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ARI IN CHILDREN:
A CASE MANAGEMENT INTERVENTION IN ABBOTTABAD

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A community-based program of acute lower respiratory infection (ALRI) case management was conducted in a rural district of northern Pakistan. The impact on infant and child mortality of this program was evaluated. During 1985-1986, ALRI-specific mortality among children <5 years old living in 31 intervention villages was 6.3 deaths per 1 (XX) children per year compared with 14.4 in seven control villages (p=0.0001). Within one year after interventions were extended to the control villages in 1987, ALRI-specific mortality in these villages dropped by 55% to 6.5 per I(XX) children per year (p=0.06). Total child mortality in 1985-86 was 29.0 per 1000 children per year in the intervention villages and 39.4 in the control villages, a difference of 287c ft=0.01). With interventions in 1987, total child mortality in the control villages declined by 297c to 27.8 per 1000 children per year (p=0.09).

INTRODUCTION

Acute respiratory infections (ARI) are responsible for about 4 million deaths annually in children under 5 years of age [1]. Most cases of ARI involve the upper respiratory tract and are mild and self- limiting; however, in developing countries, the mortality rate from acute lower respiratory infection (ALRI), principally pneumonia, is approximately 10-50 times higher titan in the developed countries [2].

The World Health Organization has proposed a program of ARI case management to reduce childhood pneumonia mortality in developing countries[2,3.] In this program, peripheral health workers are trained using recognizable signs such as increased respiratory rate and the presence of chest retractions, to detect pneumonia requiring treatment with antibiotics at home or by referral. Recent studies suggest that these signs are sensitive indicators of lower respiratory infection [4,5]. The program also includes education of mothers regarding the recognition of pneumonia, appropriate supportive measures, and the importance of timely immunization and good nutrition.

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The extent to which these measures can reduce mortality in children has been examined in several settings [6].

In Haryana, India, ALRI-specific mortality among low-birth-weight infants in several intervention villages was 30 per 1000 live births, compared with 71 in control villages [7]. A study in Bagamayo, Tanzania, demonstrated a 27% reduction in mortality in children less than 5 years old[8], and ALRI-specific mortality in infants in Nepal was reduced in one year from 53 to 20 per 1000 live births [6].

We studied the impact on childhood mortality of a primary health care-based program of ARI case management in the rural Abbottabad District of northern Pakistan. This area is characterized by severe winters, rugged terrain (1500-2000 meters' elevation), a traditional agricultural economy, and a low level of formal maternal education.

MATERIALS & METHODS

The study population included all children <5 years old living in 38 villages (population 37,245) in three district clusters. Each village cluster was the major catchment area of a basic health unit (BHU) or civil dispensary (CD), hi the BHUs, outpatient medical care was provided by a physician and one or two medical technicians; public health services included immunization, prenatal care, maternal nutritional supplementation, health education, and malaria control. In the CD, medical technicians provided basic medical and public health services.

Mortality data were collected from January 1985 through December 1987. Thirty-one "intervention" villages received the full range of interventions described below from March 1985 through December 1987. During this same time, the seven "control" villages received only improved immunization coverage in addition to services already provided by the BHU or CD. All intervention strategies were extended to the seven control villages from January-December 1987; the control area therefore became a "phase-11 intervention area" during the third year of the study. Control villages were non-randomly selected to be representative of other villages in the area, and were similar regarding elevation, population, house construction, and walking time to the BHU or CD (mean 30 minutes). However, five (71%) control villages, compared with two (6%) intervention villages, were inaccessible by road.

Intervention

Community health workers (CHWs) with a minimum of 10 years of schooling lived in the intervention villages, where they were available to evaluate and treat symptomatic children with ARI who were brought to their attention. Each CHW also systematically visited approximately 200 households every 10-14 days in active ARI case finding. If access to the BHU was not possible, CHWs, under the supervision of the BHU physician, administered oral cotrimoxazole for suspected pneumonia or acute otitis media before referral (Table 1).

Two supervising teams of two nurses monitored and checked CHW activities, administered oral cotrimoxazole for suspected pneumonia or otitis media, and with the assistance of the CHWs conducted frequent, informal, interactive health education programs.

Maternal health education included instruction on signs of severe illness, including rapid respiratory' rate and the inability to drink, the importance of childhood immunization, general hygienic measures including use of soap and water, preparation and use of oral rehydration salts (ORS), and simple supportive measures for children with mild ARI.

