Bulletin of the World Health Organization, 65 (1): 77-82 (1987)

Application of case management to the control of acute respiratory infections in low-birth-weight infants: a feasibility study

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The feasibility of introducing a case management programme for acute respiratory infections among low-birth-weight infants at the primary health care level was investigated in 37 villages in the Indian state of Haryana. Twenty-one of the villages served as the intervention area, while the remaining 16 formed the control area. All low-birth-weight infants born in the two areas between January 1982 and September 1983 (199 in the intervention area and 211 in the control area) were included in the study. Primary health care workers were contacted in 38% of episodes of acute respiratory infections in the intervention area, in contrast to only 1% of episodes in the control area. Also, the mean duration of infections in the intervention area was significantly lower ($P < 0.01$), while the case fatality was about 33% of that in the control area. The results indicate that the programme can be successfully incorporated into existing primary health care infrastructures.

Acute respiratory infections (ARI) are one of the principal causes of illness and deaths of children in developing countries. The development and implementation of a control programme for ARI is an essential component of the primary health care approach, and the introduction of an improved system of standard case management for these infections has been recommended.[a]

Low-birth-weight infants constitute 20–40% of all deliveries in developing countries, accounting also for a major proportion of infant mortalities (*1*, *4*) often from ARI. Although the attack rate of ARI is fairly uniform throughout the world, the vast difference in mortality rates from such infections in developed and developing countries may arise because of the high incidence of low-birth-weight infants in the latter countries, and the availability in developed countries of appropriate case management at an early stage of infection. We therefore examined the feasibility of introducing a standard case management programme in the primary health care setting for the prevention of deaths related to ARI and report our results here.

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[a] *Case management of ARI in children in developing countries.* Unpublished document (WHO/RSD/85.15).

MATERIALS AND METHODS

The study was carried out in 37 villages of total population 38 939 in two community development blocks in Ambala district, Haryana, India. Sixteen villages of population 16 925 formed the control area, while 21 villages of population 22 014 comprised the intervention area. Villages were selected by a two-stage cluster sampling technique. The sample was representative of the rural area of the state of Haryana and consisted mainly of poor farmers from small land holdings. Sociodemographically, the families in the control and intervention areas were comparable (Table 1). Also, villages in the two areas had similar access to health facilities as indicated by distances from a primary health centre, subdistrict hospital, and district hospital.

Weights of infants were recorded within 48 hours of birth by a primary health care worker using a portable spring balance (accuracy range ±50 g). Values were cross-checked for reliability by a trained field supervisor in a 10% subsample.

In the control areas, low-birth-weight (birth weight, <2500 g) and normal infants born between January 1982 and September 1983 were registered in the study. In contrast, only low-birth-weight infants were registered in the intervention area because of resource constraints.

Table 1. Selected sociodemographic parameters in the control and intervention areas of the study

Parameter	No. of households	
	Control area	Intervention area
Type of housing		
Kuccha[a]	1156 (53.8)[c]	1694 (53.7)
Pucca[b]	174 (8.1)	187 (5.9)
Kuccha-Pucca	819 (38.1)	1272 (40.3)
Drinking-water source		
Tap	811 (37.4)	1113 (35.3)
Hand pump	629 (29.0)	1055 (33.5)
Well	729 (33.6)	985 (31.2)
Occupation of father		
Agriculture	856 (39.5)	1138 (36.0)
Labourer	720 (33.2)	973 (30.9)
Others	593 (27.3)	1042 (33.0)
Annual per capita income		
1000 rupees (US$ 120)	1016 (46.8)	1498 (47.5)
1001-2000 rupees	436 (20.1)	571 (18.1)
2000 rupees	717 (33.1)	1084 (34.4)
Father's education		
Illiterate	790 (36.4)	1296 (41.1)
Literate	443 (20.4)	501 (15.9)
Formally educated	936 (43.2)	1356 (43.0)

[a] House made of mud with thatched roof.

[b] House built with burnt bricks and roof made of bricks and lime or reinforced concrete.

[c] Figures in parentheses are percentages of number of households in the control or intervention area.

Table 2. Main features in the three groups of acute respiratory infections used in the study[a]

Mild
- Cough
- Blocked or runny nose
- Ear discharge or pain in the ear
- Hoarseness

Moderate
- Rapid breathing
- Breathing difficulty

Severe
- Visible sucking in of ribs
- Very rapid breathing
- Unable to drink

[a] Based on observations reported by the infant's mother.

