Ann. Soc. belge Méd. trop.
1987, **67**, Suppl. 1, 83-96

MORTALITY AT YOUNG AGES AS AN INDICATOR FOR EVALUATION OF HEALTH PROGRAMMES IN DEVELOPING COUNTRIES

by

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Introduction

Critical evaluation of health (intervention) programmes has been and remains one of the most important and necessary accompaniments of any programme or project using human communities as subjects and public funds for its implementation. Aside from the importance of providing equitably distributed health services at the most cost effective rate, appropriateness and effectiveness of these services need to be constantly monitored so that services remain indeed responsive to health needs.

Infant mortality (togheter with maternal mortality) is an accepted measure of social and economic development of a country. Mortality parameters at young ages now are increasingly being singled out if not as the only acceptable ones, as the most important criteria for measuring health programme impact. This paper examines mainly the basis for, and the validity and limitations of the use of mortality as a means of (health) programme evaluation as well as briefly reviews past and present experience with its use both as measure of evaluation and basis for (intervention) programme planning.

Validity and limitations of using mortality as an indicator of programme effectiveness

The conceptual framework for using mortality as an indicator of (health) programme effectiveness is based on the fact that although prevailing child mortality rates in developing countries mainly reflect unfavourable social and environmental conditions rather than poor, or the absence of, medical care, selected health interventions have been shown to reduce the number of (child) deaths even though underlying conditions more often than not, remained unchanged. All along it should be realized, however, that social change — improvement in the quality of life in general, better nutrition, a more sanitary environment and maternal literacy, in particular — has brought about and will bring about significantly greater reductions in child deaths than selected health programmes are ever likely to achieve.

The health intervention model

The model on which the use of mortality as an evaluation indicator of a health (intervention) programme is based is shown in Figure 1. It assumes an initial status of health, i.e. absence of disease, followed by a status o ill health, i.e. disease. Ill health may resolve spontaneously, i.e. withou treatment (or despite it), improve because of personal or outside interventior or lead to permanent disability or death.

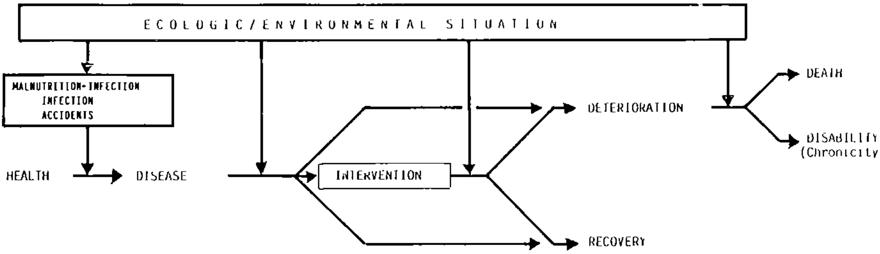

Figure 1
The Health intervention model

While this system holds true for all age and population groups everywhere child deaths at early ages in developing countries, i.e. below five years o age, usually account for half or more of all deaths and represent the greates proportion of preventable deaths in the developing world today. These death: are most frequently caused by the interaction of malnutrition-infection primarily by infection because of high pathogen density in an unhygieni environment or by accidents, whereby the latter include iatrogenic deaths i.e. are caused by inappropriate or injudicious health care. The extent t which these main causal situations exist and exert their effects is bot determined and influenced by secondary determinants of mortality consistin essentially of the ecologic/environmental situation under which the individua lives and to which he/she is exposed. Most important among these are th developmental status of a given community as well as the sociocultura microenvironment at home. This second group of (mortality) determinant: interacts with the first and together with the first needs to be subject of th initial problem diagnosis preceding the design and implementation of a (potentially effective) intervention programme. Since death is the ultimat outcome of ill health, its prevention is the ultimate objective of any healt intervention and the use of mortality rates as indicators of the effectivenes: of an appropriate intervention programme appears indeed valid. Using deat alone, however, leaves open any number of questions. If the outcome show: no, or a smaller than expected effect, reasons may include an inappropriat intervention in the first place, inadequate infrastructural support, insufficien quantity and deficient quality of (intervention) services, lack of communit participation as well as inadequate means of measuring outcome, to mentio but the most important. Using mortality as an indicator is only justified if an when one concurrently monitors both crucial process and intermediat outcome variables as well as takes account of confounding variables suc as maternal compliance and overall community acceptance and participatior A model showing the sequential programmatic steps from the initial probler diagnosis, to an analysis of secondary factors, i.e. the ecologic/environmenta situation, through the intervention «inputs» and «outputs» to the desired «impact» or «outcome», together with factors crucial to each of these steps, is shown in a simplified form in Figure 2.