Table 1. PROTOCOL FOR ARI CASK MANAGEMENT

Classification	Symptoms & Signs	Treatment
Mild	Cough with respirations <50 /min & no chest indrawing Sore throat, no exudate blocked or runny nose	Supportive measures. Paracetamol for fever. Continued breast feeding. Adequate food & fluids. Clearing nasal secretions. Home prepared herbal tea
Moderate	Cough with respirations 50-70/min & no chest indrawing. Sore throat with exudate. Far pain or discharge <2 weeks	Refer to BHU Cotrimoxazole or Procaine Penicillin
Severe	Cough with respirations >70 /min or chest indrawing. Unable to drink	Refer to hospital. Chloramphenicol or Benzyl Penicillin. Oxygen if cyanotic.

Supportive measures included providing adequate food and fluids, continued breast feeding, giving Paracetamol for fever, providing a neutral environmental temperature, use of home-prepared herbal tea for cough, clearing the nose of secretions. removal of discharge from the ear with absorbent paper, humidification of household air, and avoidance of household smoke.

The BHUs and CDs served patients from both intervention and control villages. Children from intervention villages who had signs or symptoms suggestive of pneumonia or acute otitis media were treated according to protocol with antibiotics, primarily oral Cotrimoxazole (Table 1).

Children from control villages were treated at the BHU, CD or by private practitioners on an individual, non-standardized basis, and did not receive antibiotics provided by the study. Other services, including distribution of ORS packets, immunizations, and nutritional supplements for pregnant and lactating women were provided uniformly to persons from both intervention and control villages.

Data collection

During November 1984 to January 1985, CHWs conducted an initial census of the entire study area in which child immunization status was verified and parents were asked about deaths of children less than 5 years old in the previous year. Additional censuses were conducted in September-November of each year to determine "mid-year" population. In the intervention villages, CHWs maintained active surveillance and recorded all known births, deaths, and migrations. The control villages were surveyed quarterly to ascertain child deaths in the previous 3 months.

Supervising teams conducted standardized annual surveys in the intervention villages to determine ARI knowledge, attitudes and practices (KAP) among adult females. The nurses also performed verbal autopsies using an algorithm of standardized questions that suggested a single primary cause of death; additional information was obtained in open-ended interviews with the parents of deceased children. Each case was discussed with a physician at Ayub Medical College in Abbottabad to identify the most probable cause(s) of death; the physician was aware of the study hypothesis, but was blinded regarding the child's village. In the intervention area, interviews were conducted as soon as possible after notification of death; in the control area, verbal autopsies were conducted every three months. In the control villages in 1985, cause of death was recorded only as ALRI or non-ALRI.

Statistical methods

Records of migrations, which may have reached 15% in severe winter months, were incomplete, especially for the control villages. Child-months at risk could not be calculated; annual mortality rates were therefore determined using the September- November "mid-year" population as the denominator. The chi-square was used to test for significance; two-tailed p values include Yates correction. Taylor series 95% confidence intervals were calculated around risk ratios. The terms "child mortality" and "infant mortality" refer to deaths in children <5 and <1-year-old, respectively.

RESULTS

In 1985, 4665 and 1194 children <5 years' old

lived in the intervention and control villages, respectively. At the beginning of the study, 5% of these children were found to be immunized appropriately for age; after an intensive immunization campaign in both intervention and control areas, this proportion increased to 77% by December 1985 and 87% by 1987. Little economic or social change, and no known outbreaks of measles, pertussis, or influenza occurred during the study.

A total of 508 deaths were reported in children <5 years old; 361 (71 %) deaths were reported m infants. Baseline child mortality, both in the intervention area (determined retrospectively for 1984) and in the control area (determined prospectively in 1985-86 was 39 deaths per 1000 children per year.

ALRI and diarrhoeal diseases were the leading causes of death in both the intervention and control areas (Table 2).

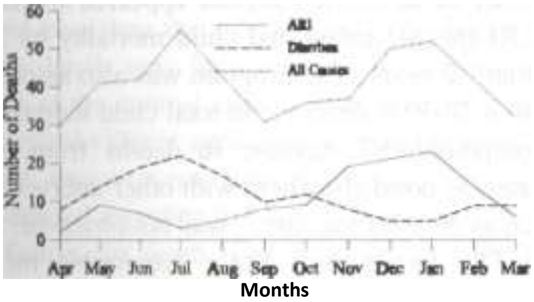
TABLE 2: PRIMARY CAUSE OF DEATH IN CHILDREN <5 YEARS AS DETERMINED BY VERBAL AUTOPSY.

- Causes of Death	Intervention Villages		Control Villages			
	1985	1986	1985		1986	
	No	%	No	%	No	%
ALRI	78	21	17	36	18	37
Diarrhoea	131	35	-	-	11	22
Malaria	9	2	-	-	4	8
Mal Nutrition	2	1	-	-	0	0
Measles	1 1	3	-	-	3	6
Neonatal Tetanus	25	7	-	-	1	2
Pre - maturity	32	8	-	-	3	6
Stillbirth	12	3	-	-	3	6
Accident/ Injury	4	1	-	-	0	0
Unknown / Other cause	74	20	30	64	6	12
Total	378	-	47	-	49	-

The causes of 50 (10%) deaths that occurred outside the study area could not be adequately ascertained by verbal autopsy. A bimodal seasonal pattern of mortality was noted, with ALR1 deaths occurring more frequently in the winter, and diarrhoeal deaths being more common in the summer months (Figure 1).

