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Resources for Child Health
REACH

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INFANT MORTALITY RATES AND CAUSE ATTRIBUTABLE PROFILES: SOME IMPLICATIONS FOR PRIMARY HEALTH CARE DESIGN

Norbert Hirschhorn, M.D.*
Mark Grabowsky, M.D.+
Robin Houston, M.D.°
with
Robert Steinglass, M.P.H.*

John Snow, Inc. (Resources for Child Health Project)
Johns Hopkins University, EPI/WHO-Geneva
° John Snow, Inc. (Nepal Integrated Primary Health Care and Family Planning Project)

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INTRODUCTION

"Selective Primary Health Care," as defined by Walsh and Warren (1) emphasizes the use of specific technologies for maximal and rapid reduction of infant and child mortality, and at relatively low cost(2). Oral rehydration therapy and vaccination (particularly against measles and neonatal tetanus) are considered to be particularly effective and most widely practised; antibiotic treatment of pneumonia, vitamin A supplementation, growth monitoring and nutrition education, and birth spacing are other interventions whose values to large populations are still under study.

Selective primary health care (SPHC) is severely criticized for different reasons:

1) It is said that SPHC diverts resources and does little to build sustainable primary health care at the community level; moreover SPHC is classically "top-down," creating dependence on outside organization and supply, uncontrolled by families themselves (3). The "military paradigm of EPI" (4), for instance, may preclude a respectful approach to health education and community diagnosis -- replaced, instead, by "manipulative social marketing" (5).

2) Others allege that SPHC focuses too narrowly on infectious disease control, ignoring (and thus, perhaps, abetting) powerful social, economic and nutritional antecedents to illness (6).

3) Finally, SPHC is not yet proved to have a lasting impact on mortality; a child saved from one bout may only live long enough to succumb to another not addressed by SPHC ("replacement mortality")(7).

This study seeks to sharpen the discussion. Developing countries are not all the same. They vary widely in such indicators as infant mortality, prevalence and severity of illness, resources and infrastructure. These variations may predict the impact of SPHC. We hypothesize that infant mortality rates and the profile of causes of death of infants are linked; and that if discernible patterns exist they may suggest refinements to the SPHC approach which take into account the criticisms noted above.

METHODS

Our analysis of infant mortality rates and infant mortality causes is based on published data.

Two cross-sectional data sets were examined. The first was derived from Preston, Keyfitz, and Schoen (8) who compiled life tables and causes of death from national data of 48 countries (13 Third World) between 1946-1964, and longitudinal analysis of mortality in England and Wales from 1861-1964 (males only). The second data set was obtained by a search of the literature for studies of infant mortality linking rate and causes. Some came from individual survey and research studies discovered through Medlars and Index Medicus going back to 1972; others had already been compiled in World Health Organization collections of vital statistics. A full listing of these sources is available from the authors. 117 reports were identified, of which 17 were excluded from analysis for having either a) more than 50% of deaths unassigned by cause, or b) listing fewer than four causes of death.

Appendix 1 shows how the data were tabulated from this second set. Up to now we have done only the most rudimentary metaanalysis: means calculated for all cross-sectional data, curves fitted to longitudinal data, stratification of IMRs (high, medium, low) with display of their corresponding cause-attributable profiles. We have not, for instance, attempted to weight the profiles by respective sample sizes, nor calculated confidence intervals and tests for significance of differences.

We are aware, of course, of all the limitations of vital data and cause-specific mortality reports; whether these faults are subdued or magnified by our metaanalysis is not known, but we may appeal our conclusions from the data to "what makes sense.

FINDINGS

Figure I, from Preston, et al, shows expectation of life at birth (a surrogate measure for IMR) and the average % of each age-cohort dying from specific causes; not surprisingly, neoplasms form a greater proportion of death at higher ages, infectious diseases at lower ages. A suggestive hump in the curve for diarrhea is magnified on Figure II; as IMR falls, deaths from diarrhea first increase proportionally, then decrease. Figure III shows a similar finding in a study by Mata in Costa Rica: as IMR fell, mortality from diarrhea in infants became increasingly correlated with IMR (9).

