

Quantifying the Benefits of Breastfeeding: A Summary of the Evidence

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FOREWORD

Each year new evidence contributes to our knowledge of breastfeeding's role in the survival, growth, and development of a child as well as the health and well-being of a mother. *Quantifying the Benefits of Breastfeeding: A Summary of the Evidence* provides scientific and epidemiological evidence in support of the World Health Organization's and UNICEF's Global Strategy for Infant and Young Child Feeding.

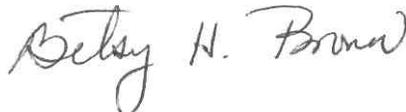
The Global Strategy for Infant and Young Child Feeding states, "Appropriate evidence-based feeding practices are essential for attaining and maintaining proper nutrition and health. Inappropriate feeding practices and their consequences are major obstacles to sustainable socioeconomic development and poverty reduction." The strategy calls on governments, civil society, and the international community "to renew their commitment to promoting the health and nutrition of infants and young children and to work together for this purpose."

As part of their commitment, the Pan American Health Organization (PAHO) and The LINKAGES Project—a 10-year breastfeeding program supported by the United States Agency for International Development (USAID)—collaborated in the development of this publication. Documentation of the evidence of breastfeeding's impact on health outcomes is particularly important at this time, when concerns about transmission of HIV through breastmilk threaten to erode support for breastfeeding programs. For the vast majority of infants and young children throughout the world, breastfeeding saves lives, prevents morbidity, promotes optimal physical and cognitive development, and reduces the risk of some chronic diseases. Evidence of the benefits of breastfeeding for mothers is growing as well.

We commend this publication to policy makers, program planners, breastfeeding advocates, researchers, and journalists. This summary of the evidence makes a powerful case for protecting, promoting, and supporting a life-saving resource that ensures the best start in life for newborns.



Sir George Alleyne
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LIST OF ABBREVIATIONS AND ACRONYMS

ALL	acute lymphoblastic leukemia
ALRI	acute lower respiratory infection
AML	acute myeloid leukemia
AOM	acute otitis media
ARI	acute respiratory infection
BF	breastfeeding/breastfed
BMI	body mass index
CI	confidence interval
DTU	Diarrhoea Treatment Unit
EBF	exclusive breastfeeding/exclusively breastfed
FF	formula feeding/formula fed (includes nonbreastfed children)
GI	gastrointestinal
HI	<i>Haemophilus influenzae</i>
HPN	Food and Nutrition Program
HPP	Health Promotion and Protection
IDDM	insulin-dependent diabetes mellitus
IDR	incidence density ratio
MR	mortality rate
NCHS	National Center for Health Statistics
NIDDM	noninsulin-dependent diabetes mellitus
OM	otitis media
OME	otitis media with effusion
OR	odds ratio
PAHO	Pan American Health Organization
PBF	partial breastfeeding
RI	respiratory infection
RR	relative risk
SES	socioeconomic status
TSB	total serum bilirubin
UR	upper respiratory
USAID	United States Agency for International Development
WHO	World Health Organization

INTRODUCTION

This annotated bibliography summarizes the published literature on the following six topics related to the benefits of breastfeeding:

- Infant morbidity because of diarrhea, acute respiratory infections, otitis media and ear infections, and other infectious diseases
- Infant mortality because of diarrhea, acute respiratory infection, and all causes
- Child development
- Chronic diseases, particularly obesity, diabetes, and cancer
- Maternal health effects, with special emphasis on breast and ovarian cancers
- Economic benefits

Articles on the association between breastfeeding and health and developmental outcomes are reviewed with respect to four major criteria: 1) avoidance of detection bias and reverse causality through use of an adequate study design, 2) adequate control for confounding factors through statistical analysis, 3) clear definition of breastfeeding, and 4) clear definition of outcome measure(s). Articles are presented chronologically, with the most recent first.

Where sufficient quantitative data are available, tables summarizing the key findings are provided. These tables are available for topics relating to infant morbidity, infant mortality, child development, chronic diseases, and maternal health effects.

