Factors associated with trends in infant and child mortality in developing countries during the 1990s

Shea O. Rutstein[1]

The 1990s have seen a remarkable decrease in mortality among infants and children in most developing countries. In some countries, particularly in sub-Saharan Africa, these declines in mortality among children have slowed and are now increasing again. Internationally comparable data derived from survey programmes, such as the Demographic and Health Survey (DHS) programme, are available both to document the changes that have occurred in mortality and to provide insight into some of the factors that may explain these trends in mortality. The factors found in repeated DHS programmes that explain these trends fall into five categories: fertility behaviour; nutritional status, breastfeeding, and infant feeding; the use of health services by mothers and for children; environmental health conditions; and socioeconomic status. Both simple analyses and multivariate analyses of changes in these factors between surveys indicate that all factors affected the mortality trends. However, to explain trends in mortality, the variables themselves had to have changed over time. During the 1990s fertility behaviour, breastfeeding, and infant feeding have changed less than other factors and so would seem to have played a smaller role in mortality trends. This study confirms that trends in mortality during the 1990s were related to more than just a handful of variables. It would, therefore, be a mistake to concentrate policy actions on one or a few of these while forsaking others. Countries with the largest decreases in mortality have had substantial improvements in most of the factors that might be used to explain these changes. In some countries mortality has risen. In part these increases can be explained by the factors included in this study, such as deterioration in seeking medical care for children with fever. Other factors that were not measured, such as the increasing resistance of malaria to drug treatment and the increased prevalence of parental HIV/AIDS, may be contributing to the increases noted.

Keywords: developing countries; infant mortality; child mortality; demographic surveys; socioeconomic factors.

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Introduction

Mortality among infants and children has been declining in most developing countries from the mid-1980s and throughout the 1990s. However, this decline has recently slowed, stopped, or reversed itself in some countries of sub-Saharan Africa. The purpose of this paper is to examine some of the factors that may be involved in these trends in mortality and to measure the strength of the relations. The analysis is based on data gathered through the Demographic and Health Survey programme.

Data and methods

The Demographic and Health Surveys

The Demographic and Health Survey (DHS) programme is the world's largest survey, collecting information on mortality among infants and children and on health status and health service indicators. Now in its 16th year, the programme has conducted 104 comparable surveys in 62 developing countries comprising over 1 million interviews with women of reproductive age. Twenty-one additional surveys are being conducted. The United States Agency for International Development has provided most of the funds required to carry out the surveys. Because of priorities within the agency and the level of country representation, not all developing countries have been able to participate. Almost all of the surveys are representative at both the national level and at the level of populations living in households. Many countries have conducted more than one survey at intervals of 3 to 6 years. The data are gathered in face-to-face interviews. The infant and child mortality rates and demographic factors are derived from birth histories obtained from the mothers interviewed. Nutritional status indicators are based on anthropometric measurements, and vaccination rates are derived from inspection of immunization cards (or mothers' reports for children whose cards are not seen). Calculations for other health indicators are based on questions asked of mothers for each child.

[1] Technical Officer, ORC/Macro International, Inc., 11785 Beltsville Drive, Calverton, MD 20705, USA (email:rutstein@erols.com).

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The data used in this study come from the 89 surveys in 56 countries that had data available for analysis at the time of writing (a summary of the countries and surveys is available on the web at http://www.who.int/bulletin/tableofcontents/2000/vol.78no.10.html). The programme recommends that data are not released for analysis until the main survey report is published, usually about a year after the fieldwork is concluded. A few countries restrict when data can be released; this may delay the release of the data for these countries by an additional 2–4 years. In this analysis, trends in mortality and factors that might explain these trends are calculated from the differences between surveys conducted at various times in the same country. The earliest surveys took place in 1986 and the latest in 1998. While many countries have had two or three national surveys in the course of the programme, some have had only one. The intervals between two surveys in the same country range from 35 to 117 months with an average interval of 63.5 months. The data allow 33 comparisons. To increase the number of cases for multivariate analysis, each country was divided into urban and rural areas and the comparisons within each these areas were used, producing 66 cases.

The data pertain only to less developed countries and, because of funding agencies' priorities, tend to represent the larger countries. Sub-Saharan Africa had the most completed surveys (28). Of the comparisons between surveys from the same country, the greatest number come from sub-Saharan Africa (16) and Latin America (8). Given that the comparisons are concentrated by region, and even by country within a region, the results of the analysis may not fully represent the changes that have taken place in all developing countries. The results of this study will not identify factors that will affect changes in infant and child mortality in developed countries.

Infant and child mortality

Calculation of rates. Mortality rates for neonates, infants, and children under the age of 5 years are expressed as the number of deaths per thousand births in a given period. Other mortality rates (post-neonatal, toddler at age 1 year, child at age 2–4 years; childhood at age 1–4 years) are expressed as the number of deaths per 1000 survivors at the younger age.

Using direct methods based on the birth histories, mortality rates were calculated for the five years preceding each survey. This period was used as a compromise between the need to provide recent estimates and to ensure that there were enough births so that sampling errors would be small. Direct methods for the calculation of mortality rates compiled dates of birth and ages at death of each child. Indirect methods used models involving assumptions of patterns used with accumulated data (i.e. tabulations of the total number of children ever born and the total number of children surviving according to age group of the mother at the time of data collection). The rates were calculated using a synthetic-cohort life table procedure (*1*) that classifies rates by the period in which the death occurred. In this method, children born at different times but exposed to mortality at the same time are combined. The alternative method, true cohort methodology, is based on a single cohort of children who are exposed to mortality at different times. The true cohort method cannot be used for the most recent period examined.

Levels and trends of infant and child mortality

Level of mortality. To calculate the level of mortality the latest available information from each country was used. Mortality among children under 5 varied from a low of 32 deaths/1000 births to a high of 274/1000 births. The mean for the 56 countries was 112 deaths/1000 births. Table 1 gives the mean, standard deviation, and minimum and maximum mortality rates. Of the component mortality rates that together make up mortality among those aged five years or less, the rate of child mortality at 2 to 4 years (3q2) has the largest variation, from a low of 29 deaths/1000 children reaching the age of 2 years to a high of 219 deaths.

Trends. The trends in mortality among those under 5 years of age ranged from a decrease of 63 deaths/1000 births to an increase of 25 deaths/1000 births with an average change of 14 fewer deaths/1000 births (Table 2). Twenty-five of the trends were decreases, seven were increases, and one was <1 death/1000 births. Fig. 1 shows the average change between surveys in each region. The greatest decreases occurred in West Africa (an average decline of 26 deaths/1000 births) and in Latin America (an average decline of 20 deaths/1000 births). Mortality increased on average in East Africa and southern Africa by about 3 deaths/1000 births.

Table 1. **Mean level and variation of infant and child mortality rates for the Demographic and Health Surveys in developing countries, 1986–98**

Value	Mortality rate						
	Neonatal	Post-neonatal	Infant (< 1 year)	Age one year	Age 2–4 years (3q2)	Age 1–4 years (4q1)	Under five years
Minimum	16.3	5.1	24.7	2.2	29.1	3.7	31.6
Maximum	67.9	93.4	144.3	70.5	218.7	171.9	273.8
Mean[a]	33.4 (11.4)	36.3 (19.9)	69.7 (19.1)	20.0 (15.4)	95.0 (48.9)	46.8 (38.5)	112.4 (60.6)

[a] Values in parentheses are standard deviations.

