

Risk-approach strategy in neonatal care

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The rural areas of developing countries like India are still faced with the problem of high neonatal mortality rates. High proportions of low-birth-weight babies and home deliveries, as well as ignorance about the need for asepsis and early referral of difficult cases, make the newborn infants highly vulnerable to birth asphyxia and neonatal infections. To lessen the imbalance between the limited availability of and the need for health care, the risk-approach strategy was applied to a cohort of newborns with the aim of giving extra care to at-risk neonates by optimum utilization of existing resources.

During the two years (1981-82) of our study on the implementation of the risk strategy, 851 newborns (28%) were found to be at risk. Adequate interventions could be made on 412 (48.4%) of these at-risk infants after identification of the risk by trained community health workers. The observed reduction in neonatal mortality from 1981 to 1982 was 51.9 to 38.8 per 1000 live births.

This risk-approach strategy may be applied in other communities with similar characteristics.

Developing countries have been and are still confronted with the problem of an unacceptably high mortality rate among children under the age of 5 years, especially in their rural populations. Even with progress in development, the expected reduction in infant mortality in these countries appears mainly in the post-neonatal period. According to the statistics from different countries (1), mortality during the neonatal period accounts for 32-76% of infant mortality (Table 1).

About 70% of deliveries among the rural population of India take place at home and about 75% of these are conducted by the mothers' relatives, based on their previous experience with an occasional childbirth. These traditional deliveries are carried out with very little concept of asepsis and those in abnormal labour are often referred late because the inexperienced birth attendants fail to recognize this condition. The newborns under these circumstances succumb very easily to birth asphyxia and neonatal infections. A high proportion of low-birth-weight babies is also responsible for the very high neonatal mortality rates.

The availability of health care services and their

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accessibility are often in inverse proportion to the needs of the population so that individuals in greater need of care are neglected. The aim of the risk-approach strategy is to give some care to all persons and extra care to those at risk. This approach involves identifying the risk factors relevant to the local situation, screening the population (with the help of primary health workers) for selection of individuals

Table 1. International comparison of neonatal and infant mortality rates^a

Country and year	Mortality rates (per 1000 live births)		Neonatal mortality expressed as a % of infant mortality
	Neonatal	Infant	
Guatemala, 1978	29.4	68.8	43
El Salvador, 1979	16.9	53.0	32
Sri Lanka, 1978	24.9	37.1	67
Mauritius, 1980	18.4	32.3	57
Peninsular Malaysia, 1978	17.5	26.7	66
England and Wales, 1980	7.7	12.0	64
Singapore, 1980	8.9	11.7	76
Australia, 1980	7.1	10.7	66
Sweden, 1980	4.9	6.9	71

^a Source: World health statistics annual 1982 (1).

at risk, and providing them with extra care in proportion to their needs according to a previously decided risk management plan based on feasibility. Thus, the risk approach aims at reduction in mortality by reallocation of existing resources, so that maximum benefit can be gained at minimum cost.

To study the effectiveness of this strategy the World Health Organization initiated and supported collaborative studies on the risk approach in maternal and child health care in Burma, India and Thailand in the WHO South-East Asia Region (2). The Indian component of this intercountry study was started at the Rural Training Centre in Sirur by the B.J. Medical College, Pune, in January 1981. Although the study is concerned with the implementation of the risk strategy from pregnancy to early childhood, this article deals with the neonatal period only.

MATERIALS AND METHODS

The study population of 47 000 living in 22 villages covered by the Rural Training Centre had a birth rate of 33 and a death rate of 15 per 1000. The majority of the population consisted of illiterate farmers with small pieces of land.

All births in this population during the two-year period from 1 January 1981 to 31 December 1982 were included in the study. Non-resident women who migrated into the study area for deliveries were included but those residents of the area who went elsewhere for delivery were excluded from the present study of neonatal mortality.

One community health worker was appointed for about every 1000 population, in accordance with government recommendations. These workers were selected from resident women aged between 30 and 60 years and educated up to the 4th to the 11th standard, preference being given to those who were traditional birth attendants. Of the 40 community health workers thus selected, 12 were birth attendants and they were all supervised by female multipurpose workers and health assistants. The field medical officer was the leader of this team. The risk strategy was thus implemented using the existing staff of the Rural Training Centre, Sirur.

