

6. ECONOMIC BENEFITS OF BREASTFEEDING

This section summarizes literature on the economic value of breastfeeding compared with infant formula from the national, public sector, hospital, household, and environmental perspective. Some of the studies explore the longer-term economic impact of breastfeeding for industrialized as well as developing countries.

Weimer J. The economic benefits of breastfeeding: A review and analysis. ERS Food Assistance and Nutrition Research Report No. 13. USDA Economic Research Service, Washington, D.C. 2001.

COUNTRY: United States

This article reviews the economic benefits of breastfeeding in the United States and provides new estimates of the economic gains from increasing breastfeeding rates from the 1998 level to targets set by the Surgeon General. From virtually all infants being breastfed in 1950, the prevalence of breastfeeding at hospital discharge declined to a low of 25% in 1967, rebounding to hover at around 64% by 1998. At least part of the erosion of breastfeeding in the United States is attributed to the increase in the proportion of women who work outside the home. After reviewing the health benefits of breastfeeding both for infants and mothers, the author examines the few studies that assess the economic benefits of breastfeeding in the United States. The economic benefits of breastfeeding include savings in reduced expenditure on publicly subsidized formula and health care, lower net food cost to households, and lower overall health care costs.

Although each analysis has a different perspective and uses different assumptions, the conclusions are unanimous: It is more expensive to provide formula than to breastfeed, and formula-feeding results in excess illness, which increases the cost of health care. Drawing on epidemiological studies that relate breastfeeding to the risk of otitis media, gastroenteritis, and necrotizing enterocolitis, and estimates of treatment costs, the author estimates that an increase in breastfeeding rates from the 1998 levels (64% at hospital discharge and 29% at 6 months) to the Surgeon General's targets (75% at discharge and 50% at 6 months), would save a minimum of \$3.6 billion.

The majority of these savings (\$3.1 billion) are attributable to preventing premature deaths due to necrotizing enterocolitis, which cost \$8.3 million per death. Savings due to reductions in medical expenses and the cost of parents' time are estimated at \$0.5 billion per year. This is considered to be conservative because it does not include a number of expenses related to the 3 conditions examined, nor does it include many other conditions with economic consequences, such as cognitive effects and other childhood, maternal, and chronic illnesses.

Ball TM, Wright AL. Health care cost of formula-feeding in the first year of life. Pediatrics 1999;103:870-6.

COUNTRY: United States and Scotland

SETTING: Small, middle-class cities

DESIGN: Retrospective

BREASTFEEDING DEFINITION: Exclusive breastfeeding < 3 months or \geq 3 months used to determine 3 feeding categories: exclusively fed if breastfed only for \geq 3 months, partially breastfed if received formula in the first 3 months of life, and never breastfed if never received breastmilk

OUTCOME MEASURE: Number of office visits and associated costs, days of hospitalization, and purchase of prescription drugs for lower respiratory tract illnesses, otitis media, and gastroenteritis.

RESULTS: After adjustments were made, the never breastfed infants were observed to have had 60 more episodes of lower respiratory tract illness, 580 more episodes of otitis media, and 1,053 more episodes of gastrointestinal illness per 1,000 infants. The total direct cost incurred by never breastfed infants during the first 12 months of life for lower respiratory tract illness, otitis media, and gastrointestinal illnesses was between \$331 and \$475 per infant. This totaled \$331,051 for the cost for medical care of 1,000 never breastfed infants, compared with the infants who were exclusively breastfed for the first 3 months of life.

METHODOLOGICAL ISSUES: Home visits for 617 infants were followed at 2 weeks and at 1-6, 9, and 12 months of age. Costs of care were estimated based on the actual experiences of the largest health management organization in Tucson, Arizona, and generally were lower than those of regular clinic fees. Chi-squared tests and adjusted mean differences were used to assess the relationship between feeding status and illness outcome.

Davis P. Time allocation and infant-feeding pattern: Women's work in the informal sector in Kampala, Uganda. Wellstart International's Expanded Promotion of Breastfeeding Working Paper. Washington, DC. 1996.