Figure IV shows the longitudinal data from England and Wales from 1861-1964, with the chance of dying by age one. Even as total IMR fell, the absolute contribution of diarrheal deaths rose and then fell.

We grouped data from 100 populations by rates of IMR which are high (IMR = 120-240, N=16), medium (IMR = 60-119, N=60) and low (IMR = 24-59, N=24). For each group the average contribution of each cause of death was determined. Figure V shows the cause-specific patterns in absolute values; Figure VI shows them in proportional terms. The two figures appear to show the following:

- Deaths from diarrhea increase absolutely and as a proportion of total deaths as IMR falls from the "high" to the "medium" level.

- Neonatal tetanus deaths fall sharply with decreasing IMR, disappearing at the "low" level.

- Measles, as a cause of infant mortality, is greatest at the "high" IMR level.

- At "high" IMR, infectious and parasitic illness contributes substantially and probably represents malaria to a large degree.

- Perinatal and respiratory deaths stay relatively constant in proportion to the high and medium levels of IMR.

- At lower levels of IMR the total number of causes contributing substantially to death also declines. (Table I)

DISCUSSION

If the distinction between categories of IMR and their corresponding cause-attributable profiles are valid, we may infer a more considered approach to SPHC. Theoretically, one prefers district-level data for district-level planning. What we show here are greatly aggregated data. But since health care planning takes place at national levels, these data provide for several inferences.

In high IMR areas, vaccinations against measles and neonatal tetanus are particularly important; independent evidence now suggests that there is a sustained reduction in infant mortality with these two interventions. Antimicrobials for treatment of pneumonia, malaria, and dysentery should be made regularly available at the community level. Vitamin A treatment of measles patients, and home-based ORT are possibly effective in addition. These steps alone are the beginnings of a basic primary care program that includes: home-care; village-based health workers who treat illness with a few basic drugs by protocol, and who prepare the community for the national EPI.

In medium IMR areas, a full-fledged national ORT program with stress on infant nutrition will be likely to cut IMR significantly (10) and a solid EPI will reduce morbidity considerably. More attention to causes and prevention of low-birth weight are also likely to pay-off in lower perinatal and respiratory deaths (in particular, birth spacing and extra food for pregnant women). Measures are needed to prevent bottle-feeding and use of contaminated weaning foods.

In low IMR areas a much greater emphasis on prenatal care is necessary to improve perinatal survival. Rush (11) estimates that higher birth weights will affect IMR more substantially at low IMR than medium IMR. Health education, better hygiene and water supply, good primary, secondary, and tertiary care will drive down the residual IMR.

This study also suggests that "replacement mortality" is a lesser factor when there are fewer conditions to do the replacement, but that diarrhea is the predominant "replacing" disease as IMR falls. Preston indicates this as well (12). In a way this is good news because as diarrhea becomes a larger component of mortality it presents more often as acute watery diarrhea, hence more susceptible to ORT, and less often as chronic diarrhea and dysentery (13).

It is not a coincidence that the falling IMR and changing cause-attributable profiles correlate with the strength of the health system and the ability of the citizenry to demand and choose equitable and quality care, although we cannot conclude a causal relationship. A nation's capacity to effect the different interventions is also related to its resources, political will and how much families know (and how much women know, in particular). PHC or SPHC alone seem unlikely to improve these attributes, unless one can show that citizens, politicians and donors recognize a falling IMR (and improved health) and that this awareness fuels more concern about the social and economic causes of poor health. UNICEF believes this to be true and promotes Nacional Vaccination Days to this end. The dialogue around Child Survival has certainly created more awareness of social development issues.

Table 2 shows the USAID Child Survival emphasis countries in descending order of IMR, and with total populations given. Knowledgeable inspection of this table informs us how, as a first approximation, these countries may approach SPHC based on IMR, available resources, and the data presented in this paper. Country and district-specific profiles could suggest more accurate allocation of resources.

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13. Compare, for instance, Bangladesh and Egypt; IMR in the former is nearly twice that of Egypt, diarrhea causes about 15-20% of IMR (compared to 50-60% in Egypt), and about 30% of diarrhea in children in Bangladesh is chronic or dysenteric (compared to about 10% in Egypt).