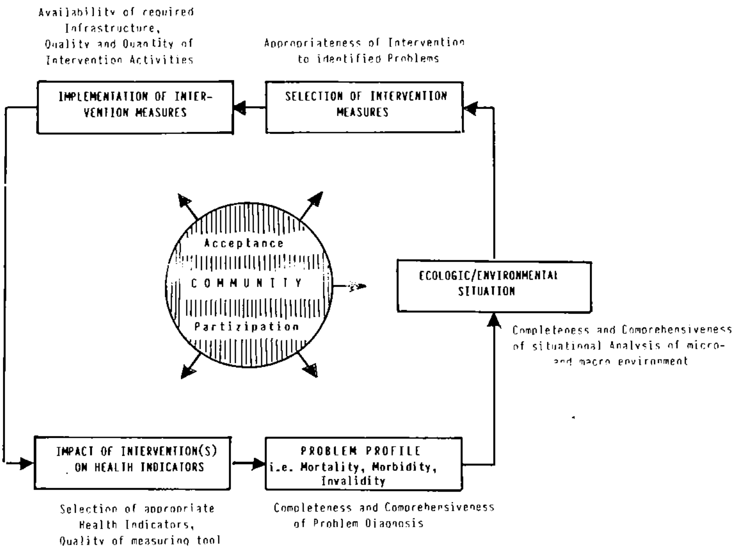

Figure 2
Health Components of a Health Intervention Programme

Limitations to the use of child mortality as an index of programme effectiveness

Use of child deaths as an indicator of health programme progress carries several limitations. Most important among these are:

The problem or problem complex mainly responsible for the elevated death rates must be readily vulnerable to intervention measures. For example, high infant mortality because of neonatal tetanus, acute respiratory tract infections, diarrheal disease and measles, all reflecting a poor status of development, may be lowered substantially through relatively simple yet highly effective interventions available today.

The system must be able of detecting changes in mortality, if indeed the intervention was effective. This might be difficult, for instance, in a setting where the population subject of study is too small to provide the required number of events in the time available for observation. While increasing the population under study may seem to be the logical answer to the problem, this may become impractical, for example, in a situation where the age of the target group is no longer in the high risk range, or where the level of mortality among young children is low to begin with and the size of the (study) population, or duration of observation required to achieve statistical significance exceed resource availability. The latter would hold true, for instance, in Costa Rica, Cuba and Sri Lanka.

(Child) mortality statistics must be reliable. This requirement may be the most difficult to meet, as death rates tend to be most inaccurate at precisely the ages most at risk of death i.e. the ones used as indicators of «success» and for whom most (health) intervention programmes are developed. A carefu examination of the quality of death statistics at young ages, hence, musi precede their use. Depending on one's findings two situations may arise Either we feel confident that the data are sufficiently precise for our purposes, or that they are not. In the latter case, we have the choice to reject theii use altogether and employ other criteria, e.g. process- or intermediate outcome variables for evaluation. We may decide to strengthen Vital Statistics (VS) reporting, as is usually done in longitudinal prospective (research) studies that compare before and after, input versus control groups, institute a special mortality (recall) survey, or use onely those age groups for which one is reasonably certain that death reporting is accurate and complete. Comparing the three separate mortality rates below one year of age with each other, i.e. first seven days, second through fourth week and postneonata deaths for the same population, has been shown to provide a rapid, yet sensitive screen for assessing the quality of death reporting*

Factors underlying mortality

Having discussed both the justification for, and limitations of, the use of child deaths for evaluating programme effectiveness, we may proceed to examine somewhat closer the mechanisms underlying, as well as experience gained with, their use.