Planning of the risk strategy included identification of risk factors, preparation of a management plan for individual risks and a plan for periodic evaluation of the strategy, and training of health workers for implementation of these plans. For ensuring community participation, group meetings were organized in the field.

Risk factors of neonatal mortality were identified from a previous study on perinatal mortality and low

Table 2. Criteria for the selection of at-risk neonates and the risk management plan

Risk factors	Management
Low birth weight and small size	<p><i>When only one factor is present:</i> domiciliary care by the mother and community health worker using health education, under the supervision of the nurse or doctor.</p> <p><i>When more than one factor is present:</i> refer to hospital for inpatient care.</p>
Pre-term birth	
Feeding problem	
Illness	<p>Refer to health centre for specific out-patient treatment with supportive care by the mother; or refer to hospital, depending on medical officer's judgement.</p>
History of prolonged and difficult labour	

birth weight carried out in the same area from 1977 to 1979 (3). A list of five important risk indicators and an outline of the management plan are shown in Table 2.

The community health workers were instructed to visit the family soon after a delivery in order to advise the mother on basic care of the newborn. Follow-up visits were fixed for the 8th and 29th day after birth to inquire about any death during the intervening period and to screen the neonates for the presence of any risk factor. The results of these visits were communicated to the field medical officer who would then visit the family within 24 hours to investigate the cause of death (4), if there was one, or to supervise the management of at-risk babies by the community health worker and nurse.

The community health workers were specially trained in various techniques, e.g., cutting the cord with adequate aseptic precautions, cleaning the infant's mouth and pharynx, resuscitating an asphyxiated baby by mouth-to-mouth respiration, weighing the newborn, and feeding a premature baby with a dropper. An ordinary new razor blade (after boiling it just before use) was the instrument for cutting the cord. Domiciliary care of low-birth-weight newborns included heating the room by keeping burning coals under the *choupai* (a wooden cot with woven ropes); humidity was increased by keeping some water always on the boil or by drying wet clothes inside the room. Adequate nutrition was maintained by breast-feeding all babies except those who were unable to suck at the breast; in the latter case, a dropper was used to feed extracted breast milk (or cow's milk when breast milk was not available). Minimum handling of the baby was advised to prevent infection.

Table 3. Mortality data for the first 4 weeks of life in Sirur, India, during 1981 and 1982 compared with earlier data

	1977-79 ^a	1981	1982
No. of live births	3083	1444	1546
Stillbirth rate ^b	28.4	18.4	21.5
Perinatal mortality rate ^b	54.2	50.3	49.4
Neonatal mortality rate ^b	—	51.9	38.8
Early neonatal mortality rate ^b	26.6	32.6	28.5
Late neonatal mortality rate ^b	—	20.0	10.7

^a Data collected for this perinatal mortality study pertained to the perinatal period only (3).

^b All rates are expressed per 1000 live births, except the stillbirth and perinatal mortality rates which are per 1000 total births (stillborn and live).

RESULTS

Implementation of the risk strategy was started and continued through 1981 and is still in progress. There were 75 neonatal deaths among 1444 live births (rate, 51.9/1000) in 1981 and 60 neonatal deaths among 1546 live births (rate, 38.8/1000) in 1982. The mortality rates observed during these two years, compared with those in 1977-79 (3), showed a decline in the stillbirth rate and a slight increase in the early neonatal mortality rate (Table 3). The late neonatal mortality rate of 20 per 1000 live births in 1981 fell to 10.7/1000 in 1982, the neonatal mortality rate showing a reduction from 51.9 in 1981 to 38.8 in 1982. However, none of these differences was statistically significant.

During 1981 and 1982, about 28% of the neonates could be designated as at risk by the selected criteria. The neonatal mortality rate for this high-risk group was significantly higher than that for the low-risk group ($P < 0.01$). The low-risk group showed a significant reduction in neonatal mortality rate from 7.7 in 1981 to 1.8 per 1000 in 1982. The neonatal mortality rate for the high-risk group also showed a reduction (from 163.4 in 1981 to 131.5 per 1000 in 1982), but this was not statistically significant.