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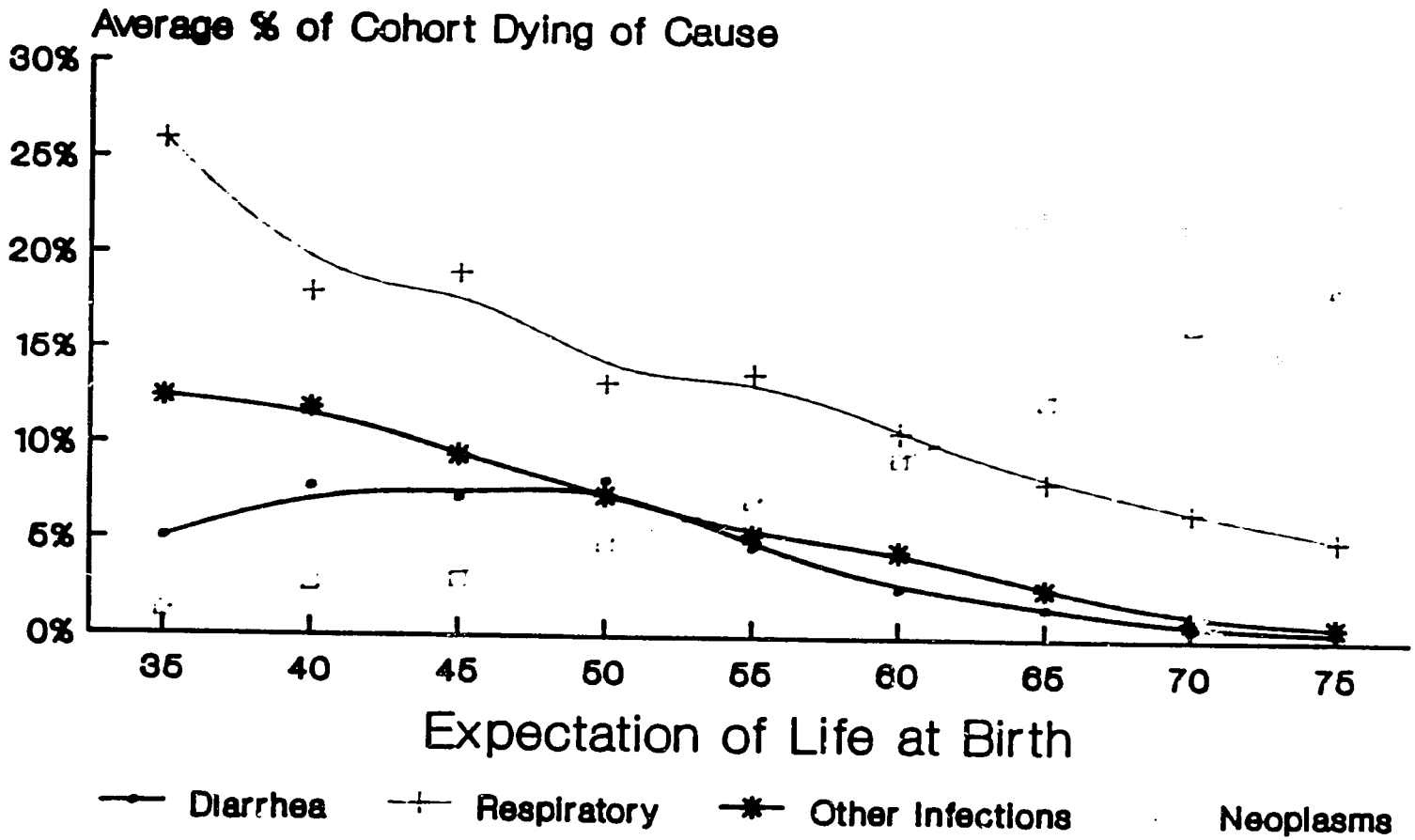