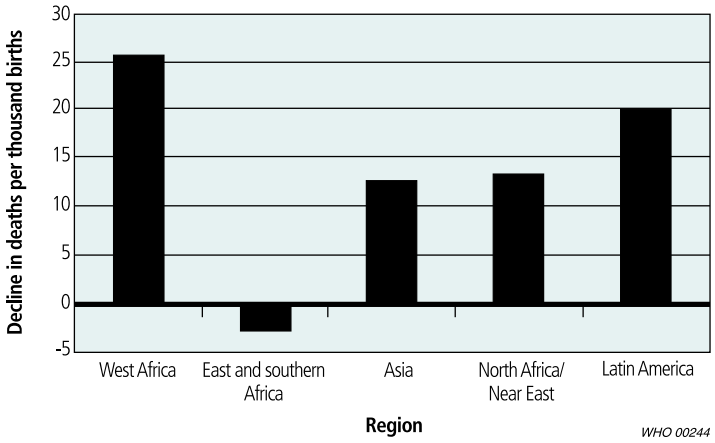
Table 2. **Changes in infant and child mortality rates between surveys**[a]

Value	Difference in mortality rate						
	Neonatal	Post-neonatal	Infant (<1 year)	Aged one year	Aged 2–4 years (3q2)	Aged 1–4 years (4q1)	Under five years
Mean[b]	–3.0 (6.5)	–2.5 (7.0)	–5.6 (11.8)	–3.8 (5.7)	–10.5 (15.7)	–8.9 (14.2)	–13.6 (19.2)
Minimum	–16.4	–19.8	–33.9	–21.9	–45.5	–50.7	–62.9
Maximum	9.3	9.3	17.4	4.6	24.3	14.7	25.4

[a] Number of comparisons = 33.

[b] Values in parentheses are standard deviations.

Fig. 1. **Regional decline in under five mortality between surveys**



Each estimate of mortality rates varies because it is based on a sample of respondents. Thus, when examining trends from DHS data, changes of <10 deaths/1000 births should be downplayed to reflect sampling error calculations made for the surveys. Using this criterion, 17 countries had decreases in mortality of >10 deaths/1000 births among those aged under five years, and only three had increases of >10 deaths/1000 births.

For infant mortality, the average change over time between surveys (average of 63.5 months) was a decrease of 6 deaths/1000 births. The greatest decrease was 34 deaths/1000 births in Brazil and the greatest increase was 17 deaths/1000 births in Mali. The changes in the other component mortality rates are given in Table 2.

Explanatory factors

Many health factors are associated with mortality. The association of causal factors of infant and child mortality has been summarized in the Mosley–Chen framework (*2*). Not all of the factors related to mortality have been included in the DHS programme. The surveys have mainly included factors that are of greatest interest for public policy and for which there are known interventions to reduce mortality.

This study considers the five groups of explanatory factors: fertility behaviour as reflected in the demographic characteristics of births, the nutritional status of children and patterns of breastfeeding and infant feeding, maternal and child health status and the use of health services, environmental health factors, and socioeconomic factors. The indicators of these factors (except median duration of breastfeeding) are expressed as percentages; the denominators vary according to the definition of each factor. The time to which each trend refers varies according to the length of time between surveys. However, because both mortality and the explanatory factors are derived from the same survey, the time reference is the same for both.

Relations between the explanatory factors and mortality can be assessed both cross-sectionally and over time. Although a factor may be important in explaining cross-sectional differences in mortality across countries, the factor may not have changed much over time within each country and therefore may not explain trends in mortality. This does not mean that the factor is unimportant in determining mortality or in explaining future trends or for choosing policy options.

Fertility behaviour

Three characteristics of fertility behaviour have been associated with infant and child mortality. High mortality has been associated with being the first born and with higher order births, with having a mother who is younger than 18 years of age or is ⩾35 years at the time of the birth, and with preceding birth intervals shorter than 24 months (*3*) or 36 months (Rutstein SO, unpublished data). The means and ranges for each of these characteristics are shown in Table 3.

There have been comparatively small changes between surveys in factors associated with fertility behaviour. On average, the change has been 4% or less. Five of the seven characteristics of fertility behaviour had average changes in the direction of reducing mortality. The greatest average change was a decline of 4% in the percentage of births for which the birth interval was <36 months. The greatest increase was in the percentage of first born children, with an average rise of 0.3%. Although most of the fertility indicators decreased the amount of the change was small. Of the 33 comparisons, those which decreased by >5% are fourth or higher birth order (4 countries), sixth or higher birth order (2), birth intervals of <24 months (3), and birth intervals of <36 months (6). No fertility behaviours increased by > 5%.

Table 3. **Demographic characteristics associated with infant and child mortality**[a]

Characteristic	Latest value			Number of countries with infant and child mortality changed over time			
	Mean[b]	Minimum	Maximum	Decreased	Unchanged[c]	Increased	Mean change
First births	23.2 (5.8)	11.9	39.1	2	8	23	22
Fourth or higher order births	42.0 (10.9)	17.1	64.1	27	4	2	–3.7
Sixth or higher order births	21.5 (8.2)	3.9	41.7	23	6	4	–2.8
Birth intervals of less than 24 months	26.2 (7.6)	12.0	44.3	23	8	2	–2.5
Birth interval of less than 36 months	60.4 (7.3)	36.2	73.6	30	1	2	–4.0
Mother's age at birth less than 18 years	6.7 (3.5)	0.9	19.2	4	22	7	0.3
Mother's age at birth 35 or more years	13.5 (3.9)	5.5	23.6	11	14	8	–0.1

[a] Number of comparisons = 33.

[b] Values in parentheses are standard deviations.

[c] Less than 1% change.

Table 3 also shows the direction of the trends in fertility characteristics. In all tables the "no change" category includes changes of <1 percentage point in either direction. The decline in the percentage of higher order births and short birth intervals is likely to have been the result of increases in the use of family planning. Given that the fertility factors have not changed much over time, they would not be expected to play a large role in explaining mortality trends in the 1990s.

Nutritional status, breastfeeding, and infant feeding

Nutritional status. Nutritional status is derived from anthropometric measurements of height and weight, comparing each child with the National Center for Health Statistics/Centers for Disease Control/WHO international reference standards (*4*, *5*). The three indicators of nutritional status are stunting, wasting, and being underweight. Stunting indicates chronic undernutrition in children; wasting indicates acute undernutrition; the proportion of children who are underweight is an indication of general undernutrition. Underweight children may either be chronically or acutely malnourished or a combination of both. Not all of the surveys weighed and measured children. Also, because of differences between surveys, the nutritional status indicators used here are based on data from children aged 3–35 months at the time of the survey.

The levels and trends of the nutritional status measures are shown in Table 4. Data from the 46 most recent surveys show that chronic undernutrition occurs on average in about 31% of these children. However, there is a wide variation between countries: the proportion ranges from 5% of children being stunted to 52%. Acute undernutrition occurs among 8% of children on average, and the proportion varies from 0–25% of children. Being underweight occurs on average among 25% of children.

Only 22 comparisons over time are available for the nutritional status indicators. On average the incidence of chronic undernutrition decreased by 3%, the average incidence of wasting increased by 2%. As a result, the average percentage of children classed as being underweight increased by 1 percentage point. Fourteen countries had decreases in the percentage of children who were stunted but only three had decreases in the percentage who had wasting (Table 4).

Breastfeeding and infant feeding. Breastfeeding advocates recommend that to minimize mortality children should be breastfed for at least 6 months, should begin to be fed solid food at age 7 months, and should breastfeed well into the second year of life (*6, 7*).