In large parts of the developing world, Infant Mortality (IM) is still above 100 (per 1000 live births). Second year mortality is about a third of IM, and third, fourth and fifth year death rates are each about one third to one fourth lower than its immediately preceding rate. Diarrheal Disease (DD), Acute (lower) Respiratory tract Infections (ARI), Low Birth Weight incl. Prematurity (LBWP), birth injuries, and malaria where the latter is endemic, are responsible for close to 3/4 of all preschool child deaths. Table 1 shows a «model» distribution of deaths in the first five years of life in developing countries as derived from actual data from rural Guatemala, rural India and rural Tanzania.

TABLE 1
Causes of Deaths 0 to 5 years of age in developing countries*

Cause of Death	Percent
Nonspecific Diarrheal Disease	19.5
Low Birth Weight (incl. Prematurity)	17.0
Intraut. Asphyxia, Birth Trauma	14.3
Acute Respiratory Infections	14.2
Malaria	6.0
Neonatal Tetanus	3.8
Malnutrition-Measles	3.5
Neonatal Septicaemia	3.0
Congenital Malformations	2.7
Accidents and external Causes	1.5
Other	5.0
Unknown	10.5
All causes	100.0

* based on data available form Narangwal, India (11); INCAP, Guatemala (2) and Daressalam, Tanzania (23) and assuming an Infant Mortality Rate of 140, a Second Year Mortality Rate of 48 and a 0-5 Year Mortality Rate of 48.

* (A. Kielmann, «A rapid method for the assessment of the quality of death reporting in developing countries», in preparation).

Accidents, including deficient health care

Accidents, including deficient health care often constitute the majority of deaths in the first few days of life, especially if deaths from neonatal tetanus, a result of poor obstetric practice, are added. Overall, they may account for as many as one sixth of all deaths below 5 years of age. In the Narangwal study, intrauterine asphyxia resulting in the majority from inadvertant use of oxytocics, and birth trauma, both reflecting poor obstetric practice, accounted for 45 out of 124 (37 %) deaths during the first seven days of life, or for almost 15 % of all infant deaths (11). Excluding iatrogenic deaths, an additional four out of 117 deaths (3.4 %) had resulted from accidents or external causes between 8 days and 5 years of age. A significantly larger proportion of deaths in the same age range resulting from wrong medical treatment was observed in the course of the Menoufia (rural Egypt) diarrheal disease control study and has been reported by Tekce in her analysis of «verbal autopsy» reports (28). Improvement in the quality of (primary) medical care services, i.e. obstetric care in Narangwal, and curative services in rural Egypt should, hence, lead to a measurable decline in child mortality rates.

Nutrition and Mortality

The malnutrition-infection synergism usually accounts for the majority, around 40 %, of all preschool deaths. Most important among the specific problems are LBWP, malnutrition with DD and malnutrition with measles. LBWP, which largely reflects maternal nutritional status combines problems and risks of undernutrition and immaturity of organ development. In developing countries it usually accounts for more than one tenths of all preschool and somewhat more than a third of deaths in infancy.

Prematurity deaths probably result from the inability of the yet immature system to cope with extrauterine life and its hazards. The immune system though developed, is not totally functional. The sucking reflex is poor and the facial musculature required to sustain vigourous sucking is as yet insufficiently developed so that the infant becomes progressively more malnourished, and a viscious circle: malnutrition-infection with its disastrous consequences is set up.