COUNTRY: Uganda

This paper describes the relationship between time spent in infant feeding and market work activities among women in the informal sector in Kampala, Uganda. The results show that women spent a large proportion of time breastfeeding their infants. Out of a 14-hour day, an average of 3.7 hours were spent breastfeeding infants of all ages, and 5.4 hours were spent breastfeeding infants under the age of 4 months. In contrast, mothers spent negligible amounts of time feeding other foods, which is explained by the fact that this was usually done by someone other than the mother. The amount of time spent breastfeeding (categorized as high, medium, and low) was inversely and significantly related to the proportion of time spent in market activities. However, the amount of time spent in market activities (categorized as high, medium, and low) was not associated with the proportion of time spent breastfeeding. This is because the proportion of time spent in market activities and breastfeeding varied markedly by specific activity. Also, the amount of time spent on household chores was inversely and significantly related to the proportion of time spent in market activities, which suggests that household work presents more of a constraint on time available for market activities than does breastfeeding.

Gryboski KL. Maternal and non-maternal time-allocation to infant care, and care during infant illness in rural Java, Indonesia. *Soc Sci & Med* 1996;43:209–19.

COUNTRY: Indonesia

The time costs of breastfeeding and time costs of caring for ill infants have emerged as important considerations in quantifying the economic value of breastfeeding. This paper describes maternal and nonmaternal time allocation to infant care during symptom-free days and ill days. A longitudinal design of repeated household visits and observation was used to record the time spent in daily tasks. The results show that infants were fed by caretakers other than the mother or by caretakers in addition to the mother on one-third of all study days. The paper does not present the data in such a way that the proportion of time spent feeding or devoted to ill infants can be related to feeding mode. There was no significant difference between well and sick days in the amount of time spent breastfeeding or the frequency of breastfeeding, mothers' remunerative work outside or inside the home, or minutes of infant care either by the mother or other caregivers.

Horton S, Sanghvi T, Phillips M, Fiedler J, Perez-Escamilla R, Lutter C, et al. Breastfeeding promotion and priority setting in health. *Health Policy and Planning* 1996;11(2):156–68.

COUNTRY: Brazil, Honduras, Mexico

This paper examines the cost-effectiveness of hospital-based breastfeeding promotion programs. Effectiveness estimates are based on 3 hospital-based programs in Brazil, Honduras, and Mexico. Costs were determined by estimating the costs associated with training, maternity ward education and support, prenatal and postnatal education, and equipment. Savings were determined by estimating the reductions in purchase of formula and changes in birthing procedures and drug use. Cost-effectiveness calculations were based on estimated reductions in mortality from acute respiratory infections and diarrhea. Based on estimated mortality reductions, the costs per disability-adjusted-life-year gained through increases in breastfeeding were estimated to range from \$4 to \$19, which were comparable to those gained from reductions in measles and rotavirus infection and less than those for oral rehydration therapy. The cost of breastfeeding promotion per birth ranged from \$0.30 to \$0.40, when the savings due to eliminating formula were included, and from \$2 to \$3 when the savings due to eliminating formula no longer could be used to offset the cost of breastfeeding promotion.

Tuttle CR, Dewey KG. Potential cost savings for Medi-Cal, AFDC, Food Stamps, and WIC programs associated with increasing breast-feeding among low-income Hmong women in California. *J Am Dietetic Assoc* 1996;96:885–90.

COUNTRY: United States

This article calculates the theoretical savings for public welfare costs from less formula use, decreased morbidity, and decreased fertility. The implications for 4 public welfare programs were analyzed for cost: Medicaid in California, Aid to Families with Dependent Children, Food Stamps, and Women, Infants, and Children (WIC). The authors report a substantial savings associated with breastfeeding. The total savings per family over a 7.5-year period range from \$3,422 to \$4,944, or from \$4,475 to \$6,060, depending on the discount rate used. Most of the savings are due to decreased fertility in

that the population studied does not use modern contraceptives and has a high fertility rate, with subsequent high public welfare costs. These estimates are conservative because they do not include the cost of maternal perinatal care or delivery or postnatal care associated with increased fertility. The savings due to formula costs are minimal because of rebates the State of California receives from formula makers for formula purchased with WIC vouchers. Also, women who partially breastfeed under the WIC program receive both a full set of vouchers for formula and an enhanced maternal package of food, which increases the cost of partial breastfeeding to the program.

Cohen RJ, Haddix K, Hurtado E, Dewey KG. Maternal activity budgets: Feasibility of exclusive breastfeeding for six months among urban women in Honduras. *Soc Sci & Med* 1995;41:527–36.