A sharp rise in neonatal mortality rates was observed with increase in the number of risk factors that were present simultaneously (Table 4). The difference in neonatal mortality for those without a risk factor and those with one, two and three risk factors was statistically significant.

The neonatal mortality rates were highest among infants with feeding problems and illness during the neonatal period. Low-birth-weight infants had the lowest rate but this risk factor was the commonest,

Table 4. Effect of multiple risks on neonatal mortality in Sirur, India, 1981-82

No. of risk factors present simultaneously	No. of at-risk neonates	Neonatal mortality rate (per 1000 live births)
One	630 (74.0) ^a	46.0
Two	170 (20.0)	329.4
Three or more	51 (6.0)	784.3
Total	851	146.9

^a Figures in parentheses are percentages.

Table 5. Risk factors and neonatal outcome in Sirur, India, 1981-82

Risk factors	No. of at-risk neonates	% of total live births	Neonatal mortality rate (per 1000 live births)
Low birth weight and small size	587 (68.9) ^a	19.6	158.4
History of prolonged and difficult labour	176 (20.6)	5.9	159.1
Pre-term birth	150 (17.6)	5.0	353.3
Illness	148 (17.3)	4.9	439.2
Feeding problem	70 (8.2)	2.3	471.4

^a Figures in parentheses are percentages.

accounting for 68.9% of all at-risk cases, and 19.6% of all live births (Table 5).

The distribution of babies according to birth weight showed that 78.9% of all low-birth-weight babies were in the range of 2000-2499 g; this group faced three and a half times higher mortality than those weighing 2500 g or more (Table 6). Although babies weighing less than 2000 g at birth constituted 4.7% of the total live births, their proportion among neonatal deaths was 33%.

The weights of 525 newborns (17.6% of babies) could not be measured owing to difficulties in the field (see Discussion). However, the impressions of the community health worker or the mother about the size of these infants could be related to the neonatal mortality rates in this group; the rate was 750 (per 1000 live births) for 32 "small" newborns and 20.3 (per 1000 live births) for the remaining 493 who were considered to be "average or big".

The effect of low birth weight alone and combined

Table 6. Distribution of infants by birth weight and their corresponding neonatal mortality rates in Sirur, India, 1981-82

Birth weight (g)	No. of infants	% of low-birth-weight infants	% of all infants	Neonatal mortality rate (per 1000 live births)
< 1500	32	5.8	1.3	687.5
1500-1999	85	15.3	3.4	270.6
2000-2499	438	78.9	17.8	54.8
Total (with low birth weight)	555	100.0	22.5	
≥ 2500	1910	—	77.5	16.8
Total	2465	—	100.0	45.6

with other risk factors was studied. Isolated low birth weight was present in 68.3% of infants and was associated with the lowest neonatal mortality among all low-birth-weight babies (Table 7); the addition of other risk factors increased the neonatal mortality rate 5-10-fold.

Out of 851 at-risk neonates, 662 (78%) could be identified with their risks and had a mortality of 151.1 per 1000 live births; the non-detection of risk in the remainder was because of the absence of a community health worker (in 2%), or her failure to visit the family or to realize the significance of the risks (8%), or because the families had moved away or

were not cooperative (12%). Death of the baby within a few hours of birth (before the health worker could visit the family) was an important factor for failure to identify the risk. Adequate intervention according to a pre-planned strategy was possible for 412 of all at-risk cases, i.e., 62% of neonates in whom risk factors had been identified by the health workers. Inadequate intervention in the remaining 439 babies was due to problems in transportation, ignorance, non-cooperation of the families, and overconfidence of health workers. The neonatal mortality rate for the adequately intervened group (89.8 per 1000 live births) was significantly lower ($P < 0.05$) than that for the group that had inadequate intervention (200.5 per 1000 live births).