Over the next two to three years nutrition continues to be a major determinant of survival. A close relationship between levels of nutrition and mortality risk has been established in a number of publications based on longitudinal field studies, notably the Narangwal (12) and Matlab (6) investigations. In both a marked rise in the risk of death was observed with declining nutritional status, other confounding variables being adjusted for. In the Narangwal study it was further shown, that children below 80 % of the Harvard weight-for-age median, who showed significantly higher death rates than those above, also showed lowered specific and nonspecific immune competence (13). In close parallel to the relationship between nutritional status and risk of death, complement C(3) — a nonspecific, immediate defense mechanism against any parenteral insult — was found to be directly dependant on the nutritional status at low levels of nutrition (below 80 % of the Harvard weight-for-age) but increased no further at or above 80 % (14). In Figure 3 the relationships between nutritional status on one hand, risk of death and Complement-(C3)-for age on the other, have been superimposec to suggest one likely mechanism through which nutrition influences survival

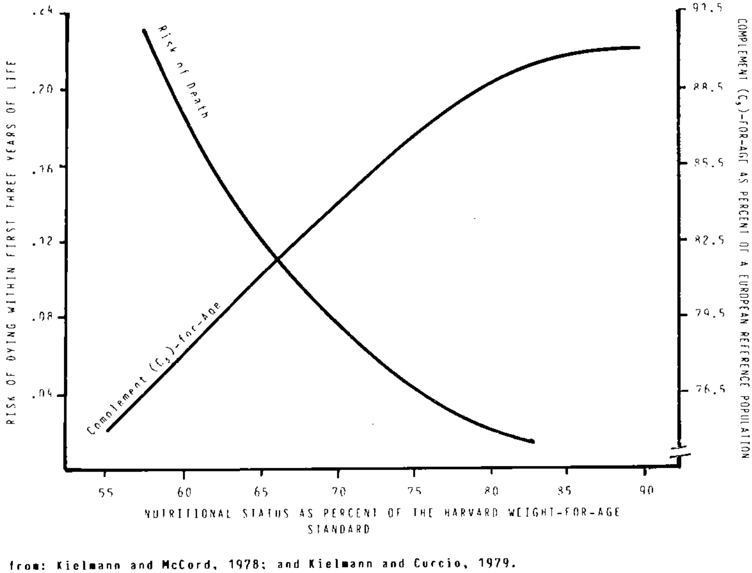

Figure 3

Nutritional Status, nonspecific immune capacity an mortality risk of children, 1 to 36 months of age
From: Kielmann and McCord, 1978; and Kielmann and Curcio, 1979.

While several factors may be operative, the decrease in child survival witl decreasing nutritional status clearly results in part from decreased resistanc to, i.e. recduced potential for recovery from, infection. And indeed, result from many parts of the world have demonstrated that improving nutritiona status among pregnant women, preschool children or both in areas wher malnutrition is prevalent, brought about a significant decline in child mortalit (1, 7, 15, 19). Recently it has been shown that children with mild Vitami A deficiency similarly have higher mortality rates than those with adequat Vitamin A intakes (25) suggesting that Vitamin A may also play an active rol in resistance to infection.

Infection and Mortality

Even in the absence of significant degrees of undernutrition, chil mortality may be elevated because of unusually high incidence and prev lence of infectious and/or parasitic diseases. Of the group of childhoo infections widely prevalent in the developing world, DD, ARI, malaria an neonatal septicaemia may be responsible for over half of all preschool death even in the absence of malnutrition. From among the parasitic disease malaria may cause as many, or more deaths than diarrheal disease amon children in areas where it is endemic (4). Aside from the disease-specific injur to the organism, deficient immune response as result of too freque infections may be co-responsible for the deaths since it has been shown least for complement (C3) that a high incidence and/or prevalence of (ski infection was associated with a significant decline in complement (C3)-for-age, other factors including nutritional status being adjusted for(14). This latter function is shown in Table 2. It is suggested that the circulating complement is being used up at a faster rate than its production whenever an infectious process persists for too long a period (prevalence) or new infections follow too close on each other (incidence). Reducing either the incidence or the prevalence of parasitic and infectious disease is invariably followed by significant reduction in child mortality (20, 24, 16).