All infants in the two areas were visited once per week until their first birthday by a trained field worker. Mothers were asked to report any illnesses experienced by the children and the duration of any episodes of ARI; information on treatment given and its source was also recorded. The respiratory infections were classified using the criteria shown in Table 2. For the purposes of the study, measles as well as coughs and/or runny noses lasting longer than 2 weeks were not included as acute respiratory infections. All deaths of infants during the study period were recorded and the cause determined by questioning using a proforma approved by WHO (*5*).

All primary health care workers in the intervention area were identified and trained in the recognition, treatment, and referral of ARI. Additional training material, including self-learning educational aids, was developed in the vernacular and field-tested to ensure its suitability and simplicity. The training was organized as part of the workers' general ongoing health care instruction at their place of employment. A simple "decision-and-action" classification of ARI (mild, moderate, or severe) was used instead of a more precise but cumbersome anatomical and etiological approach. Mild episodes of ARI were treated with symptomatic and supportive therapy, while infants with moderate or severe ARI were administered penicillin orally in two equal daily doses of 125 mg for 5 days. The health care worker gave the first dose, while the second dose was given by the mother under the supervision of the worker. Subsequent doses were administered by the mother, and the health care worker was informed of the response. Severe cases and those that did not respond to penicillin were referred to a primary health centre or a qualified medical practitioner. The reasons for referral and details of the previous treatment were recorded. Data were collected from the health care workers every month and analysed at 3-monthly intervals.

Quality control checks were carried out throughout the study. In all cases, the cause of death reported by the field workers was validated by supervisory staff within 1 month of its occurrence. Cross-checks by the supervisory staff of a 10% subsample were also performed throughout the study, paying particular

Table 3. Infantile morbidity and mortality from acute respiratory infections in the control area

	Infants	
	Low birth weight	Normal
No. of infants	211 (32.0)[a]	448 (68.0)
Follow-up (weeks)	8900	21 488
No. of attacks		
Mild	352/*3.96*[b]	857/*3.98*
Moderate or severe	61/*0.69*	125/*0.58*
Total	413/*4.65*	982/*4.56*
Duration of infections		
Mild	9.7 ± 4.8[c]	8.35 ± 5.2
Moderate or severe	8.7 ± 4.1	7.72 ± 3.3
No. of deaths	15 (79)	4 (21)
Case fatality	24.6[d]	3.2

[a] Figures in parentheses are percentages.
[b] Figures in italics are the rate per 100 infant weeks.
[c] Mean ± standard deviation in days per episode.
[d] Per 100 episodes of moderate or severe acute respiratory infections.

attention to diagnosis of ARI and whether penicillin had been administered.

In order to evaluate the results of the study, the following indicators were used: feasibility—use of standard treatment for an episode of ARI; impact—reduction in duration of moderate or severe episodes of ARI and in ARI-related mortality.

RESULTS

Data from the control area were analysed to determine the relative contribution made by low-birth-weight infants to the overall morbidity and mortality from ARI during infancy (Table 3). Altogether 659 births were recorded in the control area: 211 low-birth-weight and 448 normal infants. The low-birth-weight infants were followed for a cumulated period of 8900 weeks and normal infants for 21 448 weeks. Altogether, 1395 episodes of ARI were recorded among the infants, and of these 1209 were mild, while the remainder were moderate or severe. The contribution made by normal and low-birth-weight infants to morbidity from ARI was proportional to their distribution in the study population, and both the attack rate per 100 infant-weeks and duration of mild and moderate or severe infections were similar for both groups ($P > 0.05$).

There were 19 deaths associated with ARI in the control area: 15 low-birth-weight and 4 normal infants. Low-birth-weight infants therefore contributed to about 79% of all such deaths, but represented only 32% of all births in the control area. Also, the mortality from ARI was about 8 times higher among low-birth-weight infants.

