BREASTFEEDING SAVES LIVES:

An Estimate of the Impact of Breastfeeding on Infant Mortality in Developing Countries

prepared by
NURTURE/Center to Prevent
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AN ESTIMATE OF THE IMPACT OF BREASTFEEDING ON INFANT MORTALITY IN DEVELOPING COUNTRIES

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SUMMARY

This paper presents a methodology for the estimation of cause-specific infant mortality reduction attributable to breastfeeding practices. Applying this methodology, we estimate that breastfeeding is preventing over six million deaths per year in the developing world through the prevention of deaths due to diarrheal disease and acute respiratory infection (ARI). Moreover, we estimate that worldwide optimal breastfeeding (ie, exclusive for the first 4 to 6 months and continued partial breastfeeding through at least the first year of life) could avert an additional 2 million of the estimated 9 million infant deaths that occur in the developing world annually.

The methodology employed in calculating these estimates utilizes breastfeeding prevalences from recent Demographic and Health Survey results, cause-specific relative risks of mortality and other empirical data relating to population size and distribution. It is also based on a set of conservative assumptions concerning infant mortality and its age distribution.

The estimated mortality reductions are conservative because only deaths due to diarrheal disease and ARI are included and the additional benefits breastfeeding has on other illnesses, on birthspacing or on malnutrition, are not directly assessed. Additionally estimates are only made in relation to infant deaths. Breastfeeding continues to benefit the child's health into the second and third year of life.

INTRODUCTION

The importance of breastfeeding in the prevention of infant mortality has been well documented.[1-3] However, there have been few attempts made to actually quantify this effect in terms of the number of deaths prevented by breastfeeding, as has been done for oral rehydration usage and other preventative measures.[4-5] Feachem and Koblinsky undertook such an exercise in attempting to estimate the potential change in diarrheal disease mortality due to breastfeeding promotion,[6] but the current work differs in several ways. Firstly, we expand the health consequences of interest to include acute respiratory infection, which accounts for as large a proportion of infant mortality as diarrheal disease.[7] Secondly, we take advantage of recent empirical information on population sizes, mortality rates and relative risks by feeding mode to arrive at estimates of the number of infants affected. Finally, we determine how strongly variations in our starting assumptions influence our results.

We chose to examine the impact of breastfeeding on diarrheal disease and ARI because of the major contribution of these causes to infant mortality in all regions of the developing world, the emphasis placed on them in child survival strategies and the known relationship between these two infectious diseases and infant feeding practices. Breastfeeding of appropriate frequency and duration is consistently and strongly associated with significantly lower incidence and case fatality rates for diarrheal disease. [2-3;8-11]

Among infants younger than 2 months, for whom the protective effect of breastfeeding appears to be strongest, bottlefed infants die of diarrheal disease at up to 25 times the rate of those who are exclusively breastfed. [3]

While the protective effect of breastfeeding is lower for ARI than for diarrheal disease, a consistent relationship has been found. [3;12-14] Among the youngest infants, those who are not breastfed are more than 3 times more likely to die of respiratory infection than are those who are exclusively breastfed. [3]

Breastfeeding also plays a major role in preventing malnutrition. This effect is difficult to isolate from the effect on infectious diseases. Therefore, we have not included a separate analysis of the impact of breastfeeding on infant deaths attributed to malnutrition. We have also not included an assessment of the impact of breastfeeding on birthspacing which is known to be substantial.[13]

While cause-specific death rates from vital statistics are unreliable in many regions, two recent studies in Egypt and Bolivia have found that diarrheal disease accounted for 7-12 percent of deaths among infants less than 1 month, and 46-52 percent among infants 1-11 months. Acute lower respiratory infection was cited as the cause of

between 21-41 percent of deaths to infants less than 1 month, and 31-33 percent of deaths among older infants. [15-16] These figures are consistent with smaller field studies in South Asia, the Philippines and many other settings. [17-20] Thus among the more than 9 million infant deaths each year in developing countries, we conservatively estimate that diarrheal disease and ARI each account for approximately 25%.

METHODOLOGY

We use a simple method to estimate the number of infant deaths currently prevented by appropriate breastfeeding and the number of deaths that could be averted if the prevalence and duration of breastfeeding were universally optimal (exclusive for 4 - 6 months and partial for the remainder of the first year) under current health and environmental conditions. To do this we use: a) regional infant mortality rates [21]; b) distributions of the regional populations into urban and rural areas [22]; c) distributions of infants among breastfeeding categories -- exclusive, partial and no breastfeeding [22]; and d) cause-specific relative risks of mortality by feeding practice.[3] These data then give us an estimate of the cause-specific death rates for both diseases by region, based on the previously stated assumption that 25% of all infant deaths are attributable to diarrheal disease and an additional 25% are attributable to ARI. These rates are presented in Table 1.

