- 88	- 100	- 83
Significance†			< 0.05	< 0.01	< 0.01	< 0.01

*Interventions and number of live births < 38 weeks of gestation as in Tables 9.1 and 9.4.

†Test of equality, 1975 versus 1982.

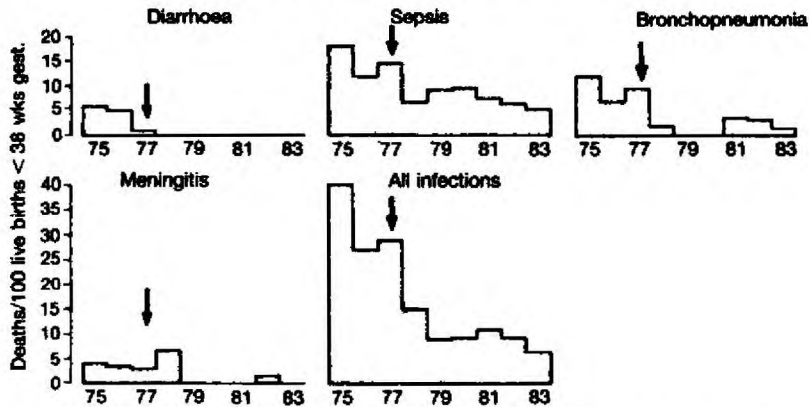


Fig. 9.1. Hospital neonatal mortality attributed to infection in the first week of life during 1975–82. The period January 1975 to January–August 1976 was pre-intervention. The arrow indicate the time in which rooming-in started. Note the reduction in deaths due to diarrhoea, meningitis, and other infections (Mata 1984).

to diarrhoea. No significant reduction in mortality due to congenital defects, immaturity, and asphyxia was recorded.

Duration of breastfeeding after hospital discharge

Data on the whole Puriscal cohort (excluding infants whose families emigrated from the area) were compared in Table 9.6 with data of the 1976 World Fertility Survey (WFS) for Costa Rica.¹² A significant increase in the mean duration (from 5 to 8.7 months) and median (from 1.8 to 6.9 months) of breastfeeding was noted for Puriscal infants, when compared with the 1976 WFS. Furthermore, differences were noted in duration of breastfeeding for the three subcohorts (Table 9.6) (Fig. 9.2), as follows: the more stimulated rural dispersed

Table 9.6. Duration of breastfeeding (months) after interventions, Puriscal, Costa Rica, 1976–83

Population	Mean	Median
Costa Rica (WFS, 1976)*	5.0	1.8
Puriscal, 1979–83		
Subcohort 1.1, r.d.†	12.6	11.4
Subcohort 1.2, r.c.	7.8	7.9
Subcohort 1.3, r.d.–c.	7.6	5.9
Total cohort	8.7	6.9

*World Fertility Survey.¹²

†r.d., rural dispersed; r.c., rural concentrated; r.d.–c., rural dispersed–concentrated.