This study uses three indicators of breastfeeding and infant feeding: the median duration of breastfeeding, the percentage of children under the age of 4 months who are fully breastfed (i.e. exclusively breastfed or receiving just plain water in addition to breast milk), and the number of children aged 7–9 months who are both breastfed and given solid food. These indicators parallel the recommendations except that the indicator of exclusive breastfeeding has been relaxed by allowing plain water to be given and by concentrating on children under 4 months of age. Compliance with the recommendations varies substantially (Table 4). There has been little change in the overall averages of the breastfeeding indicators, but the averages hide the large variations in both directions that have occurred for exclusive breastfeeding and for feeding complemented with solid and semi-solid foods. These indicators thus may have some potential for explaining both the direction and amount of change in infant and child mortality.

Table 4. **Nutritional characteristics associated with infant and child mortality**

Characteristic	Latest value			Number of countries with infant and child mortality changed over time			
	Mean[a]	Minimum	Maximum	Decreased	Unchanged[b]	Increased	Mean Change
Stunted (%)	30.8 (12.3)	4.9	51.6	14	3	5	–3.0
Wasted (%)	8.3 (5.9)	0.3	24.5	3	5	14	2.3
Underweight (%)	25.2 (13.2)	4.6	55.6	9	5	8	1.2
Median duration of breastfeeding	18.4 (5.6)	6.0	36.0	2	19	12	0.7
Children under 4 months who are fully breastfeeding (%)	51.2 (19.1)	12.0	94.6	11	3	19	3.1
Children 7– 9 months who are breastfeeding and receiving solid or semi-solid food (%)	64.2 (19.6)	29.4	96.0	10	4	17	4.6

[a] Figures in parentheses are standard deviations.

[b] Less than one percent or one month change.

Maternal and child health status. Twelve indicators of maternal and child health status were examined as factors associated with infant and child mortality. They include indicators of maternal health care, vaccination status of children and their mothers, and the use of curative services. Many of the surveys included additional indicators, such as the percentage of children ill with fever who received antimalarial drugs. In general, many of these indicators were not repeated and so time trends are not available. The new questionnaire has restored the questions on antimalarial drugs.

For maternal indicators, the percentage of births for which the mother had medical prenatal care (given by a doctor, nurse, or nurse-midwife), medical attendance at the birth, and births in a health facility are included.

Four measures indicate vaccination status. The first two are the percentage of births for which the mother received any prenatal tetanus toxoid vaccination and those for which she received two or more doses. The third indicator is the percentage of children aged 12–23 months who were vaccinated against measles, and the fourth indicator is the percentage of children aged 12–23 months who were fully vaccinated with bacille Calmette–Guérin (BCG), three doses of diphtheria–tetanus–pertussis vaccine (DTP), three doses of poliomyelitis vaccine (excluding polio vaccine given at birth), and vaccine for measles.

The use of curative child health services is indicated by five measures. The first is the percentage of children with diarrhoea who were seen in a health facility. There are also similar indicators for acute respiratory illness and fever. Two more indicators measure the percentage of children with diarrhoea who received oral rehydration salt solutions and the percentage who received the more general oral rehydration therapy, classed as either oral rehydration salts or increased liquids.

The greater the use of maternal and child health services, the lower the presumed infant and child mortality. The use of health services are given in Table 5. There is a wide variation in the use of the various health services both between the types of services and between countries. The service most commonly used is medical prenatal care, with an average of 73% of births having had such care. The least used service is treatment of diarrhoea with oral rehydration salt solution, occurring in an average of 31% of cases.

On average the use of maternal and child health services rose for all variables measured except for children with fever being seen at a health facility. The greatest average increases were for the use of oral rehydration therapy and vaccinations. The smallest changes were for the percentage of births occurring in a medical facility and the percentage of children with diarrhoea who were seen in a health facility. The direction of the changes shows that in many countries there was an increase in the use of health services, again except for children with fever. Substantial numbers of countries show a decline in this indicator. Given the changes in use of health services, we would expect a decline in infant and child mortality to occur except in countries where malaria is prevalent.

Environmental health factors. Removing contaminants from the living space of children is an important means of preventing the deterioration of health that may lead to death. In developed countries, much of the decline in mortality has come about through public health measures that have improved environmental health, such as water purification, sanitary sewerage, trash and garbage collection, and reductions in food contamination (*8*). Other im-

Table 5. **Indicators of maternal and child health services associated with infant and child mortality**

Indicator	Latest value			Number of countries with infant and child mortality changed over time				
	Mean[a]	Minimum	Maximum	Decreased	Unchanged[b]	Increased	Mean change	Number of comparisons
Percentage of births								
Prenatal medical care	73.3 (20.6)	26.9	98.3	4	3	23	7.0	30
Births in a health facility	46.4 (24.6)	4.6	98.4	5	3	9	1.3	17
Births with medical attendance	47.2 (20.9)	8.2	98.4	5	3	24	9.5	32
Any tetanus toxoid vaccination	63.8 (19.0)	17.7	95.6	4	2	25	11.6	31
Two or more tetanus toxoid vaccinations	43.2 (17.3)	1.0	86.3	6	0	11	4.4	17
Percentage of children aged 12–23 months								
Measles vaccination	60.2 (18.6)	19.2	86.7	7	3	20	13.0	30
Fully vaccinated	46.0 (19.8)	9.4	79.3	7	2	21	11.4	30
Percentage of ill children								
With acute respiratory infection seen at a health facility	47.9 (18.6)	18.2	87.1	5	0	12	3.1	17
With fever seen at a health facility	36.1 (18.7)	8.7	89.7	15	0	3	−10.1	18
With diarrhoea seen at a health facility	34.0 (13.5)	11.1	71.1	9	3	16	0.8	28
With diarrhoea treated with oral rehydration salts	31.4 (15.4)	1.7	79.2	9	2	17	4.1	28
With diarrhoea treated with oral rehydration salts or increased liquids	55.4 (18.3)	4.7	86.8	4	2	22	17.0	28

[a] Figures in parentheses are standard deviations.

[b] Less than 1% change.

provements can be linked to increases in economic status; these include better household construction, especially flooring; the use of refrigeration; the increased ability to clean clothes, bedding, and the home; and the use of low-smoke cooking fuels.

The environmental health factors considered in this report are the source of drinking water, the type of toilet, and the type of flooring. Certain surveys contain additional data on environmental health factors, but they are not available consistently across countries or over time. Environmental health indicators are usually strongly associated with socioeconomic status and place of residence.

Two indicators are used here for the type of drinking water supply: the percentage of women living in households with a piped supply either inside the dwelling or inside the yard and the percentage of women living in households where drinking water is obtained from a surface source (river, stream, pond, lake, dam, etc.). These two indicators were taken to represent the extremes of a lesser likelihood of contamination and a greater likelihood, respectively. Similarly, two indicators of faeces disposal are used here: the percentage of women living in households with flush toilets and the percentage with no toilet or latrine (that is, those using the bush, field, etc.). The type of flooring is represented by the percentage of women living in dwellings where the principal floor is dirt, mud, sand, clay, or dung (classed as dirt floor). Other types of flooring are assumed to offer more protection from contamination, especially for children who crawl and are beginning to walk.

The most recent results of the environmental health indicators and the changes that have occurred over time are shown in Table 6. Overall, the changes in the averages indicate that environmental health factors have improved slightly. For all indicators except flush toilets, over half of the countries have time trends indicating an improved situation. Only about 1 in 5 countries indicate a worsening of these environmental health conditions.