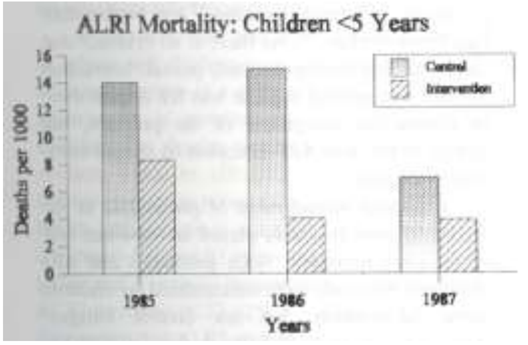
Figure 1

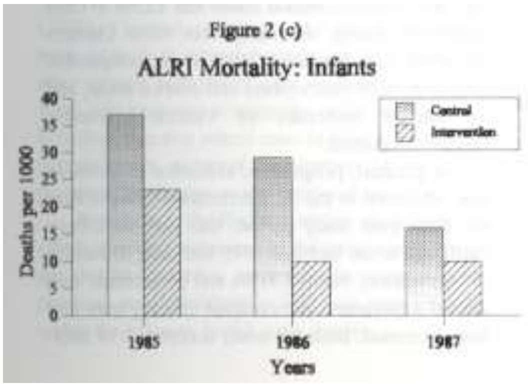
Deaths in Children <5 years, 19815-1987



Female: male mortality risk ratios were virtually identical in children from both interventions.

Figure 2 (a)

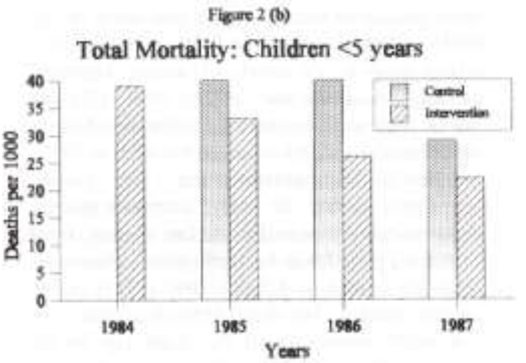


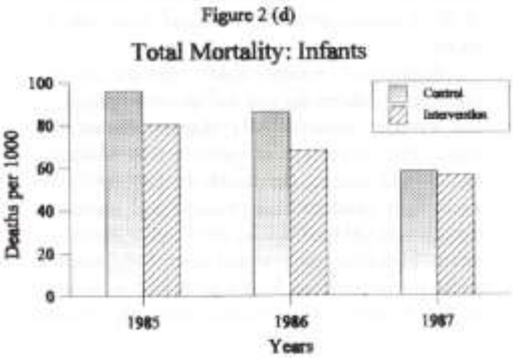


and control villages. Compared with males, the ALRI-specific mortality rate for females was 16 % higher in children < 5 years old and 25 % higher in infants, but these differences were not statistically significant. The total annual mortality rate for girls <5 years old in all villages was 31.6 per 1000, compared with 24.8 per 1000 for boys, (risk ratio, RR, 1.28; 95% confidence interval, Cl, 1.07-1.51). In infants, total annual mortality for females was 78.4 per 1CKK), compared with 60.3 for males (RR: 1.30; Cl: 1.06 - 1.59).

ALRI-specific mortality

During 1985-1986, ALRI-specific child mortality was 6.3 deaths per 1000 children per year in the intervention villages and 14.4 in the control villages (Figure 2), a difference of 56% (p = 0.0001). Following the introduction of interventions to the control villages in 1987, ALRI mortality dropped by 55% to 6.5 (p = 0.06).





Similarly, ALRI-specific infant mortality in the intervention villages was 15.5 per 1000 live births per year during 1985-86, compared with 32.5 in the control villages, a 52% difference (p = 0.0006).

After intervention began in the control villages in 1987, ALRI-specific infant mortality dropped to
15.0 per 1000 per year (p = 0.12).

Total mortality

During 1985-1986, total child mortality was 29.0 per 1000 children per year in the intervention villages and 39.4 in the control villages, a difference of 26% (p = 0.01). In 1987, total child mortality in the control villages declined by 29 % to 27.8 per 1000 children per year (p = 0.09).

Total infant mortality in the intervention area during the first two years of the study was 73.8 per 1000, compared with 93.1 in the control area, not a significant difference. Total infant mortality in the control villages declined to 54.9 per 1000 children per year in 1987 (p = 0.03).