Significantly greater use was made of health care facilities in the intervention area, as indicated by the

Table 4. Utilization of health care facilities by infants with acute respiratory infections in the study

	Control area				Intervention area	
	No. of normal infants		No. of low-birth-weight infants		No. of low-birth-weight infants	
Health facility	Mild infection	Moderate or severe infection	Mild infection	Moderate or severe infection	Mild infection	Moderate or severe infection
None	145 (16.9)[a]	0	53 (15.1)	0	45 (13.0)	0
Home treatment	86 (10.0)	0	9 (2.6)	0	22 (6.3)	0
Primary health care worker	46 (5.36)	1 (0.8)	19 (5.4)	0	231 (66.6)	26 (37.7)
Registered medical practitioner[b]	477 (55.6)	96 (76.8)	215 (61.4)	42 (68.8)	39 (11.2)	33 (47.8)
Physician[c]	103 (12.0)	28 (22.4)	54 (15.4)	19 (31.1)	10 (2.9)	10 (14.5)
Total	857	125	350	61	347	69

[a] Figures in parentheses are percentages.
[b] May or may not be institutionally qualified.
[c] Trained in modern system of medicine in an approved medical institution.

proportion of infants who had contact with a health care facility, including health care for case management of ARI (Table 4). This indicates the feasibility of the approach. In the intervention area, the primary health worker was contacted in 66.6% of cases of mild ARI and in 37.7% of moderate or severe episodes. In contrast, in the control area the corresponding proportions were 5% for mild ARI and less than 1% for moderate and severe infections.

All 15 infants who died from acute respiratory infections in the control area were found upon investigation to have received inappropriate treatment. For 13 of the deaths, one or more incompletely trained practitioners had been consulted, resulting in frequent changes of treatment for seven of the infants. For the remaining two deaths, qualified doctors were also contacted but only when the infants were in the terminal stages. In the intervention area, a standard case regimen was followed in two of the six deaths, but discontinued within 24 hours; unqualified medical practitioners were also consulted. For the other four deaths, treatment was sought from unqualified medical practitioners from the outset.

The 199 low-birth-weight infants born in the intervention area were followed for a cumulative period of 7114 weeks. Altogether, 416 episodes of ARI (347 mild and 69 moderate or severe) were recorded, equivalent to a mean attack rate of 5.8 per 100 infant-weeks (4.9 mild and 0.97 moderate or severe attacks per 100 infant-weeks). The average duration of ARI among low-birth-weight infants in the intervention area was significantly shorter (5.9 days) than among similar infants in the control area (9.7 days); for moderate and severe infections the corresponding periods were 5.7 days and 8.7 days, respectively.

Case fatality proportions for episodes of moderate to severe ARI are shown in Table 5. For low-birth-weight infants in the intervention area, the proportion was 8.7%, compared to 24.6% in the control area ($P < 0.05$). The risk of such infants dying from the effects of ARI was therefore substantially reduced by standard case management. An indication of the reduction in mortality is given by the ARI-specific mortality rate (30 in the intervention area and 71 in the control), which circumvents difficulties that may have arisen in classifying the infections in the two areas.

Table 5. Case fatality and specific mortality due to moderate or severe acute respiratory infections (ARI) among low-birth-weight infants

Parameter	Intervention area	Control area
No. of moderate or severe episodes	69	61
No. of deaths from ARI	6	15
Case fatality (per 100 attacks)	8.7	24.6
Total infant deaths	40	58
Infant mortality rate (per 1000 live births)	210	275
ARI-specific mortality (per 1000 live births)	30	71

DISCUSSION

The results of the study indicate that the case management programme was successful. The costs involved included that of a middle-level supervisor, purchase of antibiotics and antipyretics, production of training and health education material, and travel expenses incurred in training the health care workers. The service efforts of the primary health care workers and health institutions were not included in the costs.

The study demonstrated that control of ARI at the primary health care level is feasible and that the case management programme had a significant impact on reducing mortality among low-birth-weight infants. Previously, the only report of a reduction in mortality from acute respiratory infections in India involved the use of injectable penicillin by trained medical auxiliaries (*3*).

Several difficulties were, nevertheless, encountered in implementing the programmes. In the first instance, the field staff often had difficulty in discriminating between severe and moderate cases of ARI, even though the treatment-orientated classification provided for this distinction. All births and deaths of infants in the intervention and control areas were, nevertheless, correctly registered by the workers. In addition, good correlation (84%) was found between the number of deaths ascribed to ARI and the number actually caused by such infections (21), with 2 false positives and 2 false negatives. Examination of the accuracy of the classification of severity of infection indicated that the correlation was 93.4% for the 15 moderate or severe cases and 90% for the 70 mild cases that were verified. Reporting of penicillin treatment was found to be accurate in 14 of the 15 moderate or severe cases investigated. Even when the primary health care workers successfully identified severe cases and referred them for treatment, the families did not

always comply, and, in this respect, case management was similar in the control and intervention areas. The method used to identify severe cases and their subsequent referral therefore requires to be improved.