Socioeconomic factors. Improvements in socioeconomic status can improve children's health when measured by the indicators discussed above. Additionally, improved socioeconomic status can lead to improvements in childcare in environmental conditions that have not been measured and in child health factors that have not been measured (for example, changes in micronutrients). Indicators of socioeconomic conditions are included as proxies for these unmeasured factors. Three socioeconomic factors are considered here: residence, women's education, and household electricity supply. Residence is indicated by the percentage of women who live in urban areas. Women's education is indicated by the percentage of women who have completed at least primary school. Electricity supply is measured as the percentage of women who live in households with electricity.

Table 6. **Environmental factors associated with infant and child mortality**

Indicator	Latest value			Number of countries with infant and child mortality changed over time				
	Mean[a]	Minimum	Maximum	Decreased	Unchanged[b]	Increased	Mean Change	Number of comparisons
Percentage of women								
In households with piped water supply	30.6 (25.2)	0.8	94.8	7	8	18	3.0	33
In households with water from river, stream, pond, lake or dam	11.7 (12.2)	0.0	51.7	17	7	6	–2.1	30
In households with a flush toilet	23.8 (25.2)	0.0	91.8	7	9	12	1.7	28
In households with no toilet or latrine	28.0 (22.2)	0.0	78.3	17	6	7	–3.2	30
In households with a dirt floor	42.1 (29.3)	0.2	95.5	20	3	6	–3.8	29

[a] Figures in parentheses are standard deviations.

[b] Less than 1% change.

Most women in these surveys live in rural areas and have not completed primary school (Table 7). About half of the women live in homes with electricity. There is a wide variation in the trends for each indicator. As expected most countries show improvements over time in all three indicators. Surprisingly though, not all of the changes in these indicators are improvements. Three countries, Cameroon, Peru, and Zambia, have had decreases in these indicators of more than two percentage points. This may be due to changes in the country's official definition of "urban" or to sampling variance. In the specific case of Peru, the decrease is due to the exclusion in the earlier survey of some of the rural areas that were subject to conflict. By the time of the later survey, all the rural areas were surveyed. In two countries, Kenya and Zambia, the percentage of women with at least a complete primary school education decreased by more than two percentage points. Peru is the one country in which there was a decrease in the percentage of women living in households with electricity.

Results

How the explanatory factors relate to mortality

To determine which factors are important in explaining the change in mortality in the 1990s, the relation between the levels of the factors and infant and child mortality found in each survey was examined. The changes over time in the explanatory variables were then related to the trends in mortality for each country by considering each indicator without regard to its association with other indicators (a bivariate relation). Finally, the relation between the indicators and mortality is examined simultaneously to determine their independent effects (multivariate analysis).

Relation between mortality and the factors

Firstly, bivariate Pearson correlation coefficients were calculated for each of the explanatory factors with the various mortality rates for all available surveys (see supplementary table available at http://www.who.int/bulletin/tableofcontents/2000/vol.78no.10.html). Only the correlation of the indicators with mortality for children under 5 years

Table 7. **Socioeconomic factors associated with infant and child mortality**

Indicator	Latest value			Number of countries with infant and child mortality changed over time				
	Mean[a]	Minimum	Maximum	Decreased	Unchanged[b]	Increased	Mean Change	Number of comparisons
Percentage of women								
Living in an urban area	38.9 (19.6)	3.9	83.6	8	7	18	2.0	33
With primary or greater education	41.1 (26.1)	4.5	99.6	4	1	28	7.5	33
With household electric supply	46.0 (32.6)	2.7	100.0	1	2	23	5.0	26

[a] Figures in parentheses are standard deviations.

[b] Less than 1% change.

old are reviewed here. All of the indicators of fertility behaviour have a significant relation to mortality except the percentage of births with preceding intervals of <36 months. However, for two of the indicators (the percentage of births of first order and the percentage of birth intervals <24 months) the direction of the association is the opposite of that which would be expected.

Breastfeeding, however, is unexpectedly not inversely related to mortality. All three recommended measures (a longer duration of breastfeeding, exclusive breastfeeding of children <4 months old, and using a combination of breastfeeding and solid foods for children aged 7–9 months) are associated with higher mortality. These results may be due to confounding by socioeconomic status; this should be clarified in the multivariate analysis. However, the higher the percentage of children who are undernourished — indicated by stunting, wasting, and being underweight — the higher the level of mortality, as expected.

All three of the maternal care factors (prenatal medical care, medical assistance at the delivery, and delivering in a health facility) are significantly correlated with mortality among those under 5 years of age in the expected directions.

Measles vaccination and being fully vaccinated, but not tetanus toxoid vaccination, are significantly correlated with mortality. Bringing a sick child to a medical facility is significantly correlated with lower mortality for all three illnesses (diarrhoea, acute respiratory infection, and fever). Surprisingly, oral rehydration and giving antibiotics to a child with acute respiratory infection are not. Giving antibiotics and antimalarial drugs to children with fever are significantly related to lower mortality among those aged five years or less.

The environmental factors and the socioeconomic indicators are all significantly related to mortality in the expected directions. The date of interview is not significantly related to mortality, as would be expected.

Changes in explanatory factors and changes in mortality

A simplified look at the relation between changes over time in the explanatory factors and changes over time in mortality rates among those under 5 years of age is given in Table 8. Changes in mortality in the urban and rural areas of each country are classified into three categories: a decrease of $\geqslant$30 deaths/1000 births, a decrease of <30 deaths/1000 births, and an increase in mortality among those aged five years or less. For each category, the mean value of each of the explanatory factors is calculated. Explanatory factors that have a consistent relation with the change in mortality are indicated in Table 8.

Three of the indicators of fertility behaviour have trends consistent with the trend in mortality: the percentage of births of fourth or higher order, the percentages of births with preceding intervals of <24 months, and the percentages of births with preceding intervals of <36 months.

Medical prenatal care and medical attendance at birth have strong relations with the trend in under-5-years-of-age mortality. Areas where there have been large decreases in mortality have had increases in the use of these maternal services that are threefold to fourfold greater than in areas where there has been an increase in mortality. The same holds true for vaccinations as well.

For health services for sick children, areas with large decreases in mortality have had slightly greater increases in the percentage of children seen medically for diarrhoea coupled with a large increase in the use of oral rehydration therapy. The one service for which use has decreased over time is medical attention for fever. The areas that have had an increase in mortality rates have also had the greatest decline in children receiving attention for fever.

The trends in nutritional status are small or inconsistently related to the amount of change in under-5-years-of-age mortality. The correlation analysis of infant feeding factors and mortality shows that changes are unexpectedly not inversely related to the change in mortality among those aged five years or less. Again this may be due to confounding by socioeconomic status.

Changes in environmental health factors are related in the expected direction to trends in mortality rates. Two of the socioeconomic factors (the change in the percentage of women with at least a complete primary education and the percentage of women living in households with electricity) are related to mortality in the expected ways.

Because of the nature of this analysis, which splits each country into rural and urban areas, the change in the percentage of women living in urban areas cannot be related to the change in mortality. However, the percentage living in urban areas in the recent survey can be examined: the areas where there has been a small decrease in mortality or an increase are more urban than the areas with larger declines in mortality among those aged five years or less.

Multivariate analyses

The factors that may explain changes in infant and child mortality are related. Because of this, they need to be analysed together simultaneously using multivariate analysis to determine each factor's independent or unique effect on mortality. Ordinary least squares regression was used as the multivariate technique. Not all of the factors were measured by each survey in each country so some of the data are missing. In these cases, the average amount of change for each factor was substituted for the missing values so as not to reduce the number of cases for analysis.