Search Methods

The databases Medline and Popline were searched between February 26 and March 6, 1997; between July 24 and August 3, 2001; and in January 2002 for keywords related to the six topics. These keywords, identified in italics for each topic, are as follows:

- Infant morbidity: *breastfeeding, lactation, diarrhea, acute respiratory infection, morbidity*
- Infant mortality: *breastfeeding, lactation, infant mortality*
- Child developmental and adult outcomes: *breastfeeding, lactation, cancer, intelligence, cognitive, motor development, diseases*
- Chronic diseases: *breastfeeding, lactation, obesity, diabetes, chronic diseases, cardio-vascular disease*
- Maternal health effects: *breastfeeding, lactation, maternal health, breast cancer, ovarian cancer, anemia, hemorrhage, maternal depletion*
- Economic benefits: *breastfeeding, lactation, economic benefits, health costs*

This search was limited to articles published in English and, except for the topics on the economic benefits of breastfeeding, to articles available in the Library of Medicine of the National Institutes of Health and on the Web. Because the searches identified few published articles on the economic and environmental benefits of breastfeeding, the review of these effects included unpublished papers.

The search strategy resulted in numerous articles, only some of which were relevant to the specific topic under investigation. For example, the search on infant mortality yielded 783 articles. To narrow the search, article titles and keywords were reviewed for relevance to the topic. In addition, where recent review articles were available, the references were checked against the search to ensure that all relevant articles were

identified. This review process often identified additional relevant literature. Ultimately, 188 articles were reviewed and are summarized here.

Epidemiological Methods

Evidence of the advantages of breastfeeding over alternatives comes from several main lines of research. One deals with the unique constituents and properties of human milk known to be important for optimal growth and development. Examples include nutrients in precisely the right form and balance for the infant and antibodies that are specific to the disease experience of the mother. Another line of research uses animal models to provide evidence that may be relevant to humans. Although the evidence provided by these lines of research can be extremely important in leading to new hypotheses and in helping to understand biological mechanisms, neither is reviewed here.

The line of research summarized in this review uses epidemiological methods to provide information on the functional consequences of breastfeeding human infants compared with alternative infant feeding methods.

In epidemiological research, the type of study that can offer the most conclusive evidence of a causal link between breastfeeding and any functional consequence of interest is the **randomized controlled trial**, in which different feeding methods are randomly assigned to different infants, themselves randomly selected from the population of interest. Ethical objections aside, this type of study is almost never feasible for breastfeeding because few mothers are willing to accept random assignment of feeding method for their infants.

Most epidemiological evidence, therefore, comes from observational case-control and cohort studies. In **case-control studies** the infant feeding strategies of “cases” (infants with an illness or other problem) are compared with those of “controls” (infants without the problem). In **cohort studies**, the outcomes of infants fed differently are compared instead of the infant feeding methods for infants with different outcomes. For obvious reasons, case-control studies tend to be retrospective and cohort studies prospective.

Although there are many variants of these basic observational designs, all are flawed by the mother’s simple act of choosing an infant feeding method. As long as the feeding method is not randomly assigned, like placebos and real medicine in clinical trials, there is a good chance that other characteristics of the mother (such as her education or income) or of the infant (such as a pre-existing illness) are associated with the chosen method of infant feeding or may have actually caused it. Then it becomes difficult to know what is responsible for the association between breastfeeding and the outcome of interest.

For example, if more educated mothers tend to breastfeed, a positive association between breastfeeding and health or intellectual development may be due in part to the direct effect of the mother’s education. In statistics this is known as **confounding**.

Another example is the common observation that breastfed infants stop breastfeeding when they become very ill or are switched to an alternative method of feeding in an effort to make them better. In this case, the illness, or the death that eventually may result, is the cause rather than the consequence of not breastfeeding. This is known as **reverse causality**.