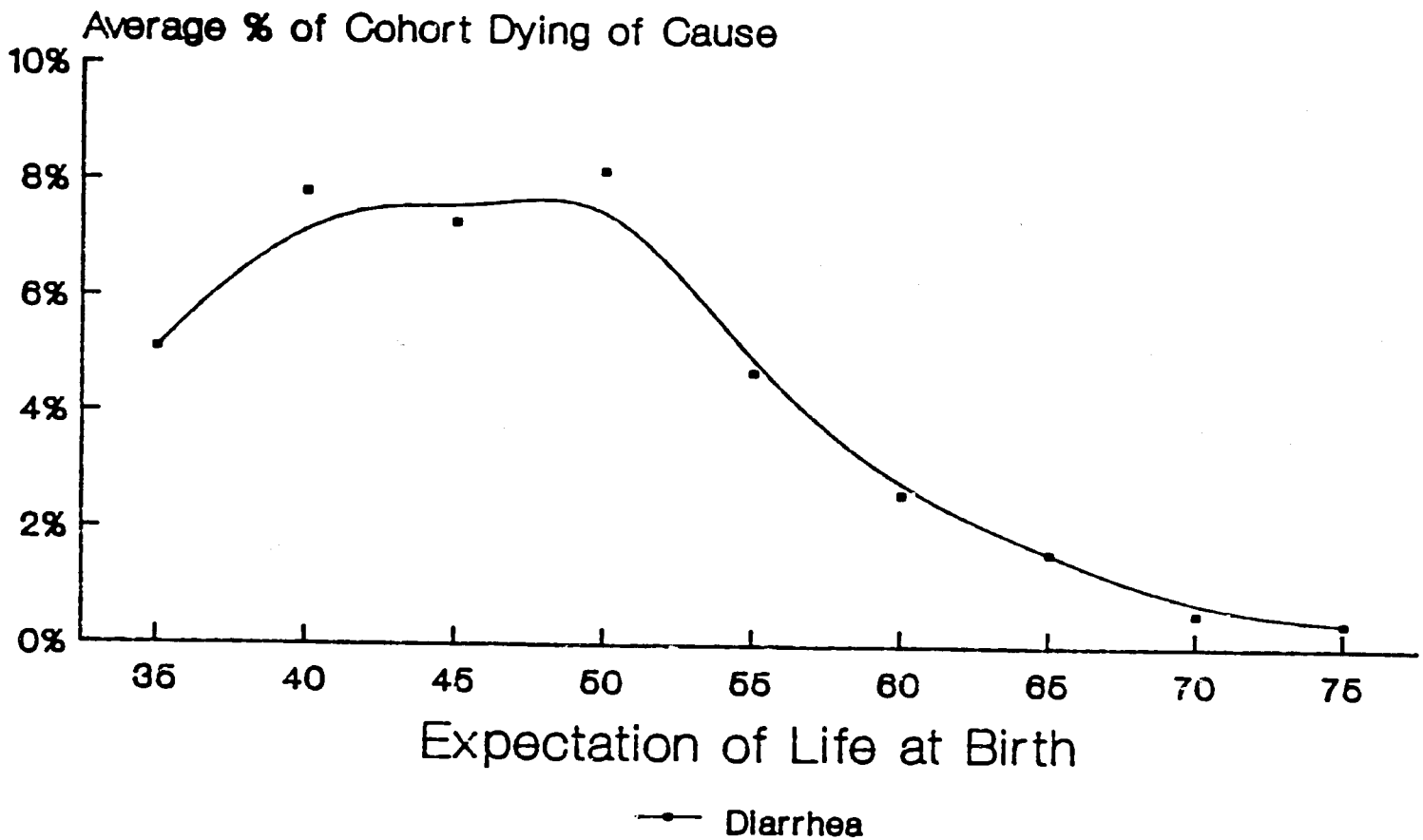
Cause of Death of Newborns By Expectation of Life at Birth