In the total of 135 neonatal deaths (Table 8), 44 (32.6%) took place within the first 24 hours of birth; 28 of these were home deliveries and 16 were cases of prolonged labour referred to hospital after a trial labour at home. In spite of the available expert advice and special care these 16 babies could not be saved because they had been referred too late during labour. The distribution of causes of neonatal deaths (Table 8) showed that 42% of deaths were related to low birth weight and associated complications; another 20% resulted from neonatal infections and 17.8% from asphyxia at birth.

DISCUSSION

Before the commencement of the project on risk approach in 1981, about 25% of the deliveries in Sirur took place in hospital (in the municipal hospital, the Rural Training Centre, or a private hospital). These newborn babies received routine care

Table 7. Effect on the neonatal mortality rate of low birth weight (LBW) alone and in combination with other risks among neonates in Sirur, India, 1981-82

Risk factors	No. of at-risk neonates	Neonatal mortality rate (per 1000 live births)
Full-term LBW alone	401 (68.3)*	32.4
Premature LBW	61 (10.4)	360.7
LBW + feeding problem	17 (2.9)	411.8
LBW + illness	23 (3.9)	304.3
LBW + birth asphyxia	37 (6.3)	162.2
LBW + ≥ 2 other risk factors	48 (8.2)	791.7
Total	587	158.4

* Figures in parentheses are percentages.

Table 8. Age and cause of deaths among neonates in Sirur, India, 1981-82

	No. of deaths
<i>Age at death:</i>	
24 hours	44 (32.6) ^a
1-7 days	47 (34.8)
8-28 days	44 (32.6)
Total	135 (100.0)
<i>Cause of death:</i>	
Low birth weight	57 (42.2)
Neonatal infection	27 (20.0)
Asphyxia	24 (17.8)
Congenital malformations	7 (5.2)
Feeding problem	7 (5.2)
Others	13 (9.6)
Total	135 (100.0)

^a Figures in parentheses are percentages.

during their stay in the hospital which averaged about 3 to 4 days. The remaining deliveries were at home and only about 15-20% of these infants were examined in the first four weeks of life during home visits by auxiliary nurse midwives. As a result of the project, the proportion of neonates getting home care increased to 80%, which was mainly due to the home visits by the trained community health workers. While similar workers may be active in all primary health centres, special responsibility for care of the newborn is usually not given to them, as it was in our project area. No significant change was noted in the percentage of hospital deliveries because of the project. The improved coverage in the present study appears to have helped not only the high-risk babies but also the low-risk groups because, as indicated in the Results section, a significant reduction in mortality was observed in the low-risk groups from 1981 to 1982. An increase in coverage is one of the important benefits of the risk approach.^a

Our community health workers were initially trained for three months. Throughout the period of the project weekly meetings of these workers were organized for collecting data, solving problems, and reinforcing the training received by them. It was observed that the skills improved with the experience gained during the project, which probably explains the decline in mortality from 1981 to 1982.

^a *A workbook on how to plan and carry out research on the risk approach in maternal and child health, including family planning.* Experimental edition. Unpublished WHO document FHE/MCH/RA/84.1 (1984), p.27

The success of the risk approach strategy depends upon appropriate selection of risk factors, identification of these by primary health workers, and management of the majority of cases at risk by simple but effective interventions under field conditions. In the present study the selection of risk factors appears to have been appropriate, since 92% of neonatal deaths occurred in only 28% of all the newborns who formed the groups at risk. Identification of at-risk neonates was not difficult for the primary health workers, the confirmed detection rate being 78%.

Simpler guidelines are required so that community health workers with a limited educational background can decide which cases need referral, although a scoring system (a higher score for increased risks) might be suitable for better-trained workers. The steep rise in neonatal mortality with increase in the number of risk factors is highly significant. An infant presenting with only one risk factor (like low birth weight, prematurity, or feeding problem) can be managed at home or at the primary health centre and this group constituted about 74% of all the at-risk babies; the measures are simple and consist of education of the mother by the trained community health worker. Any child presenting with more than one risk factor, on the other hand, must be hospitalized because of the eightfold increased risk of neonatal death. Two or more risk factors presenting together were observed in 7.3% of all neonates, i.e., 26% of all at-risk babies. Skilled management of these patients in hospital may substantially reduce the mortality in this group.