TABLE 2
Partial values for variables in multiple regression model A[a] (complement (C3)-for-age as dependant variable)

Variable[b]	b	Standard error (b)	Partial r^2	F (1,51)	P
Nutritional status	185.2	42.7	0.22	18.8	< 0.005
Skin infection	— 11.0	4.2	0.09	6.8	< 0.025
(constant)	89.3				

[a] Mutiple R = 0.317; $S_{y.x}$ = 15.2; F(2,50) = 11.61; P < 0.005 for the total model.
[b] Nutritional status = (weight-for-age — 1)^3; skin infection variable value is 1 if it was present in the past; zero if it was absent.
From: Kielmann and Curcio, 1979.

Use of mortality rates to measure social and environmental situations

As mentioned earlier, social development usually has a significantly greater impact on child deaths than selected health interventions. In Ludhiana district (Punjab), death rates among preschool children between 1960 and 1970 were almost halved as result of the Green Revolution and its resultant improvement in the overall quality of life. Over this same period no major changes had occurred in the health care delivery system(15). In the past,

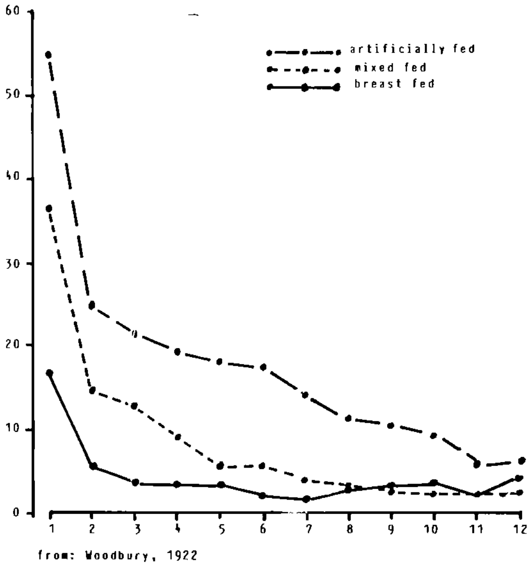

Figure 4
Monthly mortality rates (MMR per 1000 infants) by type of feeding followed during the month in eightAmerican cities
From: Woodbury, 1922.

mortality rates in small children have been used fairly extensively to shov the ill effects of an unsanitary environment, of unsound child rearing practice: and of adverse socio-demographic characteristics. A classic among these studies is one carried out by Woodbury in 1920 on childhood mortalit patterns in eight U.S. cities where he compared death rates among bottle-fed mixed-fed and breast-fed infants (29). As shown in Figure 4 the relationshi was strongly in favour of breast feeding and found to be age dependant, i.e the younger the child the more detrimental the effects of bottle and mixe feeding. A subsequent examination of infant feeding practices and postneona tal deaths in Europe over the course of the last century by Wray confirme Woodbury's findings (31).

One wonders why in the late sixties when the issue of bottle- versu: breast-feeding once again surfaced it took so long to come to the sam conclusions. In a subsequent study Woodbury also demonstrated the progres sive increase in infant mortality with increasing birth order and decreasin birth interval, with low (i.e. less than 20) and high (i.e. more than 35) materna age (30). Mortality rates in small children were found to be sensitive indicator: of unfavourable social and envrionmental conditions (9, 27, 26) as well a: of improving social conditions (22). Child mortality rates may be employe successfully to (retrospectively) deemphasize the role immunization an modern medicine played in, and at the same time demonstrate the beneficia effects of overall improvement of social conditions towards, the dramati decline of child mortality experienced in England and Wales between th middle of last and this century. As shown in Figures 5, the decline in mortalit long preceded availability of immunizations and antibiotics against th traditional scourges of childhood such as Diptheria, Pertussis and Measles and pneumonia, respectively.