The division of regions into urban and rural areas is deemed necessary due to the differences in breastfeeding practices observed in these areas and because of the differential in infant mortality that exists between the two areas. For example, it has been demonstrated by recent DHS findings from Mexico that rural infant mortality is almost twice the urban infant mortality.[24] There are numerous explanations for these differences such as environmental conditions, access to health care, and educational differences thus making it important to differentiate between urban and rural populations.

Breastfeeding prevalences from Demographic and Health Survey data are presented in Table 2 along with the percent of the population in urban or rural areas. The surveys, which were conducted between 1984 and 1989, were intended to be nationally representative of women in their childbearing years. Women between the ages of 15 and 49 were asked about the breastfeeding experience of all children born in the preceding five years. In our calculations we use data on breastfeeding for each region, based on averages of the DHS countries in each region. For Africa and Latin America and the Caribbean this does not present a problem since they are based on averages from 11 and 9 countries, respectively. However, prevalences for Asia are based on averages from 3 countries (Indonesia, Sri Lanka and Thailand) which makes them less representative of the region as a whole. Since these countries generally have lower rates of breastfeeding than many others in the region (eg, India, Pakistan, Nepal and

Bangladesh for Asia), our estimates are biased in a conservative direction. Estimates for China's breastfeeding prevalence are based on the breastfeeding prevalences for Asia.

It should also be noted that exclusive breastfeeding is defined as when the infant received breastmilk only, and partial breastfeeding includes breastmilk plus water or other supplements (solids or liquids) on the day preceding the interview.

These data are then used in conjunction with the regional cause-specific death rates shown in Table 1 to give us cause-specific death rates (CSDRs) by area and breastfeeding category. These estimates of the CSDRs depend on two similar premises:

1) the cause-specific death rate in a given region is an average of the cause-specific death rates in the urban and rural areas weighted by the proportion of the population in each area, and

2) the cause-specific death rate in a given area (urban or rural) is an average of the cause-specific death rates in each of the breastfeeding categories within that urban/rural area weighted by the proportion of the population in each category.

These rates are applied to the total population of infants in each area assuming that 60% of infant deaths occur in the first six months of life.

The rural cause-specific death rate was assumed to be twice the urban cause-specific death rate. This figure is an estimate based on data from DHS results of 15 countries. Cause-specific death rates by feeding mode were estimated to have a ratio of 1:3:18, exclusive:partial:no breastfeeding using data from Victora et al's study in Brazil.[3] Estimates of the relative risk for young infants were made by averaging the relative risk of infants 0-2 and 3-5 months in this paper. The relative risk for partial breastfeeding equates with Victora's rate of breastmilk plus non-milk supplements.

Also, in this paper children who are ages 0-5 months are actually 0-5.9 months. This differs slightly from ages in the DHS where children 0-5 months are 0-5.0 months of age. Therefore, we have used a DHS distribution of 0-6 months and 7-12 months as they correspond more closely to the age ranges in Victora's study of 0-5.9, and 6.0-11.9 months. Table 3 is a summary of the reference assumptions used in the estimate calculations.

RESULTS

Based on these assumptions and using a simple spreadsheet procedure, we calculate the number of infant deaths averted by current breastfeeding practices. This is done by applying the CSDR for non-breastfeeders in each area to the infant population in each area. The number of deaths if no one breastfed is then compared to the actual

number of deaths occurring annually. Using these calculations we estimate that over 6,000,000 deaths are currently averted by breastfeeding. The regional results are presented in Table 4.

Using the same information we can assess the improvement in infant survival that would occur if breastfeeding patterns were to improve so that all infants 0-5 months were breastfed exclusively and infants 6-11 months were partially breastfed. The expected number of deaths under these conditions can then be compared to the actual number of deaths. This difference is then the number of deaths due to "sub-optimal" breastfeeding (i.e. preventable by optimal breastfeeding), which according to our estimation is over 2,000,000. It should be noted that this estimate assumes that children on average are exclusively breastfed between the midpoint of 0-5 months and partially between the midpoint of 6-11 months. If all infants were exclusively breastfed through the recommended 4 to 6 months and throughout the first year of life the estimate of deaths averted would be even greater.

Because many of the assumptions are rough, it is helpful to assess the sensitivity of the overall results to changes in the assumptions. The results of these variants are presented in Table 5.