Oral penicillin was used in the study, but this may not have been the optimum drug. On the one hand, medical auxiliaries or health volunteers are not permitted to use injectable penicillin in the State of Haryana, while, on the other, co-trimoxazole was considered inappropriate for administration to young infants. Also ampicillin was too expensive for use in the programme. Despite health education efforts in the study areas, the community continued to rely on home remedies and on village medical practitioners. In addition, villagers expected a dramatic effect with conventional medical treatment and did not adhere to it unless the response was marked. These cultural barriers therefore did not facilitate administration of penicillin for a time long enough to allow the concentration of the drug to accumulate sufficiently in blood or body tissue to produce a successful outcome. It should be noted that none of the six deaths in the intervention area arose because of shortcomings in the case management procedure.

The difficulties discussed above will have to be resolved before control programmes are implemented. In particular, the community should be educated not to expect instant effects from the case management approach. Compounding illnesses such as marasmus, diarrhoea, feeding problems, or diseases of the central nervous system may be important determinants of survival for infants with moderate or severe ARI (*2*). A concerted attempt to deal with these illnesses, especially marasmus and diarrhoea, may therefore have a favourable effect on mortality from respiratory infections. Furthermore, universal immunization of infants, particularly against measles, is also likely to reduce this mortality.

RÉSUMÉ

LA PRISE EN CHARGE DES CAS APPLIQUÉE À LA LUTTE CONTRE LES INFECTIONS RESPIRATOIRES AIGUËS CHEZ LES ENFANTS DE POIDS INSUFFISANT À LA NAISSANCE: ÉTUDE DE FAISABILITÉ

Les auteurs décrivent comment l'approche fondée sur la prise en charge des cas peut aider à réduire la mortalité due aux infections aiguës des voies respiratoires chez des enfants de poids insuffisant à la naissance. L'étude, réalisée dans le cadre de l'infrastructure des soins de santé primaires existante, a porté sur 37 villages de l'Etat de Haryana, Inde. Vingt et un villages ont été choisis pour servir de zone d'intervention, les 16 villages restants constituant la zone témoin. Tous les enfants de faible poids à la naissance nés dans la zone d'intervention (199) et dans la zone témoin (211) entre janvier 1982 et septembre 1983 ont été inclus dans l'étude. Pour déterminer la contribution relative de ces nourrissons à la morbidité et à la mortalité dues aux infections respiratoires aiguës, on a aussi inclus dans l'étude les enfants de poids normal à la naissance nés au cours de la même période dans la zone témoin.

Des agents de soins de santé primaires spécialement formés ont recueilli les données relatives à la morbidité et à la mortalité de ces nourrissons une fois par semaine jusqu'à leur premier anniversaire. Ces agents, qui avaient appris à reconnaître et à évaluer les infections, avaient à leur disposition des doses orales de pénicilline et du matériel d'éducation sanitaire. Dans la zone témoin, le taux d'atteinte des infections respiratoires aiguës était le même chez les enfants de poids normal et chez les enfants de poids insuffisant à la naissance mais 79% de tous les décès de nourrissons dus à ces infections ont été enregistrés parmi les enfants de faible poids à la naissance. Le taux d'utilisation des installations de soins de santé primaires pour le traitement des infections aiguës des voies respiratoires était sensiblement plus élevé dans la zone d'intervention. Les agents de soins de santé primaires ont été consultés pour 38% environ des épisodes modérés et graves d'infections aiguës des voies respiratoires affectant des enfants de poids insuffisant à la naissance dans la zone d'intervention, contre moins de 1% dans la zone témoin. La durée moyenne des épisodes d'infections aiguës des voies respiratoires dans la zone d'intervention était aussi nettement inférieure à ce qu'elle était dans la zone témoin ($P < 0,01$) tandis que le taux de létalité y était approximativement trois fois moins élevé.

L'introduction de l'approche décrite dans l'infrastructure des soins de santé primaires existante a donc été couronnée de succès et elle a permis de réduire la mortalité due aux infections aiguës des voies respiratoires chez les nourrissons de poids insuffisant à la naissance. Les efforts déployés pour sensibiliser davantage la communauté et accroître sa participation pourraient améliorer encore son efficacité.

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