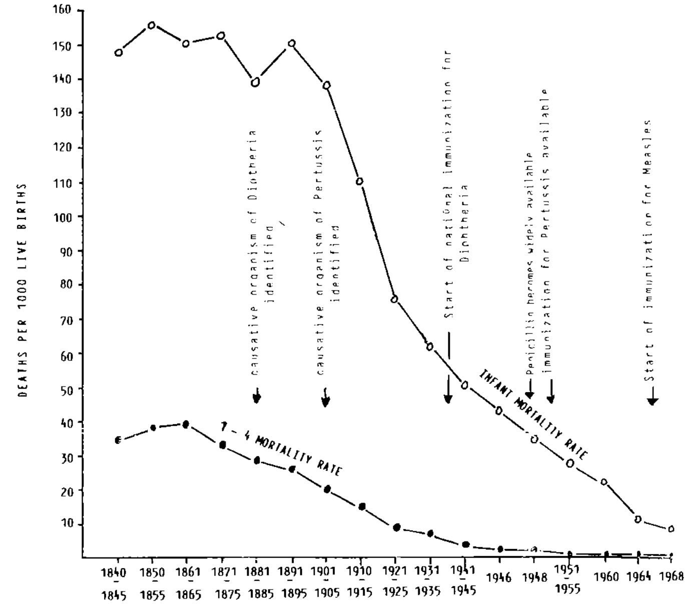

Figure 5
Infant- and 1-4 year mortality rates, England and Wales (1840-1968)

Lastly, the dramatic decline of child mortality in post-revolutionary Cuba has been used convincingly to vindicate the reorganization and equalization of the health care system under socialism (8).

Death rates at young ages, and particularly in infancy, together with their causes thus provide excellent clues to the overall level of (social) development prevailing at the given time. Table 3 shows the distribution of infant deaths in eight American cities around the turn of the century. Both age- and cause distributions are rather similar to that of rural India today, if anything the situation then appears to have been worse. Among the most prevalent causes of death, diseases associated with unsanitary personal or environmental hygiene, deficient medical services — curative as preventive, and under- and malnutrition seem to have predominated. One may well assume that conditions prevalent in the United States then were not much different from those in developing countries today.

TABLE 3
Causes of infant deaths in eight U.S. cities 1900 and in Narangwal, Punjab, 1972

INFANT MORTALITY RATE	U.S. 1900	NARANGWAL 1972
	150	130
DISTRIBUTION OF CAUSES OF DEATHS*:		
Infective and parasitic diseases	11.9	10.5
Diarrhea and enteritis	37.0	27.0
Pneumonia and Influenza	22.0	17.0
Congenital Malformations	9.6	5.4
Certain diseases assoc. with early infancy incl. prematurity	51.8	41.9
All other causes	17.7	28.3

* per 1000 life births.

From: Woodbury, 1926; and Kielmann *et. al.*, 1978.

Let us now look to what effect mortality rates in preschool children have been used to measure the impact of specific health programme effects.

Mortality rates as specific programme evaluation indicators

Short-term and vertical interventions

As we have seen, using mortality retrospectively to demonstrate cause-effect relationships including validation of the effectiveness and appropriateness of social reforms is not new. Using it as a prospective tool to evaluate the effectiveness of a new treatment similarly is not and has been employed in hospital based studies or on other captive population groups since the beginnings of modern medicine. Its use to measure community-wide health programme effects has gained widespread acceptance only since the 1970's. Prospective use of mortality as an indicator of programme effectiveness usually does not lend itself for short-term, e.g. seasonal, projects, such as DD control, unless the size of the population under investigation is large enough to show-up mortality differences, if indeed there are any. Even then, it is imperative that a control group, comparable in all aspects to the beneficiary population, be monitored in parallel to account for seasonal trend as well as normal fluctuations in child deaths.