The dependent variables studied are the trends in mortality rates for neonates, post-neonates, infants, toddlers (age 1 year), for children age 2–4 years, children ages 1–4 years, and among all children under 5 years. The results of the multivariate analyses are

Table 8. **Mean change between Demographic and Health Surveys of developing countries in explanatory variables by amount of change in under five mortality rate, 1986–98**

	Change in under five mortality rate (differences in percentages between surveys)			
	Decrease ⩾ 30	Decrease < 30	Increase	Total
	Deaths per 1000 births			
First birth order	2	2	2	2
Fourth birth order or higher[a]	–3	–4	–4	–4
Sixth birth order or higher	–2	–3	–3	–3
Age of mother <18 years at birth of child	0	0	0	0
Age of mother 35 or above at birth of child	1	0	0	0
Birth interval <24 months[a]	–3	–3	–2	–3
Birth interval <36 months[a]	–4	–4	–5	–4
Medical prenatal care[a]	13	6	3	7
Birth in medical facility	–2	4	–1	1
Medical birth attendance[a]	21	12	6	12
Any tetanus toxoid vaccination[a]	19	11	5	11
Two or more tetanus toxoid vaccinations[a]	5	4	3	4
Measles vaccination[a]	26	12	6	13
Full vaccination[a]	23	10	1	11
Health facility for diarrhoea treatment[a]	2	1	0	0
Oral rehydration solution for diarrhoea	8	3	5	5
Oral rehydration solution therapy for diarrhoea[a]	21	18	11	17
Medical facility for acute respiratory infection	3	6	1	4
Medical facility for fever[a]	–5	–8	–17	–11
Stunted	–4	–4	1	–3
Wasted[a]	–1	0	0	0
Underweight	3	2	5	3
Median duration of breastfeeding[a]	0	1	1	1
Full breastfeeding under 4 months[a,b]	–5	3	6	3
Breastfeeding and solids at 7–9 months[a]	0	4	8	5
Piped water supply	2	2	0	2
Surface water supply[a]	–4	–2	1	–1
Flush toilet[a]	0	0	–2	–1
Bush, field for latrine[a]	–6	–3	1	–2
Dirt floor[a]	–6	–3	0	–3
Primary education complete or more[a]	11	6	4	6
Electricity[a]	6	4	4	4
Percentage in urban areas[a]	39	47	63	50

[a] Factors that have a consistent relationship with the change in mortality.

[b] Exclusively breastfeeding or receiving just plain water with breastfeeding.

shown in Table 9. Although some factors may be important in determining mortality, if they have not changed much over time they will not be significantly associated with the changes in mortality that have occurred.

The regression coefficients (b) in Table 9 represent the predicted change in the number of deaths per 1000 children for each 1 percentage change in the indicator. The coefficient for the duration of breastfeeding represents the predicted change in the number of deaths occurring with a 1-month change in duration. Also presented in the table are β coefficients: these are standardized coefficients representing the number of standard deviations of change in the mortality rate that will occur given a change of one standard deviation in the explanatory indicator.

The explanatory factors predict mortality trends fairly well for each of the mortality rates. The factors explain between 45% and 70% of the variance in the trend of mortality. In Table 9, only coefficients of factors significant at $\leqslant 0.10$ are shown. Coefficients significant at $\leqslant 0.01$ are indicated.

Fertility behaviour

Fertility behaviour is represented by the demographic characteristics of birth order, mother's age at birth, and length of birth intervals. An increase in the percentage of births that are of first birth order was associated with higher mortality rates among post-neonatal infants and toddlers but not with changes in other mortality rates. An increase in the percentage of births of fourth or higher order was associated with a decrease in mortality for all mortality rates. This result

Table 9. **Regression results for changes in mortality rates between Demographic and Health Surveys in developing countries, 1986–98**

Independent variables[a]	Change (%)													
	Neonatal		Post-neonatal		Infant		Toddler (1q1)		Child (3q2)		Childhood (4q1)		Under five years of age	
	b	*β*	*b*	*β*	*b*	*β*	*b*	*β*	*b*	*β*	*b*	*β*	*b*	*β*
First born			0.6	0.2			0.6	0.2						
Fourth birth order or higher	**–0.9**	**–0.4**	**–0.6**	**–0.2**	**–1.8**	**–0.4**	–0.5	–0.3	**–2.4**	**–0.5**	**–1.4**	**–0.4**	**–2.5**	**–0.4**
Age of mother at birth of child <18 years	0.8	0.2					**–1.1**	**–0.3**			**–2.2**	**–0.3**	–1.7	–0.1
Age of mother at birth of child 35 or above	**1.6**	**0.4**			1.1	0.2								
Birth interval <24 months			**0.8**	**0.3**	**1.1**	**0.2**								
Medical prenatal care							NI[b]	NI	NI	NI	NI	NI	**–0.5**	**–0.3**
Medical birth attendance	**–0.2**	**–0.4**	–0.2	–0.1	**–0.2**	**–0.2**	NI	NI	NI	NI	NI	NI	**–0.4**	**–0.3**
Any tetanus toxoid vaccination							NI	NI	NI	NI	NI	NI		
Measles vaccination	NI	NI			–0.2	–0.3			**–0.5**	**–0.5**	**–0.3**	**–0.3**	**–0.3**	**–0.3**
Full vaccination	NI	NI	**–0.1**	**–0.2**			**–0.1**	**–0.3**						
Medical facility for diarrhoea	**–0.3**	**–0.3**			**–0.5**	**–0.3**			**–0.4**	**–0.2**			**–0.5**	**–0.2**
Oral rehydration therapy for diarrhoea	–0.1	–0.2	**–0.1**	**–0.2**	**–0.1**	**–0.2**			**–0.3**	**–0.3**	**–0.2**	**–0.3**	**–0.3**	**–0.2**
Medical facility for acute respiratory infection			**–0.2**	**–0.2**										
Medical facility for fever			**–0.3**	**–0.3**	–0.2	–0.1			–0.3	–0.1				
Median duration of breastfeeding	NI	NI	**–0.7**	**–0.2**										
Full breastfeeding under 4 months			**0.2**	**0.3**			NI	NI	NI	NI	NI	NI		
Breastfeeding and solids 7–9 months			–0.1	–0.1	**–0.2**	**–0.1**	NI	NI	NI	NI	NI	NI		
Stunted			0.2	0.1	0.4	0.1								
Wasted	**0.6**	**0.4**	**0.4**	**0.2**	**1.0**	**0.4**					–0.4	–0.2	0.6	0.2
Underweight	**0.7**	**0.3**			**0.7**	**0.2**			**1.4**	**0.3**	0.6	0.2	**1.7**	**0.3**
Piped water supply							**–0.3**	**–0.3**						
Surface water supply	**0.5**	**0.3**			**0.7**	**0.2**			**0.7**	**0.2**			**1.1**	**0.2**
Flush toilet											**–0.3**	**–0.1**	–0.4	–0.1
Bush, field for latrine														
Dirt floor	**0.2**	**0.2**	**0.2**	**0.2**	**0.4**	**0.2**			**0.4**	**0.2**			**0.5**	**0.2**
Primary education complete or more			**–0.3**	**–0.3**	**–0.4**	**–0.3**			**–0.5**	**–0.3**			–0.4	–0.2
Electricity	**–0.3**	**–0.3**	–0.2	–0.1	**–0.5**	**–0.2**			**–0.7**	**–0.2**			–0.7	–0.2
Constant			2.2				**–4.2**				**–9.2**		–6.1	
Adjusted R2	**0.410**		**0.728**		**0.684**		**0.297**		**0.572**		**0.382**		**0.614**	

[a] Coefficients shown are significant at ⩽ 0.100. Coefficients in bold face are significant at ⩽ 0.010; *b*, regression coefficient; *β*, standardized coefficients representing the number of standard deviations of change in the mortality rate that will occur given a change of one standard deviation in the explanatory indicator.