Programmes to Promote Breastfeeding

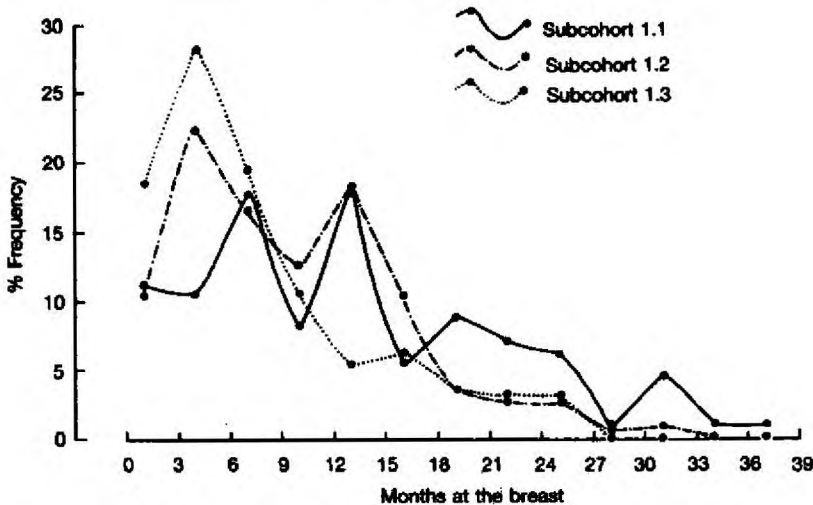


Fig. 9.2. Duration of breastfeeding in three subcohorts of Puriscal infants observed during their first three years of life. A significantly longer duration was noted among subcohort 1.1 of mother-infant dyads of rural dispersed population, stimulated by INISA's field personnel. Subcohort 1.2, also of rural dispersed population, less stimulated, had a shorter duration of breastfeeding. Subcohort 1.3, of rural dispersed and concentrated population, showed the shortest duration.

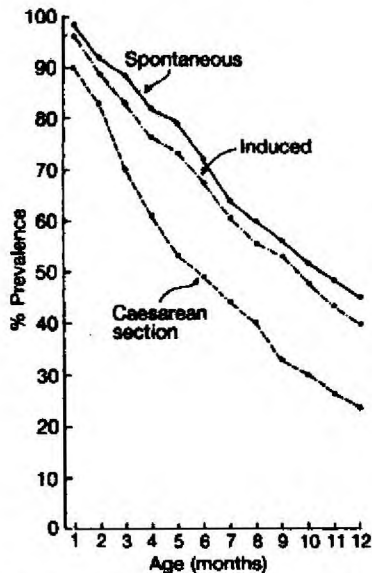


Fig. 9.3. Prevalence of breastfeeding by month in three subcohorts of Puriscal infants defined by type of delivery. The lowest prevalence of breastfeeding was in infants born by Caesarean section, the best rate was in those born by spontaneous delivery.

subcohort 1.1 (Table 9.2) showed the longest duration of breastfeeding; duration was less in a similar rural dispersed population which had much less stimulation (subcohort 1.2); the rural concentrated and dispersed subcohort 1.3 exhibited the shortest duration of breastfeeding of the three groups, but the figure was nevertheless significantly greater than in the pre-intervention period. The bimodal frequency distribution of subcohort 1.1 (Fig. 9.3) probably resulted from intensification of breastfeeding efforts related to sustained emphasis and stimulus by the field staff.

Prevalence of breastfeeding by type of delivery

Monthly prevalence rates of breastfeeding by type of delivery (four cases of induced delivery were excluded) revealed the highest breastfeeding rates in infants born by spontaneous delivery, and the poorest in infants born by Caesarean section (Fig. 9.3). Induced deliveries were associated with some negative effect on the rate of nursing. The effect of other manipulations such as episiotomy was not investigated.

Discussion

Premature weaning was very common in Costa Rica in the 1950s and undoubtedly contributed to the high rates of diarrhoeal disease, malnutrition, infant death, and excessive demographic growth recorded in that decade.⁶ A sustained governmental emphasis on social development and improved health resulted in significant gains in the control of infectious diseases and infant deaths, particularly in the 1970s.¹² The decline in breastfeeding continued, and campaigns to promote breastfeeding through the radio, television, and press were launched in the 1970s by Social Security, the Ministry of Health, and the Costa Rican Association of Demography. However, in 1976 the World Fertility Survey found that 26 per cent of infants were not given the breast,¹² while the 1978 Nutrition Survey¹⁴ revealed a deteriorated situation from the level found in similar nutrition surveys conducted in 1966 and 1975.¹⁵ According to the 1978 Nutrition Survey, 24 per cent of infants from rural areas were not breastfed or were weaned during the first days of life; by three to six months, about one-half had been weaned onto cow's and formula milks.¹⁴

Such a deterioration in infant feeding practice appeared to be due to (i) several years of drastic separation of mothers and infants at delivery; (ii) formula-feeding in hospitals and clinics; (iii) many years of intense promotion of processed cow's milk for infants by the medical and commercial establishments; (iv) several years of distribution of powdered milk by Social Security and the Ministry of Health to delivering mothers; and (v) cultural distortion of the role of breasts and breastfeeding. Costa Rica has not shown profound urbanization or incorporation of women into the labour force.