Measuring death rates only for the duration of the intervention, howeve has its limitations. Unless deaths continue to be monitored longitudinally, remains unknown to what extent mortality benefits will continue to accru beyond the immediate intervention period. Thus they may return to their usu levels or even manifest a rebound increase to higher levels following an initi decline. Mosely postulates that many health programmes, though temporaril decreasing child mortality will have little or no overall lasting impact, as lon as the social ecology in which these deaths occur remains the same(24 In simple words, a child saved from death through ORT today, ma subsequently succumb to another bout of DD or any other equally prevalen and potentially lethal health problem, making the net result zero. That th in fact does occur is supported by findings of the Kasongo team, who note that even though deaths from measles declined significantly followin measles immunization, overall childhood mortality levels over time on showed a very small decline(10). This latter train of events is especially like to occur with vertical or unidirectional health programmes carried out i isolation of general developmental activities.

Intermediate and long-term interventions

The level of preschool child death is a sensitive and perhaps the on acceptable, indicator for evaluating intermediate and long term (comprehe sive) health interventions. While for programmes of primarily service natur impact may be measured through analysis of mortality trends, especially they can also be compared to regional or national ones, use of the parall «control group» is still a «sine qua non» for research programmes. Resul from Jamaica, Matlab and Narangwal may serve as examples. In the firs community health workers in a county were recruited to survey prescho children, to provide nutrition education and, selectively, supplements to thos identified as malnourished. Measurement of programme impact relied, esse tially, on a before and after comparison. The initial impression of a maj reduction in child mortality could not be sustained when a follow-up surve revealed an overall decline in child mortality also in the neighbouring coun as part of a secular trend(18). For the Matlab area information c «background levels» of childhood mortality had been known for more tha a decade on 180,000 people, when MCH consisting of tetanus immunizatior to women, diarrheal disease control, nutrition education and family plannir services were systematically introduced for one part of the population whi the other continued to serve as controls(7).

In the Narangwal nutrition study, carried out in rural Punjab between 196 and 1973, a variety of health intervention packages, featuring nutritic supplementation to preschool children and needy pregnant women, ar infectious disease control singly or in combination, backed by health ed cation and measures of community participation, were provided to a grou of ten villages and effects on child morbidity, mortality and nutritional statu were measured on an ongoing basis between three input and one contr cells(13). Because of the large sample size, the gradual decline of chi deaths over time could be well demonstrated only in the Matlab project a shown in Table 4.

TABLE 4
Crude birth and death rates, and child mortality rates in Matlab MCH-FP and comparison areas, 1979-81

Year	Vital events	MCH-FP area	Comparison area
1979	Midyear population	89'574	86'313
	CBR	34.9	47.0
	CDR	12.1	15.6
	Neonatal mortality rate	70.9	74.6
	Postneon. mortality rate	43.5	43.3
1980	Midyear population	91'010	88'280
	CBR	37.1	45.5
	CDR	11.3	14.8
	Neonatal mortality rate	59.3	72.7
	Postneon. mortality rate	32.6	41.3
1981	Midyear population	92'634	90'377
	CBR	35.3	43.8
	CDR	11.9	14.4
	Neonatal mortality rate	65.8	69.0
	Postneon. mortality rate	37.7	46.3

From: Chen *et. al.*, 1983.

In addition to showing a reduction of deaths in all input vs. control villages, the Narangwal study provided important clues to the specific (cost) effectiveness of various intervention mixes as well as on the effects of social variables on child deaths. Thus, nutritional supplementation of needy mothers (a preventive activity) was identified as the most cost-effective means of lowering child (i.e. neonatal) deaths and was significantly more effective in reducing neonatal mortality than infectious desease control. In the postneonatal period, when the child was increasingly exposed to a pathogen-dense environment, infectious disease control was able to reduce child deaths by close to 40 %, whereas nutritional supplementation yielded no measurable benefits. After the age of one either of the two showed a significant impact. The (mortality) data further indicated that overextension of the responsibilities of the health worker, as had occurred in a comparable cell of a parallel population project, where health workers additionally provided family planning and health care services to women, greatly reduced programme effectiveness on child mortality below one year of age; probably because of a «dilution» of efforts.