Nearly 70% of the neonatal deaths in the present study were directly or indirectly linked with low birth weight. Improvements in antenatal nutrition and extra rest for the pregnant mother can improve the birth weight to some extent. Efforts to prevent preterm delivery can also reduce the incidence of prematurity. If, however, a baby is born before term or with a low birth weight, domiciliary care of the baby by the mother could save some of these infants.

Though the overall survival among low-birth-weight babies improved with the extra care given at home, no change was observed in the mortality among infants weighing <1000 g or those born after a gestational period of <28 weeks. These deaths are probably unavoidable in the existing rural situation in India. However, about 70% of deaths among low-birth-weight babies were in the weight range of 1500-2499 g; extra attention to this group with supervised domiciliary care and early referral of those weighing <1500 g may significantly reduce the mortality among low-birth-weight babies.

In the present study 17.6% of newborns could not be weighed owing to death soon after birth and disposal of the body before the community health

worker could visit the family, or refusal by a few families to allow the baby to be weighed for fear of an evil eye, or failure of the health worker to visit the families. The study confirmed that community health workers were able to weigh the newborn infants although the provision of a weighing balance to every such worker would involve considerable expenditure just for screening low-birth-weight babies. Under these circumstances, we relied on the impression of the health worker or the mother about the size of the newborn and used this as the criterion for identification of low-birth-weight, at-risk neonates. The observed difference in neonatal mortality faced by such "small-looking" newborns as against babies of average size indicates the appropriateness of this criterion. These "small-looking" babies should be given extra care at home if they are able to suck at the breast; but if they are unable to suck or have any other complication, institutional care is indicated because the combination of low birth weight with any other risk factor is associated with a 5-12-fold higher mortality during the neonatal period.

Neonatal infections including septicaemia and neonatal tetanus were responsible for 20% of neonatal deaths, which is not surprising since 70% of the deliveries were conducted by relatives under domiciliary conditions. Health education of mothers and giving them a "cord kit" containing a sterile razor blade, some cotton swabs and pieces of thread, and a small bottle of tincture of iodine or spirit for the cord dressing should help considerably in preventing neonatal infections.

Insisting on hospital delivery for mothers with an antenatally detected abnormal presentation, or with short stature, pelvic deformity, a bad obstetric history, etc. as well as early recognition of abnormal labour in otherwise low-risk mothers with timely referral should reduce the mortality due to birth asphyxia.

Deaths connected with feeding problems were due

to inability of the mother to maintain adequate nutrition of the baby in a hygienic way when the mother's milk was not available. Health education of the mother or mother substitute about artificial feeding is essential to save the babies with this type of problem.

About 50% of early neonatal deaths took place within 24 hours of birth, 60% of these were home deliveries and death occurred before the community health worker could visit the family and identify the at-risk neonate. In the remaining cases, the deliveries were in an institution but the babies could not be saved because of delayed referral. The more marked reduction in mortality during the late neonatal period may be because there was sufficient time for risk identification and intervention.

The overall risk detection rate could be improved by active efforts to identify non-resident pregnant women and to screen them for the presence of risk factors. Continued training and supervision of community health workers will help them in the better identification of at-risk neonates and timely referral of these cases. Acceptance of these interventions could be improved by promoting more co-operation with families by means of health education. Meetings with local leaders, teachers, traditional birth attendants and women's groups could be organized to explain the principles of the risk-approach strategy. Once these key persons have been convinced of the importance of safe conduct of labour and timely referral of high-risk pregnant women and children, community participation should follow. The provision of "cord kits" to mothers and transport of cases needing referral could be carried out with support from the local people. Application of the risk approach was found to be most effective in increasing the population coverage and referrals to hospital, and in improving local re-organization, training of health workers, and health care of families (6).