To determine if these reductions in mortality were associated with increased utilisation of the BHU or CD, we reviewed BHU records from a control village for the months of January, February and July in both 1986 and 1987. In 1986. 107 visits (49 for ARI) were recorded for children <5 years old compared with 80 visits (36 for ARI) in 1987.

Non-ALRI mortality did not change appreciably during the study; diarrhoea-specific child mortality appeared to decline slightly, from 11.1 to 8.2 per l(XK) in the intervention villages and from 8.8 (1986) to 5.7 per 1000 (1987) in the control villages, but these differences were not statistically significant. If the death rate in the control villages in 1985-1986 is accepted as the baseline "expected" rate, then an estimated 97 child deaths were averted in the intervention villages during the first two years of the study; 76 (78.4%) of these deaths would be expected to be due to ALR1.

Results of annual KAP surveys in the intervention villages suggest that maternal practices and attitudes towards ARI changed during the study. The proportion of mothers who indicated they would contact the health facility or CHW when their child had cough and fever increased from 5% in 1985 to 58% in 1987, while the proportion indicating they would seek help from a traditional or religious healer decreased from 60% to 16%. In 1987, 78% of mothers stated they would contact the CHW and go to the BHU or CD if their child had difficulty breathing, compared with 34% in 1985. The proportion of mothers with knowledge of ARI symptoms also increased during the study.

DISCUSSION

A program of ARI case management in a rural district of northern Pakistan appeared to reduce ALRI-specific infant and child mortality by 50% within 1-2 years. The program was also associated with a 20-30% decrease in total child mortality; a "compensatory"' increase in deaths from other causes, as noted elsewhere with other interventions such as measles vaccine, was not observed.

The factor most likely responsible for the reduction in child mortality was ARI case management by CHWs, including education of mothers to recognize ARI and seek appropriate care. Maternal education appeared to result in improved health- seeking behaviour and knowledge of ARI as determined by KAP surveys. Health education also addressed several other reported risk factors for severe ARI, including malnutrition [10,1] *, indoor air pollution [l2], parental smoking and bottle rather than breast-feeding [l4], but there is no evidence that these changed during the study period. Instruction in ORS and general hygiene was felt to contribute to community acceptance of the program, but impact of this non-ARI education on overall mortality is unclear.

Improved management of pneumonia at the BHU/CD may also have played an important role in reducing mortality, since antibiotics and ARI treatment protocols were standardized for children from intervention, but not control villages. Although data is limited, the decline in mortality does not appear to be associated wutli an increase in the number of children referred to the BHU or CD for ARI. Both vaccination status and access to ORS improved during the study, but these changes occurred simultaneously and to a comparable degree in both intervention and control areas, and no known outbreaks of vaccine-preventable diseases occurred.

A gradual, progressive reduction in mortality was observed in the 31 intervention villages over the three-year study period; this may have been partly due to the fact that 1985 had only 10 months of intervention, but as CHWs and programme staff gained experience, intervention efficacy may also have increased. Both the ready acceptance of interventions by control villagers in 1987 and unproved coverage of fewer villages by experienced CHWs likely contributed to the more rapid decline in mortality observed in the control villages after intervention strategies were introduced there.

This study has several limitations. Cause of death was based on verbal autopsy, a method of limited accuracy [6] The interval between death and verbal autopsy was up to three months longer in the control area than the intervention area; recall of certain details may have been more difficult for parents in the control area. Although intervention and control villages appeared comparable in most respects, they were not randomly selected, and may have differed regarding baseline mortality and other risk factors for death. For example, data on the incidence of low birth weight and malnutrition, both risk factors for ALRI [10,11] were not obtained. Once interventions began, however, similar declines in mortality were observed in villages in both areas. Finally, because the program was implemented at the level of the village rather than the individual, use of the chi-square test may have led to overestimating the statistical significance of the observed differences in mortality [15,16].

In summary, total and ALRI-related mortality m infants and children was substantially reduced after introduction of a program of ARI case management in a mountainous area in northern Pakistan. The degree to which these same interventions would be effective in other geographic settings or in other populations served by different health care systems is unknown, although similar community-based ARI intervention trials in Nepal, India and Tanzania demonstrated reductions in ALRI mortality of 27-62% [6,8]. Baseline mortality data suggest that ALRI-specific mortality was particularly high in this study area, and a basic health clinic infrastructure already existed that was able to support CHW activities. Active case-finding by CHWs, a central component of ARI case management strategy in this study, may not be feasible in other settings, particularly on a regional or national level. ARI intervention strategies could be expected to be less effective where case-finding is primarily dependent on maternal recognition of signs of pneumonia and appropriate care-seeking.

Nonetheless, the findings of this study support efforts currently underway in Pakistan and in other developing countries to establish national ARI programs and to standardize ARI case management within the primary health care system.

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