Use of mortality to identify areas for promising health interventions

Careful examination of the distribution of child deaths by cause and numbers is part of the situational analysis essential in (health) programme planning. On re-examining Table 1 one may readily identify health problems vulnerable to effective yet low-cost interventions, i.e. those for which with relatively simple means maximal decrease in (child) mortality may be effected. The first step in this examination consists of establishing health problem priorities among the vulnerable population groups; the second of determining for which of these cost-effective interventions are available; the third whether selected (intervention) strategies are indeed implementable given locally prevailing resource constaints.

Thus for DD, LBWP, ARI, malaria, neonatal tetanus and malnutrition-measles, intervention programmes are available that have been tried in the community setting and found to be both highly effective and readily implementable. Although we are not aware of any successful community obstetric programme, it stands to reason that also in this area (i.e. perinatal care), major improvements in child survival may be achieved with proper re-training and supervision of midwives — trained and traditional.

For four out of the six identified promising intervention strategies (i.e. DD, ARI, malaria and measles-malnutrition), maternal involvement and active participation are crucial to the success of the intervention. For the first three, the effectiveness of the intervention, e.g. oral rehydration, early treatment with antibiotics or antimalarials directly depends on the mother's (early) recognition of the disease process and initiation of intervention measures; for the fourth, the mother's knowledge and practice of proper child feeding and her compliance with an immunization programme are vital prerequisites for success. Although the mother's role in the reduction of deaths from LBWP is more of a passive nature, the intervention — maternal supplementation — still requires her compliance. No wonder then, that maternal education had been repeatedly identified as one of the strongest determinants of child survival (3, 5).

TABLE 5
Levels and Causes of Deaths 0 to 5 years of age in developing countries, and the potential for their reduction

Cause of Death	%	ADSMR*	Intervent. available	% Reduct.** achieved	Potential ADSMR
Nonspec. Diarrheal Dis.	19.5	9.2	yes	50 (17, 19)	4.6
Low Birth Wt. (incl. Prematurity)	17.0	8.3	yes	33 (18)	5.6
Intraut. Asphyxia, Birth Trauma	14.3	6.8	?	25 ***	5.1
Acute Resp. Infections	14.2	6.6	yes	40 (20, 23)	4.0
Malaria	6.0	2.9	yes	30 (23)	2.0
Neonatal Tetanus	3.8	1.9	yes	98 (17)	0.0
Malnutrition-Measles	3.5	1.7	yes	4 (10)	1.6
Neon. Septicaemia	3.0	1.5	?		1.5
Cong. Malformations	2.7	1.2	no		1.2
Accidents and ext. Causes	1.5	0.7	no		0.7
Other	5.0	2.4	?		2.4
Unknown	10.5	4.8	?		4.8
All causes	100.0	48.0		30	33.5

* ADSMR = Age- and disease-specific mortality rate; i.e. numbler of deaths from a given cause per 1000 children in the specified age range.
** Figures in brackets are reference numbers.
*** Estimate, given an intensive training programme for indigenous midwives.

Even in the absence of social and environmental changes and restricting oneself to interventions that already have been tested and proven in the (child) community setting, child mortality below five years of age could readily be reduced by 30 % or more in most developing countries that have a (child) mortality profile similar to the one presented in Table 1. Where and how this reduction might be achieved is shown in Table 5. Whether such an achievement, in the absence of overall development is worth attaining, remains questionable.

Summary — The paper assesses the basis for, and the validity and limitations of the use of mortality at young ages as an indicator of health intervention programme evaluation. The various factors influencing and determining child deaths are being discussed. Past and present experience with the use of death rates of childhood as evaluation and monitoring tool are being reviewed and the use of mortality indicators as guideline in the selection of intervention strategies for programme planning is being examined.

Résumé — Les bases scientifiques, la validité et les limites de l'utilisation de la mortalité aux jeunes âges en tant qu'indicateur pour évaluer des programmes d'intervention sanitaire sont examinées. Les différents facteurs pouvant déterminer la mortalité sont discutés. L'expérience passée et présente est revue ainsi que l'utilisation des mesures de mortalité pour la sélection de stratégies d'intervention pour la planification des programmes.

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