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RÉSUMÉ

L'APPROCHE FONDÉE SUR LA NOTION DE RISQUE DANS LES SOINS AUX NOUVEAU-NÉS

Le problème d'une très forte mortalité néonatale s'est posé et continue à se poser aux pays en développement. La faiblesse du poids et l'asphyxie à la naissance, ainsi que les infections néonatales constituent les principaux facteurs contributifs aux causes de décès. La possibilité d'accès aux soins de santé et, en vérité, l'existence même de ces soins sont, d'ordinaire, inversement proportionnels aux besoins de la population. Le système classique de prestations de soins étant dans l'incapacité d'identifier les individus qui ont besoin d'une attention toute particulière, l'approche fondée sur la notion de risque a pour but de repérer les individus à risque (à partir d'un dépistage opéré par les agents de santé primaires dans la population) et de les faire bénéficier d'un surcroît de soins, tout en dispensant des soins à l'ensemble de la population, grâce à la redistribution des ressources existantes.

Dans le cadre d'un projet inter pays patronné par l'Organisation mondiale de la Santé, cette approche fondée sur la notion de risque a été appliquée à tous les nouveau-nés d'une communauté rurale en Inde. Pendant le cours de cette étude qui a porté sur la période 1981-1982 et concerné une population de 47 000 individus, 2990 naissances ont été enregistrées.

La faiblesse du poids à la naissance ou la petitesse de l'enfant, les naissances prématurées, les accouchements prolongés et difficiles, la maladie et les problèmes d'alimentation de l'enfant ont été considérés comme d'importants facteurs de risque. Des femmes âgées de 30 à 60 ans et dont le niveau d'instruction se situait entre la quatrième et la onzième année d'étude, ont été choisies comme agents de santé communautaires. Une formation leur a été dispensée afin de leur apprendre à donner les soins les plus élémentaires à tous les nouveau-nés, à repérer les bébés à risque et à envoyer à l'hôpital ceux qui avaient besoin d'une surveillance plus attentive. Le plan de gestion des risques a été fondé sur le système de prestations de soins de santé en vigueur en Inde. La plupart des nouveau-nés à risque ont reçu des soins au centre de soins primaires ou fait l'objet d'une surveillance à domicile. Les soins à domicile ont

consisté à contrôler la température et l'humidité de la pièce dans laquelle se trouvait le nouveau-né, à prévenir les infections et à maintenir un bon état nutritionnel au moyen de mesures simples dérivées des pratiques traditionnelles. Ces mesures étaient appliquées aux enfants de faible poids à la naissance, aux prématurés et à ceux qui se montraient difficiles à alimenter, lorsque l'existence de l'un de ces facteurs de risque était constatée.

Pendant les deux années qu'a duré l'étude, 851 nouveau-nés (28%) ont été considérés comme à risque, compte tenu des critères susmentionnés. On a constaté que le risque de mortalité néonatale était plus élevé chez les enfants qui avaient des difficultés à s'alimenter ou qui avaient été atteints de maladie pendant la période néonatale. Tout en étant le moindre des facteurs de risque retenus, la faiblesse de poids à la naissance était aussi le facteur de risque le plus courant, puisqu'elle se retrouvait chez 68,9% de tous les cas à risque.

La détection du risque par les agents de santé communautaire a été possible chez 78% des nouveau-nés à risque. Chez les 22% restant, la non détection du risque était attribuable au départ des parents de la zone couverte par l'étude, au manque de coopération des familles ou à une erreur de l'agent de santé qui n'avait pas rendu visite à la famille ou qui n'avait pas compris l'importance du facteur de risque.

Une intervention adéquate, selon une stratégie préorganisée, a été possible dans 48,4% des cas de nouveau-nés à risque identifiés; dans les autres cas, les interventions n'ont pas été satisfaisantes pour des raisons qui tenaient aux difficultés de transport, à l'ignorance et à la non coopération des familles. La mortalité néonatale est apparue nettement plus faible ($P < 0,05$) dans le premier de ces deux groupes.

Le déclin observé dans la mortalité néonatale, qui est passée de 51,9 pour 1000 naissances vivantes en 1981 à 38,8 en 1982, est encourageant; il devrait se poursuivre grâce à l'application continue de la stratégie. Les résultats de l'étude donnent à penser que cette stratégie pourrait être étendue, notamment aux collectivités présentant des caractéristiques similaires.