The number of deaths currently prevented by breastfeeding among the variant assumptions ranges from over 3,000,000 to over 7,000,000. If the percent of deaths due to diarrheal disease and ARI is as high as 30% (as opposed to the 25% we estimate) the estimate increases greatly. Using a lower relative risk of death due to diarrheal disease decreases the estimate. Eliminating the urban/rural differential in mortality affects the estimate by only a small amount.

This methodology also allows us to estimate the impact of changes in population distribution by area and breastfeeding category. For example, given that all other conditions remain constant but an additional 25% more of the population becomes urbanized, the number of deaths due to sub-optimal breastfeeding would increase by 6%. This shows that even though infant mortality rates are lower in urban areas, improved access to health care or other environmental factors are unable to compensate for the lower breastfeeding prevalences found in urban areas.

We can also examine the impact that targeting breastfeeding promotion activities to mothers of younger and older infants has on the number of deaths due to sub-optimal breastfeeding. If the projected percent of non-breastfed infants decreases to 5% among 0-5 months old infants and to 10% in 6-11 months old infants in all regions (See Table 2 for current prevalences), we find that the total number of infant deaths due to sub-optimal breastfeeding decreases by 11%. (See Table 6)

Similarly, if the rate of exclusive breastfeeding in infants 0-5 months increases to 50% in all regions, the number of deaths due to sub-optimal breastfeeding decreases by

11%. If partial breastfeeding is increased among women who are breastfeeding at 0-5 months so that the percentage of breastfeeders in the 0-5 month group remains constant through the 6-11 month group the number of deaths due to sub-optimal breastfeeding decreases by 8%. These results illustrate the importance of both increasing the percent of both young and older infants breastfeeding and especially those exclusively breastfed in the first six months.

DISCUSSION

These results raise several important policy implications. Firstly, breastfeeding is a resource that currently is responsible for averting an immense number of deaths that would otherwise be occurring. While oral rehydration therapy (ORT) has been suggested to prevent 2.5 million deaths annually and immunizations to prevent 2.6 million deaths to children under 5 years , breastfeeding annually prevents over 6 million deaths to children under one year. Preserving exclusive and partial breastfeeding practices is critical to offset existing risks of infant mortality due to infectious diseases.

Secondly, promotion of improved patterns of breastfeeding should be seen as a vital component in any child survival strategy and should have a pivotal role in programs to reduce infectious diseases. Immunization has been estimated to be have the potential to prevent an additional 2.6 million deaths to children under 5. ORT has been estimated to be able to prevent an additional 1 million deaths in children under 5 per year.[25] Breastfeeding even under the most conservative assumptions is shown in this paper to have the potential to prevent a similar number in only the first year of life. If all infants in the developing world could be exclusively breastfed for the first 4-6 months and partially for the first year of life an additional 2 million infant deaths could be averted.

By varying the assumptions used in the calculations, we can assess the potential impact of different breastfeeding promotion activities. For example, although both increasing the proportion of infants exclusively breastfed and increasing the proportion of infants who are breastfed through the first year of life have an impact on infant survival, substantially increasing the proportion of infants who are exclusively breastfed will have a greater effect than increasing the proportion of infants only maintaining breastfeeding through the first year of life. On the other hand, urbanization of part of the population does not result in dramatic reductions in mortality because of associated reductions in breastfeeding rates.

CONCLUSION

The calculations made in this paper on the impact of breastfeeding on infant survival are underestimates, since they take into account only:

- Deaths due to diarrhea and acute respiratory tract infections
- Deaths only to infants (breastfeeding also has an impact on survival in the second and third year of life
- Deaths from the above diseases, and not the generalized morbidity and associated reduced resistance to other fatal infections and malnutrition.

In addition, the impact of breastfeeding on nutritional status and birth spacing are not included. Due to data limitations, optimal breastfeeding is defined as breastfeeding only to the midpoint of 0-5 months, rather than 4-6 months as generally recommended for exclusive breastfeeding.

Thus breastfeeding should be among the foremost interventions in the internal health agenda. The focus of programmatic interventions should be to increase exclusive breastfeeding in both urban and rural areas. This can be accomplished through hospital and community-based interventions and national policy changes to support breastfeeding.

Lastly, breastfeeding promotion is part of a much larger environment and, while essential to a child survival strategy, must be considered along with improvements in nutritional status, sanitary conditions, the education of women, increases in birth spacing and household resources and other determinants of the welfare of women and children.