[b] Indicator not included in the analysis.

is contrary to what is found in cross-sectional and individual analyses and is not predicted by the literature. (The percentage of births of sixth order or higher is part of the indicator for the percentage of births of fourth order or higher and is not included in this regression.) Increases in the percentage of births to mothers under age 18 was associated with higher neonatal mortality but lower toddler, childhood, and under-5-years-of-age mortality; again, this is contrary to expectations. An increase in the percentage of births to women aged ⩾35 years was associated with higher neonatal and infant mortality rates. Decreases in the occurrence of short birth intervals, those of <24 months, reduced post-neonatal and infant mortality. (Because the indicator for birth intervals of <36 months includes that of <24 months, only the latter indicator was used in the regression.)

Nutritional status, breastfeeding, and infant feeding

Nutritional status. Improvement in the nutritional status of children, as measured by decreases in the percentage of children who were stunted (indicating

chronic malnutrition), wasted (acute malnutrition), and underweight (general malnutrition), were associated with decreases in mortality rates. For example, a decrease of 1 percentage point in the proportion of children who were underweight was associated with a decrease of almost 1.7 deaths/1000 births in the under-5-years-of-age mortality rate. There is an unexpected result for children ages 1–4 years: a decrease in the proportion who were wasted was associated with an increase in mortality.

Breastfeeding and infant feeding. The various indicators of breastfeeding and complementary feeding were included when appropriate. Since almost all children in less-developed countries begin life breastfeeding, the median duration of breastfeeding was not used to explain neonatal mortality. Similarly, the indicator for feeding solid, complementary foods at age 7–9 months was not applied to the neonatal period. For children $\geqslant 1$ year old, only the median duration of breastfeeding was considered; however, no significant association was found. On the other hand, an increase in the duration of breastfeeding was associated with a fall in post-neonatal mortality. A rise in the percentage of children aged 7–9 months who were both breastfed and getting solid foods was associated with decreases in both post-natal and infant mortality rates. However, a rise in the percentage of children <4 months who were fully breastfed was associated with an increase in post-neonatal mortality. These conflicting results are puzzling, and further work needs to be done on these indicators.

Maternal and child health status

Maternal care. The mother's prenatal care by a physician or a nurse and being attended at birth by a physician or nurse are considered as potential explanatory factors for the decline in mortality in the child's first year of life but not thereafter. Therefore, they were not included in the analyses of mortality at ages 1 year, 2–4 years, and 1–4 years. Increases in the percentage of births that received medical care at delivery were associated with decreasing mortality during the first year of life. Increases in prenatal care were associated with decreases in mortality among those under 5 years of age as well.

Immunization. Tetanus toxoid vaccinations given to the mother during pregnancy are used to protect the child from neonatal tetanus. Thus, this indicator is only included in the analyses for children aged <1 year. A change in the percentage vaccinated during pregnancy with tetanus toxoid did not explain the change in mortality for children aged <1 year.

DTP vaccinations usually start at 6 weeks of age and should be completed by 14 weeks. Polio vaccine is usually given with DTP. Vaccine for measles is given to babies starting at about 8 months of age. Therefore these vaccinations do not protect the child during the neonatal period (during which there is little need for them). The indicators for full vaccination status and measles vaccination are thus not included in the analysis of changes in neonatal mortality.

However, measles vaccination status forms part of the indicator for full vaccination status so there may be a high correlation between the two variables. An increase in the percentage of children vaccinated against measles was associated with declines in infant mortality and with mortality at ages >1 year. An increase in the percentage of children who were fully vaccinated was associated with a decline in mortality in the post-neonatal period and for children aged 1 year. This alternating effect is likely to be due to the high correlation between the two indicators.

Care of sick children. Increases in the percentages of children receiving medical attention for diarrhoea, acute respiratory illness, and fever were associated with declines in mortality. The association was evident between increases in receiving medical attention for diarrhoea and reductions in neonatal and infant mortality, with reduced mortality at ages 2–4 years and with a fall in under-5-years-of-age mortality. An increased use of oral rehydration therapy was also associated with a decline in mortality for all ages except for children age 1 year where the results are not statistically significant. Children given oral rehydration solutions are included in the oral rehydration therapy category so only the latter was used in the regression equation.

An increase in those attending a medical facility for acute respiratory infection reduced mortality only during the post-neonatal period. In many countries, as seen earlier, the incidence of taking children to a medical facility when they have a fever declined in the 1990s. The results of the regressions indicate that this decline will lead to higher mortality rates for post-neonates and for children aged 2–4 years.

Environmental health factors

The environmental health factors considered here are water supply, type of toilet, and type of flooring. The changes that have occurred in environmental factors are all related to changes in mortality in the expected directions. However, none of the selected indicators is statistically significant for all mortality rates. The most consistent of the relations is that of a decrease in the percentage of households with a dirt floor related to declines in five of the seven mortality rates.

Socioeconomic status

Changes in socioeconomic status may lead to positive changes in fertility behaviour, nutritional status, and the use of health services. They may also have their own impacts on the development of better childcare practices, better food preservation, household cleanliness, etc. Two indicators were used to summarize change in socioeconomic status and to control for this effect when considering the other explanatory factors: the percentage of women who have completed at least primary school and the percentage of women living in households with electricity. As expected, increases in both indicators were associated with declines in mortality.

For the trend in the mortality rate for those aged five years or less , the four strongest factors were

the percentage of births of fourth order or more (–2.5 deaths/1000 births for a 1% change), the percentage of children born to mothers under age 18 (–1.7 deaths/1000 births), the percentage of children who were underweight (1.7 deaths/1000 births), and the percentage of women living in households with drinking water provided by a surface source (1.1 deaths/1000 births).

Discussion

The 1990s have seen a remarkable fall in infant and child mortality in most of the less-developed countries. In some countries, particularly in sub-Saharan Africa, these declines in mortality among children have slowed and are now rising again. Internationally comparable data derived from survey programmes, such as the Demographic and Health Surveys, are available both to document the changes that have occurred in mortality and to provide insight into some of the factors that may explain these trends in mortality. This paper is an attempt to utilize these data to explore some of the associations between important explanatory factors for these trends and the declines or reversals in mortality that have occurred.

Rates of infant and child mortality estimated from the birth histories recorded by the surveys show that a range of changes occurred in the 1990s. While most countries with data from the DHS that can be compared over time have had declines in mortality — some rates have fallen by as much as 63 deaths/1000 births among children aged under 5 years — some have seen this trend reverse, and there have been increases in mortality by up to 25 deaths/1000 births.

There are five groups of variables in the DHS programme that might explain these mortality trends: fertility behaviour, nutritional status and infant feeding, use of health services by mothers and children, environmental health conditions, and socioeconomic status. In this paper, 33 indicators were originally selected to represent these explanatory variables. Initial analyses using correlations between the variables and mortality rates guided the selection of alternative indicators. A first look at the relation between the variables and the trends in mortality was done by grouping the countries according to the trends in mortality and calculating the average change in the variable for each group. This analysis indicated that all the groups of explanatory variables had a role in the mortality trends. However, to explain trends in mortality, the variables themselves had to have changed over time. During the 1990s, fertility behaviour, breastfeeding, and infant feeding have changed less than other factors and so would seem to have played a smaller role in mortality trends.