Preston, Keyfitz and Schoen, 1972.
Cause of Death: Life Tables for National Populations

Cause of Death of Newborns By Expectation of Life at Birth



Prston, Keyfitz and Schoen, 1972.
Cause of Death: Life Tables for
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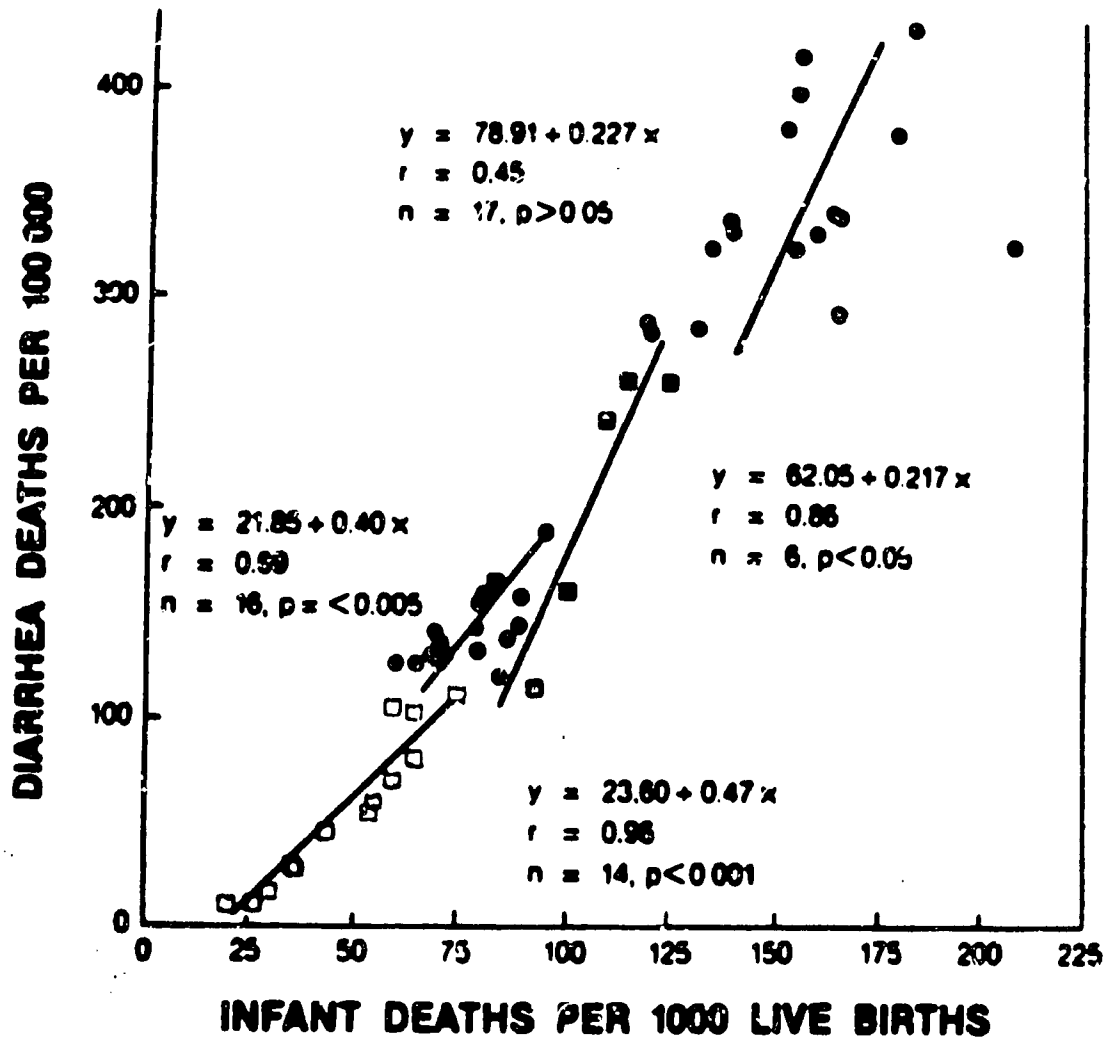
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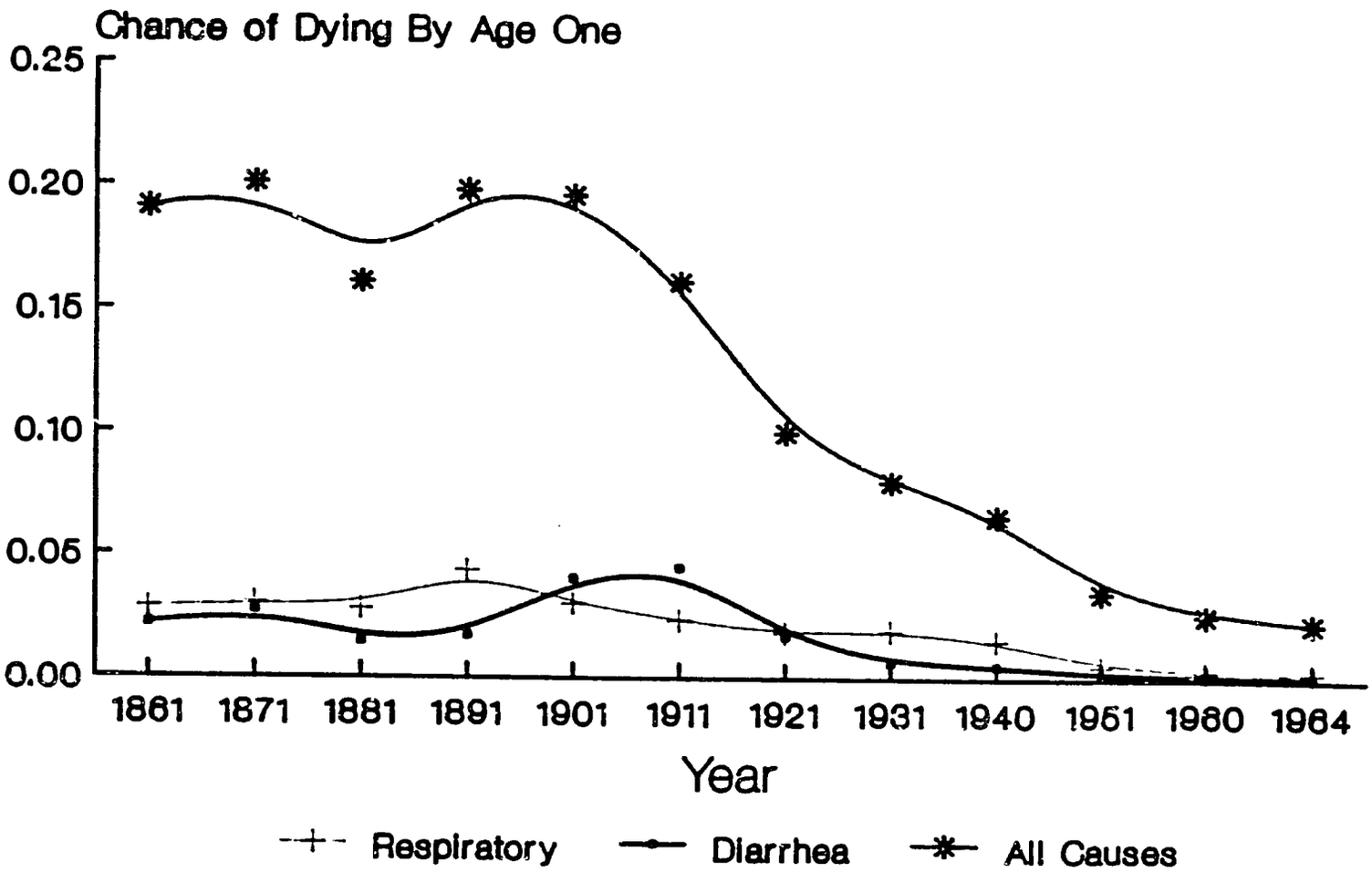
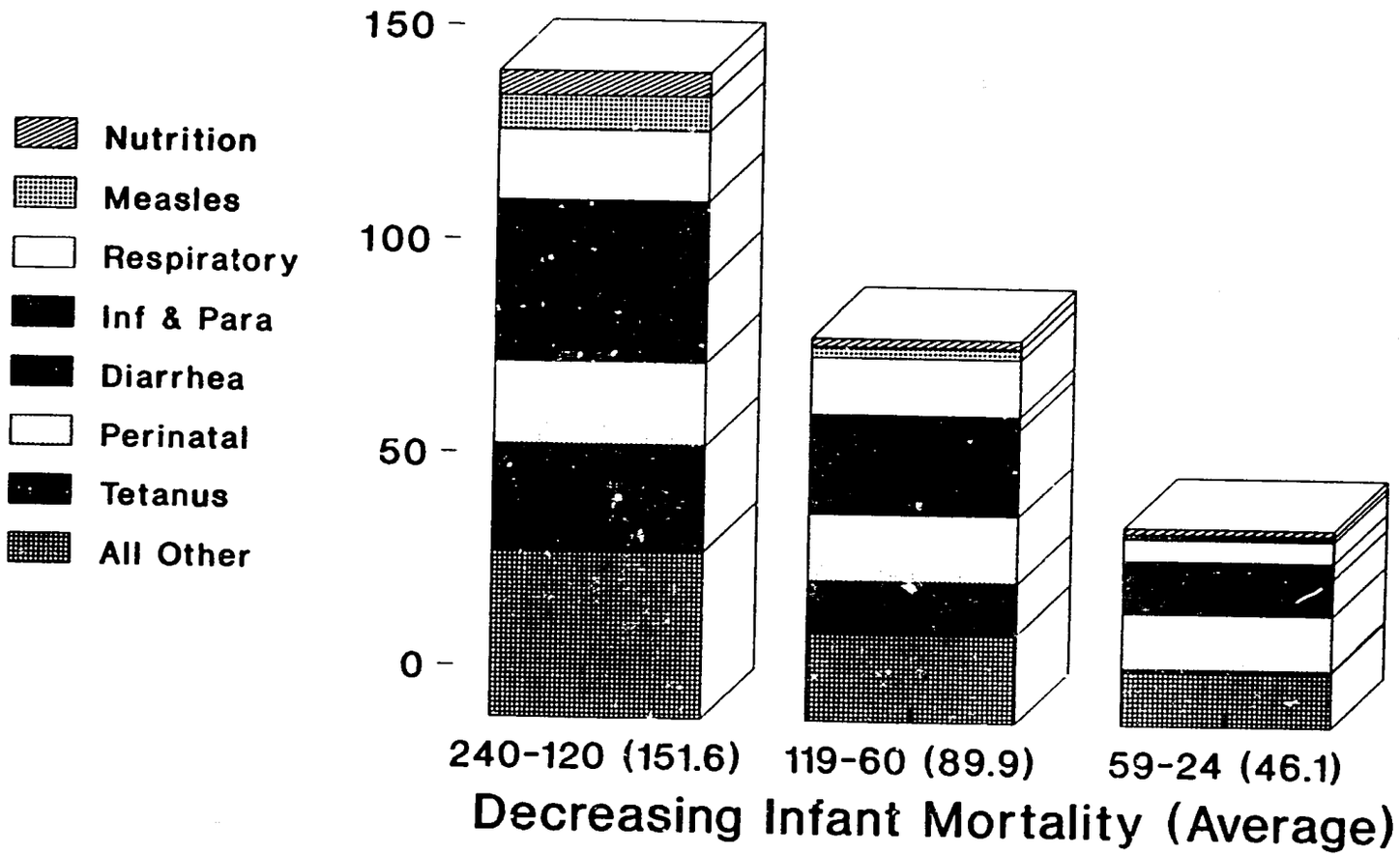
r = 0.45
n = 17, p>0.05
y = 62.05 + 0.217 x
r = 0.86
n = 6, p<0.05
y = 21.85 + 0.40 x
r = 0.59
n = 16, p = <0.005
y = 23.60 + 0.47 x
r = 0.96
n = 14, p<0.001
DIARRHEA DEATHS PER 100 000
INFANT DEATHS PER 1000 LIVE BIRTHS
0
100
200
300
400
0
25
50
75
100
125
150
175
200
225