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TABLE 1

Regional and Causal Distribution of Infant Mortality

	Infant	All Causes[a]		DD or ARI[b]	
Region	Population (millions)	Rate (per 1,000)	Deaths (thousands)	Rate (per 1,000)	Deaths (thousand)
LA/C	12	54.6	655	13.7	164
ME/NA	14	99.1	1388	24.8	347
AFRICA	18	133.8	2409	33.4	602
ASIA*	41	97.7	4005	24.4	1001
CHINA	19	34.0	646	8.5	161
LDCs	104	67.5	9103	21.9	2276
WORLD	121	77.6	9396		

* Excluding China

[a] Bulatao and Stephens, 1990

[b] Assumes 25% of deaths from all causes

Table 2

Breastfeeding Patterns in Each Setting

		0-5 Months			6-11 Months		
REGION	% of pop	Exclusive (%)	Partial (%)	No BF (%)	Exclusive (%)	Partial (%)	No BF (%)
LA/C							
Urban	(70)	11	61	28	2	46	52
Rural	(30)	24	57	19	5	58	37
ME/NA							
Urban	(45)	21	61	18	8	53	39
Rural	(55)	35	54	11	11	66	23
AFRICA							
Urban	(20)	12	81	7	1	81	18
Rural	(80)	18	75	7	3	85	12
ASIA							
Urban	(30)	9	68	23	3	58	39
Rural	(70)	15	77	8	3	82	15

From DHS data, 1986-1990

Table 3

Assumptions Accepted in the Calculation of CSDR's by Breastfeeding Category

	Assumptions	Supporting Data
#1	25% of all infant deaths are attributable to diarrheal disease or ARI	Puffer & Serrano (Latin America)[7] Berman, in ALRI Workshop (Nepal, Indonesia)[18]
#2	60% of all DD or ARI infant deaths are of infants 0-5 months	Breiman, in ALRI Workshop[19] Rahman & Nessa (Bangladesh)[20]
#3	50% of infant population is 0 - 5 months	
#4	RR of mortality, urban:rural = 1:2	DHS (based on overall infant mortality rates)[23]
#5	RR of mortality as follows:	Victora, et al (Brazil)[3]

	BF Practices		
	Exclusive	Partial	None
DD			
Age (in mos.)			
0-5	1	3	18
6-11	1	1	3
ARI			
Age (in mos.)			
0-5	1	2	2.5
6-11	1	1	1.5

Table 4

Deaths Currently Averted by Breastfeeding

Region	Age in months 0-5 DD	0-5 ARI	6-11 DD	6-11 ARI	Total 0-11 DD & ARI
LA/C	190,180	28,020	38,490	14,750	271,440
ME/NA	671,180	88,830	131,520	44,300	935,830
AFRICA	1,395,160	123,950	336,210	98,950	1,954,270
ASIA*	1,986,990	184,540	479,750	148,430	2,799,710
CHINA	326,180	30,050	78,730	24,250	459,210
	4,569,690	455,390	1,064,700	330,680	6,420,460

Deaths Currently Attributable to Sub-optimal Breastfeeding

Region	Age in months 0-5 DD	0-5 ARI	6-11 DD	6-11 ARI	Total 0-11 DD & ARI
LA/C	82,230	47,740	30,840	12,000	172,810
ME/NA	159,350	39,390	48,690	16,740	314,170
AFRICA	263,770	167,230	48,530	14,330	493,860
ASIA*	456,990	286,630	107,080	34,540	885,240
CHINA	73,400	46,120	15,820	5,370	141,710
	1,035,740	637,110	251,960	82,980	2,007,790

*Excluding China

Table 5

Estimate of Infants (Age 0-5 months) Lives Affected under Varying Assumptions

Variant	Change in Assumption	Deaths Averted by Breastfeeding	Deaths due to Sub-Optimal Breastfeeding (Preventable Deaths)
I	Reference	6,420,460	2,007,790
II	30% of all infant deaths due to either DD or ARI	7,704,550	2,409,320
III	Low relative risks for breastfeeding (1:2:5, 0-5 months; 1:2, 6-11 months)	3,224,940	1,595,980
IV	No urban-rural mortality differential	6,140,270	2,049,670

Table 6

Deaths due to sub-optimal breastfeeding with changes in starting conditions

	Deaths	Change from Reference
Additional 25% of the population becomes urbanized	2,125,010	+ 117,220
% of non-breastfed infants decreases to 5% in 0-5 months and 10% in 6-11 months Total	1,785,390	- 222,400
0- 5 months	1,588,390	
6-11 months	197,000	
% of exclusively breastfed infants 0-5 months increases to 50%	1,794,000	- 213,790
% of nonbreastfeeders at 0-5 months remains constant in 6-11 months	1,836,800	- 170,990