Comparing mortality rates with variables and comparing trends in mortality with trends in the variables shows that some of the variables associated with mortality do not explain much of the decline. Others have effects that are the opposite of those expected from the analysis. This is especially true for the variables for fertility behaviour and breastfeeding. One of the reasons for this is that these variables have not changed all that much over the decade. On the other hand, the trends in mortality that have occurred are related to more than just a handful of variables. Many explanatory variables have played a part, such as maternal care, vaccinations (particularly measles), medical treatment of childhood illnesses, nutritional status, environmental health, education, and other socioeconomic factors. It would therefore be a mistake to concentrate on one or a few of these while forsaking others.

To summarize the results of the multivariate analysis, countries were selected to represent the three groups of change in mortality among children under 5 (countries with a fall of $\geqslant$30 deaths/1000 births, countries with a fall of <30 deaths/1000 births, and countries with a rise in mortality). The countries at the midpoints of each of the groups are Ghana, Bolivia, and Senegal, respectively. The results of the regression on the trend in mortality are then applied to each country to obtain a predicted change. For Ghana, the regression predicts a fall of 41 deaths/1000 births, and the actual fall was 35 deaths. For Bolivia, the predicted fall was 13 deaths, and the actual fall was 14 deaths. The prediction for Senegal was poor. The regression predicts a fall of 17 deaths, but in reality there was a rise of 7 deaths. However, information on changes in the percentage of children who were vaccinated against measles and the percentage of children with wasting or stunting were not available. Thus, the average value for the groups was used for these indicators. Other factors, not measured by the DHS, such as a resurgence of malaria and an increased prevalence of HIV/AIDS, may explain some of the discrepancy.

The policy implications of the findings of this study are clear: there is no "magic bullet" to which changes in infant and child mortality during the 1990s can be attributed, rather a broad set of factors was responsible. Countries with the largest decreases in mortality have had substantial improvements in most of the factors that might be used to explain these changes. In some countries mortality has risen. In part these rises can be explained by the factors included in this study. An example is the deterioration in the seeking of medical care for children with fever, which was associated with rises in mortality and thus has offset some of the potential decline that may be explained by improvements in other factors. Variables that were not measured, such as the increasing resistance of malaria to drug treatment and the increased prevalence of parental HIV/AIDS, may be contributing to the increases noted.

This examination represents a beginning in the study of trends in infant and child mortality. Further work is necessary to refine the analyses and to add other potentially important factors, which are beyond the contents of the DHS data sets. Other variables that could be examined include the accessibility of health

services, the quality of medical services including the availability of medicine and trained staff, the changing prevalence and virulence of malaria and HIV, and parents' knowledge of the signs and symptoms that indicate a child should receive medical care. Some of the surveys contain information on some of these factors, but they are not available generally or across surveys in the same country.

Conclusions

The 1980s and 1990s have seen concerted efforts to decrease infant and child mortality around the world but most particularly in developing countries. During the 1980s the emphasis was on "magic bullets", such as immunization and oral rehydration solution salts. Their success led to commitments made at the World Summit for Children in New York in 1990, where for the first time nations committed themselves to specific goals in reducing infant and child mortality during the 1990s. In the 1990s mortality fell in most countries, and the emphasis on magic bullets waned. A broader approach was developed which included the current strategy for the Integrated Management of Childhood Illness programme. Other interventions were recognized as important in continuing to reduce infant and childhood mortality: making improvements in children's nutritional status, including ensuring that they had adequate vitamins and minerals; ensuring appropriate breastfeeding and timely supplementation with complementary feeding; adequately spacing births; and providing proper prenatal care and delivery care. With comparative data on infant and child mortality and important associated factors now available for many developing countries, it is possible to evaluate some of these approaches.

In most of the developing countries surveyed, infant and child mortality rates have declined substantially. In some countries, however, earlier declines have slowed and reversed. Five broad areas that may explain or be associated with trends in infant and child mortality were investigated in this study. The results indicate that there are no "magic bullets" responsible for the declines in mortality. Indeed, in the countries with the larger falls in mortality there have been improvements in a wide range of factors.

During the 1990s the two most important groups of factors explaining the decrease in mortality among children under the age of five years were the decline in the proportions of children who were malnourished (either underweight or too thin) and those who were living in poor environmental conditions (that is, where water supply, sanitation, and housing are poor). Medical care during pregnancy, at birth, and for children ill with diarrhoea are the next most important factors. Socioeconomic factors, such as electricity and the mother's education, follow in importance.

Two other conclusions can be derived from this study. The first is that not all of the factors known to bring about a decrease in infant and child mortality have improved much during the 1990s. The principal ones of concern are birth spacing and breastfeeding and complementary feeding; there could have been even greater decreases in mortality had these factors improved substantially. The second conclusion is that lapses in efforts to reduce death among children can lead to a slowing of and even a reversal of the decline in mortality rates. This may help explain why there has been a fall in the seeking of medical attention for respiratory illnesses in children and the reduced efforts to immunize children especially in urban areas; there may be a feeling that the battle has already been won. There is a continuing need to increase efforts to reduce deaths among children especially in the face of increasing HIV infection and the resurgence of malaria in some countries. ■

Résumé

Facteurs associés aux tendances de la mortalité infanto-juvénile dans les pays en développement au cours des années 90

Au cours des années 90, on a constaté une diminution considérable de la mortalité infanto-juvénile dans la plupart des pays en développement. Dans certains pays, en particulier en Afrique subsaharienne, on a observé un ralentissement et même un renversement de cette tendance. On dispose de données comparables au plan international, provenant d'enquêtes telles que les enquêtes démographiques et sanitaires, qui permettent d'attester les changements intervenus dans la mortalité et donnent des indications sur certains des facteurs susceptibles d'expliquer ces tendances de la mortalité.

Au cours des années 80, l'accent était mis sur des « remèdes miracles », comme la vaccination et les sels de réhydratation orale. Leur succès a amené les pays participant au Sommet mondial pour les enfants, tenu à New York en 1990, à s'engager pour la première fois à atteindre des buts spécifiques pour réduire la mortalité infanto-juvénile au cours des années 90. Pendant cette décennie, la mortalité a baissé dans la plupart des pays et les remèdes miracles ont été relégués au second plan. On a reconnu que d'autres interventions étaient importantes pour continuer à réduire la mortalité infanto-juvénile : améliorer l'état nutritionnel des enfants, en veillant notamment à ce qu'ils aient une quantité suffisante de vitamines et de substances minérales ; assurer un allaitement au sein approprié et fournir en temps voulu une alimentation complémentaire ; prévoir un espacement suffisant des naissances ; et dispenser des soins prénatals et des soins lors de l'accouchement qui soient de qualité.

Le programme d'enquêtes démographiques et sanitaires comporte cinq groupes de variables suscep-

tibles d'expliquer les tendances de la mortalité : le comportement en matière de fécondité, l'état nutritionnel et l'alimentation du nourrisson, l'utilisation des services de santé par les mères et les enfants, le niveau d'hygiène du milieu et la situation socio-économique. Les analyses simples et multivariées des changements de facteurs entre les enquêtes indiquent que toutes ces variables ont influé sur les tendances de la mortalité. Toutefois, pour expliquer ces tendances, les variables elles-mêmes ont dû être modifiées avec le temps. Au cours des années 90, le comportement en matière de fécondité, l'allaitement au sein et l'alimentation du nourrisson ont changé moins que d'autres facteurs et semblent donc avoir joué un rôle moins important dans les tendances de la mortalité.