Infant Deaths, England & Wales, 1861-1964
Cause Specific Life Table Analysis



Preston, Keyfitz, and Schoen, 1972

Infant Mortality Profiles:
Cause of Infant Death at Varying Levels



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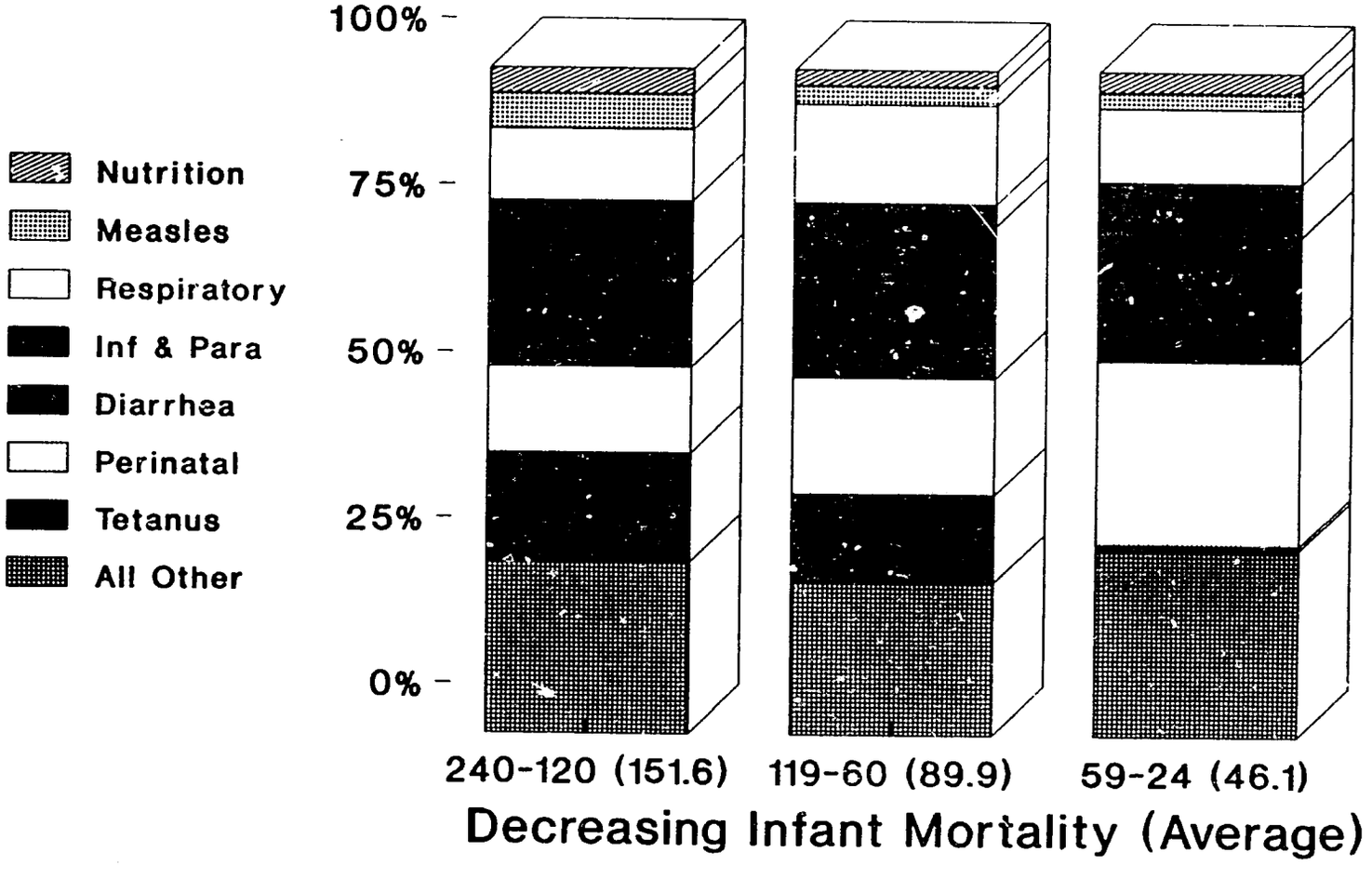

Table 1

Infant Mortality Rates and Total Populations of the 22 Child Survival Emphasis Countries

Country	Infant Mortality Rate (per 1000 live births)	Total Population (in millions)
Mali	175	8.1
Malawi	157	6.9
Niger	140	6.1
Senegal	137	6.4
Nepal	134	16.5
Bangladesh	124	101.1
Haiti	123	6.6
Yemen Arab Republic	120	7.3
Bolivia	117	6.5
Pakistan	115	100.4
Sudan	112	21.6
Nigeria	110	95.2
India	105	758.9
Zaire	103	29.9
Peru	94	19.7
Egypt	93	46.9
Morocco	90	21.9
Indonesia	79	166.4
Hoduras	76	4.4
Kenya	76	20.6
Ecuador	67	9.4
Guatemala	65	8.0

Source: State of the World's Children 1987, UNICEF