Other Latin American nations evolving from traditional to modern lifestyles experienced a decline in breastfeeding according to transcultural surveys during the period 1975-78.¹² Causes for the decline are common to many nations, with a strong commonality of equivocal, unsupportive medical, and hospital practice.¹⁶

It is evident from the studies described here that rapid transition resulting in a significant increase in hospital delivery without the benefit of non-violent birth, rooming-in and promotion of breastfeeding, undoubtedly had a harmful effect on breastfeeding and infant health. The Costa Rican case illustrates that the phenomenon is no longer urban, since it affected the rural population receiving universal institutional delivery.

Alternative approaches to curtail premature weaning seem indicated for nations such as Costa Rica, and these include drastic changes in the conditions of childbirth and perinatal care, much more than an emphasis in health education through the health centre infrastructure. The significant gains in a large maternity unit in Costa Rica leave no doubt that the interventions were justified not only in terms of improved benefits on rate of breastfeeding and health of suckling neonates, but also in terms of benefits for preterm and high-risk neonates who receive fresh human colostrum and milk.

A follow-up of neonates born in two Costa Rican hospitals with contrasting practice showed that all infants separated at birth had been weaned by nine months of age, while more than one half of those experiencing rooming-in had remained at the breast at that age.¹¹ Rooming-in, promotion of breastfeeding, and early mother-infant stimulation was related to a sharp decline in the rate of abandoned newborns, whether ill or healthy: an observation of great public health significance.

Field observations in a traditional Guatemalan village where most infants were born in the home, showed universal and successful breastfeeding; survival was very high for neonates able to suck within the first 24 hours of life.¹⁷ Furthermore, physical growth of preterm and small-for-gestational-age breastfed rural infants was adequate under extreme poverty in a microbially-contaminated environment.

In the Costa Rican experience, the separation of preterm and high-risk neonates for medical reasons was partially compensated by maternal stimulation, and nutrition and anti-infectious properties of human colostrum and milk. The theoretical and practical implications of feeding human milk to preterm infants have been discussed,¹⁸ but field experience in two contrasting rural settings has reiterated its benefits and desirability.^{9,17} The administration of fresh human colostrum and milk had no side-effects even if it is given as early as one hour after birth.^{7,9}

Feeding of pooled human colostrum to institutional neonates has been extensively and successfully done by Larguía *et al.*^{19,20} in Argentina, and was followed by a striking reduction in diarrhoeal disease and neonatal mortality. Similarly, changes in medical practice leading to rooming-in and breastfeeding in a

Philippines hospital resulted in a reduction in morbidity and mortality of similar magnitude to that observed in Costa Rica, according to Relucio-Clavano.²¹

The effect of hospital interventions on prolongation of breastfeeding and overall nutrition and health throughout infancy was outstanding.^{9,22} For example, breastfed Puriscal infants had a much lower attack rate of diarrhoea and of rotavirus infection than artificially-fed infants.¹¹ The protective role of breastfeeding against diarrhoea has been proved in industrial,²³ transitional,²⁴ and traditional societies.²⁵ It was not surprising that Puriscal infants, who enjoy a relatively clean environment, grow according to the WHO recommended NCHS growth charts.²⁶ Furthermore, virtually no stunting or wasting were diagnosed in infants and preschool children, while infant mortality rate was below 20 in these cohorts.

The hospital interventions apparently had a lasting effect on rural mothers and infants which had close contact with the field team after hospital discharge (subcohort 1). Retrospective analysis showed that the prevalence of breastfeeding for cohort infants was greater than that for the corresponding older siblings.^{1,26} While the rate and duration of breastfeeding seem to have improved as a result of stimulation by field workers, the most important health action consisted in early mother-infant stimulation, rooming-in, and promotion of breastfeeding in the hospital. Furthermore, the marked differentials in breastfeeding with regard to the type of delivery attest to the need to reduce Caesarean sections, anaesthesia, and other interventions to a minimum compatible with good medical practice.^{1,16}

In the light of the present observations, change in orthodox hospital practice in developing countries is mandatory and has a higher priority than the alternative approach of intervening after hospital discharge when the damage has already been done or may not be easily corrected. However, health interventions prior to delivery and after discharge using the communication media and the health infrastructure should not be neglected.

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