Les tendances de la mortalité qui ont été observées sont liées à plusieurs variables, et les facteurs dans chacun des domaines sont associés aux tendances de la mortalité. Les résultats de la présente étude montrent qu'il n'y a pas de remèdes miracles pour faire baisser la mortalité. En fait, dans les pays où la mortalité a diminué le plus, on a constaté des améliorations de toute une série de facteurs. Ce serait donc une erreur de prendre des mesures en se fondant sur l'un de ces facteurs ou sur quelques-uns d'entre eux et en négligeant les autres. Dans les pays où la mortalité a baissé le plus, on a relevé des améliorations sensibles de la plupart des facteurs susceptibles d'expliquer ces changements. Dans certains pays, la mortalité a augmenté. Au cours des années 90, les deux principaux facteurs expliquant la diminution de la mortalité chez les enfants de moins de cinq ans ont été la baisse de la proportion des enfants malnutris (d'un poids inférieur à la normale ou trop maigres) et de ceux qui vivaient dans un environnement médiocre (c'est-à-dire où l'approvisionnement en eau, l'assainissement et le logement laissaient à désirer). Par ordre d'importance, viennent ensuite les soins médicaux pendant la grossesse, à la naissance et pour les enfants atteints de diarrhée et enfin des facteurs socio-économiques tels que l'approvisionnement en électricité et l'éducation de la mère.

Dans certains pays, on a constaté une augmentation de la mortalité, qui peut s'expliquer en partie par les facteurs mentionnés dans cette étude. Un exemple est la moindre demande de soins médicaux pour les enfants fébriles. D'autres facteurs qui n'ont pas été mesurés, comme l'accroissement de la résistance du paludisme aux traitements médicamenteux et la prévalence accrue du VIH/SIDA chez les parents, peuvent avoir contribué à l'augmentation observée.

On peut tirer deux autres conclusions de cette étude. La première est que les facteurs dont on sait qu'ils ont entraîné une baisse de la mortalité infanto-juvénile ne se sont pas tous améliorés beaucoup au cours des années 90. Les principaux facteurs qui laissent à désirer sont l'espacement des naissances, l'allaitement au sein et l'alimentation complémentaire ; si ceux-ci s'étaient améliorés sensiblement, la baisse de la mortalité aurait pu être encore plus forte. La seconde conclusion est qu'un relâchement des efforts déployés pour réduire les décès chez l'enfant peut entraîner un ralentissement de la diminution des taux de mortalité et même une augmentation de ceux-ci. Cela peut aider à expliquer pourquoi on a négligé de soigner les maladies respiratoires chez les enfants et prêté moins d'attention à la vaccination des enfants, notamment en milieu urbain ; en effet, on peut avoir le sentiment que la bataille est déjà gagnée. Au contraire, il faut continuer d'accroître les efforts pour réduire la mortalité infanto-juvénile, compte tenu en particulier de la propagation de l'infection à VIH et de la résurgence du paludisme dans certains pays.

Resumen

Factores asociados a las tendencias de la mortalidad de lactantes y de niños pequeños en los países en desarrollo durante los años noventa

Durante los años noventa se ha registrado una notable disminución de la mortalidad entre los lactantes y los niños pequeños en la mayoría de los países en desarrollo. Algunos países, en particular del África subsahariana, han experimentado una desaceleración, e incluso una inversión, de esa tendencia. Se dispone de datos internacionales comparables extraídos de programas de encuestas, como las Encuestas Demográficas y de Salud (DHS), tanto para documentar la evolución de la mortalidad como para arrojar luz sobre algunos de los factores que pueden explicar esa evolución.

Durante los años ochenta se hizo hincapié en las «balas mágicas», como la inmunización y las sales de rehidratación oral. El éxito de esas medidas condujo a los compromisos contraídos en la Cumbre Mundial en favor de la Infancia, celebrada en Nueva York en 1990, donde por primera vez las naciones se comprometieron con objetivos concretos a reducir la mortalidad infantil durante los años noventa. Durante esa década la mortalidad descendió en la mayoría de los países, desvaneciéndose el entusiasmo por las balas mágicas. Se reconoció la importancia de otras intervenciones para seguir reduciendo la mortalidad de los lactantes y los niños de corta edad: la mejora del estado nutricional de los niños, incluido el aporte de suficientes vitaminas y minerales; un amamantamiento adecuado y la administración oportuna de alimentos complementarios; un espaciamiento adecuado de los nacimientos; y la prestación de atención prenatal y durante el parto.

En el programa de las DHS hay cinco grupos de variables que quizá podrían explicar esa evolución de la mortalidad: el comportamiento reproductivo, el estado nutricional y la alimentación del lactante, el uso de los servicios de salud por las madres y los niños, el grado de salud ambiental, y el nivel socioeconómico. Los análisis, simples y multifactoriales, de los cambios de esas variables entre las encuestas indican que todas ellas influyen en las tendencias de la mortalidad. Sin embargo, para explicar estas tendencias, las variables mismas tenían que haber cambiado con el tiempo. Durante los años noventa el comportamiento reproductivo, la lactancia materna y la alimentación del lactante han

evolucionado menos que otros factores, de modo que probablemente han tenido menos repercusión en la evolución de la mortalidad.

Las tendencias observadas están relacionadas con algo más que un simple puñado de variables, pues en cada una de esas áreas hay factores asociados a tales tendencias. Los resultados del estudio indican que no existe ninguna bala mágica que explique los descensos de mortalidad. De hecho, en los países con los mayores descensos de mortalidad se han registrado mejoras en una amplio espectro de factores. Por consiguiente, sería un error concentrar la acción política en sólo alguno, o unos pocos, de esos factores, e ignorar los otros. Los países con las mayores disminuciones de la mortalidad han experimentado mejoras sustanciales en lo tocante a la mayoría de los factores que podrían utilizarse para explicar esos cambios. En algunos países ha aumentado la mortalidad. Durante los años noventa los dos grupos más importantes de factores responsables de la disminución de la mortalidad entre los menores de cinco años fueron la menor proporción de niños malnutridos (con peso inferior al normal o demasiado delgados) y la menor proporción de niños que vivían en malas condiciones (esto es, con una infraestructura de abastecimiento de agua, saneamiento y vivienda deficientes). La atención médica durante el embarazo y el parto y el tratamiento de los niños aquejados de diarrea son los factores más importantes que siguen a continuación. Vienen luego factores socioeconómicos, como la electricidad y la educación de la madre.

En cuanto al aumento de la mortalidad observado en algunos países, parte del fenómeno puede explicarse por los factores abordados en este estudio. Un ejemplo es el deterioro en la búsqueda de atención médica para los niños febriles. Otros factores que no se midieron, como el aumento de la resistencia del paludismo a la farmacoterapia y la mayor prevalencia de la infección por el VIH/SIDA en las madres, pueden estar contribuyendo también a los aumentos observados.

Del estudio se desprenden también otras dos conclusiones. La primera es que no todos los factores con un efecto demostrado de disminución de la mortalidad infantil han mejorado mucho durante los años noventa. Los que suscitan mayor preocupación son el espaciamiento de los nacimientos y la lactancia materna y la alimentación complementaria; la reducción de la mortalidad habría sido aún mayor si esos factores hubiesen mejorado sustancialmente. La segunda conclusión es que cualquier discontinuidad en los esfuerzos encaminados a reducir las defunciones infantiles pueden conducir a una desaceleración, si no a una inflexión, de la disminución de las tasas de mortalidad. Esto puede ayudar a explicar el retroceso observado en la búsqueda de atención médica para las enfermedades respiratorias de los niños, así como la menor actividad de inmunización infantil, especialmente en zonas urbanas; existe el riesgo de creer que ya se ha ganado la batalla. Sin embargo, persiste la necesidad de redoblar los esfuerzos para reducir las defunciones entre los niños, máxime teniendo en cuenta el aumento de las infecciones por el VIH y la reaparición del paludismo en algunos países.

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