In our assessment of these studies, frequent mention is made of confounding and reverse causality because these are always threats when observational methods are used. Although these threats can be reduced using statistical methods or more sophisticated

study designs, none of these methods is perfect. Therefore, no single study is as conclusive as a randomized controlled trial could be. However, as the epidemiological evidence favoring breastfeeding is generally derived from multiple studies in a variety of situations, the evidence is in sum, convincing.

Another line of support comes from being able to document a “*dose-response*” *relationship*. This term, borrowed from clinical trials, refers to a relationship in which the response (say, the observed benefit of breastfeeding) is proportional to or appears to be a function of the dose (the amount, duration, exclusiveness, etc.). A dose-response relationship is taken to suggest a causal link between the dose and the response. The reviews provided here frequently identify dose-response relationships.

The Benefits of Breastfeeding

The work described here attests to the enormous benefits of breastfeeding in terms of infant health, intellectual and motor development, later chronic disease risk, and maternal health. As the research base expands, and as understanding of this subject grows, the superiority of breastfeeding over alternative feeding methods for all of these outcomes becomes ever clearer. These benefits come not at a price, but with additional economic benefits for the household, the health system, employers, and society.

Morbidity and Mortality

The greatest and most obvious benefits of breastfeeding are for the immediate health and survival of the infant. Rates of diarrhea, respiratory tract infections, otitis media, and other infections, as well as deaths due to these diseases, are all lower in breastfed than in nonbreastfed infants. During the first six months, the rates are lower for exclusively breastfed than for partially breastfed infants.

These benefits, resulting from stronger immunity and reduced exposure to infectious agents, are greatest in younger infants and where hygiene and sanitation are poor. However, the research described here also suggests that these health and survival benefits extend beyond infancy and to well-off Western populations.

Intellectual and Motor Development

Many studies reviewed here confirm that children who are breastfed do better on tests of intellectual and motor development than children who are not breastfed. When potential confounders are taken into account, these differences are often smaller but nevertheless persist, indicating that not all of the observed effect is due to confounding. The consistency of the observed differences across time and space and the observed dose-response relationship further suggest that this effect is real and has a biological basis.

Finally, although the mechanisms are not well understood, there are plausible biological explanations for a causal link between breastfeeding and intellectual development. Unlike breastmilk substitutes, breastmilk contains long-chain polyunsaturated fatty acids known to be important for brain growth and development. Both human and animal studies have documented a correlation between serum levels of these nutrients and test scores. The unique physical contact between mother and infant provided by breastfeeding also is thought to provide psychosocial stimulation and bonding that may have developmental benefits.

Chronic Diseases

Associations between infant feeding and a number of chronic or noncommunicable diseases have been observed in the literature reviewed here. These include allergies, obesity, diabetes, hypertension, cancer, and Crohn's disease. The small number of observational studies on any single outcome suggests cautious interpretation at this time. However, the broad range of chronic diseases that may be attributed to suboptimal breastfeeding, and the enormous impact of many of these conditions on health and the costs of medical care, suggest that more research along these lines is urgently needed. In the meantime, reduction of chronic disease risk can be promoted as an additional potential benefit of breastfeeding.

Maternal Health

Initiation of breastfeeding immediately after delivery stimulates the release of oxytocin, a hormone that helps to contract the uterus, expel the placenta, and reduce postpartum bleeding. Breastfeeding also delays the return of fertility, thus reducing exposure to the maternal health risks associated with short birth intervals. In the longer term, mothers who breastfeed tend to be at lower risk of premenopausal breast cancer and ovarian cancer.

Economics

The analyses reviewed here show clearly that apart from being the safest and healthiest infant feeding method, breastfeeding is also the least expensive. For many poor households, the prohibitive cost of breastmilk substitutes puts this option completely out of reach. For others, the impact of formula purchases on the household budget can be crippling. This is especially true when the unanticipated additional cost of health care for the sick infant takes its toll.

When the cost of medical care is borne by the health system or insurers, the economic impact is felt at that level. When infant illness requires mothers to miss work, employers and the economy are also affected. Although the economic costs of not breastfeeding generally are considered to be greatest for poor households and poor countries, the evidence summarized here suggests that the impact in developed countries is also serious.