COUNTRY: Honduras

In this study, data from 2 12-hour in-home observations at 19 and 24 weeks postpartum are used to estimate maternal time costs of exclusive breastfeeding versus partial breastfeeding infants 4–6 months of age. Two groups of partially breastfeeding women were considered: those who maintained nursing frequency similar to that of an exclusively breastfeeding woman and those who did not. The results show that the time spent breastfeeding was similar in both groups of women and averaged about 75 minutes per 12-hour period. One exception was that multiparous women in the exclusive breastfeeding group spent more time breastfeeding at 24 weeks than women in the partial breastfeeding group. When total time spent feeding an infant was considered (breastfeeding plus preparing and feeding solids), partially breastfeeding women spent more time than exclusively breastfeeding women, except for multiparous women, at 24 weeks. For example, at 19 weeks, exclusively breastfeeding primiparous women spent 71±27 minutes breastfeeding, compared with 99±40 and 108±38 minutes in the 2 partially breastfeeding groups ($p < 0.01$).

This comparison underestimates the time spent preparing baby food because primiparous women were provided baby food in jars and did not have to make it from scratch. Time spent on other activities shows that both exclusively and partially breastfeeding women spent 2–3 hours per 12-hour period resting, chatting, or watching television. However, mothers expressed a preference for partial breastfeeding because they perceived it to be less time-consuming. The authors conclude that time was not a constraint to exclusive breastfeeding in this population, but that it was perceived to be a barrier. Such perceptions should be addressed in programs to promote exclusive breastfeeding.

Cohen R, Mrtek MB, Mrtek RG. Comparison of maternal absenteeism and infant illness rates among breast-feeding and formula-feeding women in two corporations. *Am J Health Promot* 1995;10:148–53.

COUNTRY: United States

This study used an observational design to study the effect of infant feeding practices on infant illness and maternal absenteeism over a 1-year period. Two groups of women were studied: those employed at a utility company, and those employed at an aeronautics corporation. Both companies had on-site lactation programs. A total of 101 mother/infant pairs were studied for whom breastfeeding was the feeding mode in 59 of the cases, and bottle-feeding was the feeding mode in 42 cases. Entry into the study was voluntary, so

self-selection may limit validity. Because the associations found did not differ by company, the companies are combined for presentation of results. Breastfeeding mothers had higher levels of education and salaries than the formula-feeding mothers. For example, more than 80% of breastfeeding mothers earned more than \$30,000 per year, compared with 40% among the formula-feeding mothers. More than 26% of the breastfeeding mothers earned more than \$60,000, compared with 15% of the formula-feeding mothers. Ethnic background was also significantly related to feeding mode: 74% of the formula-feeding mothers were Asian or Hispanic; only 28% of the breastfeeding mothers were Asian or Hispanic.

The results show a significant 6-fold difference in the risk of becoming ill between breastfed and formula-fed infants. A total of 28% (28 out of 101) of the study infants experienced no illness during the study period. This “well-babies” group consisted of 86% breastfed infants ($n = 24$) and 14% formula-fed infants ($n = 4$). A total of 205 episodes of illness was reported among the remaining 73 infants. Of these, the rates are significantly different from those expected if there were no association between infant feeding mode and illness. An insignificant difference was found by feeding mode for mild illnesses that did not require mothers to miss work (74% of all episodes for breastfed infants and 57% of all episodes for formula-fed infants). However, of the 40 episodes that caused a 1-day absence, absences were twice as frequent among the formula-feeding mothers than among the breastfeeding mothers (26% versus 11% [$p < 0.05$]). No difference in feeding mode was found for the remaining 26 episodes of serious illness that resulted in significantly longer days of maternal absenteeism.

METHODOLOGICAL ISSUES: This study does not control for other factors that may be related to infant feeding mode, infant illness, and maternal absenteeism, such as household smoking and child care arrangements.

Jarosz LA. Breast-feeding versus formula: Cost comparison. Hawaii Med J 1993;52(1):14–8.

Country: United States

This article compares the cost of 2 months of either exclusive breastfeeding or formula-feeding of a hypothetical healthy, full-term newborn in Hawaii. Calculations are based on several assumptions: 1) infant weight at 1 month and 2 months, which is based on National Center for Health Statistics medians for male infants; 2) dietary energy needs, which are assumed to be similar to and based on requirements set forth by the National Academy of Sciences; 3) the energy content of artificial formula; and 4) the cost of the maternal diet to produce the infant’s energy requirements in breastmilk, using an assumed efficiency of converting this food into breastmilk of 80%. Two different food spending plans specified by the U.S. Department of Agriculture were used: a thrifty plan and a moderate plan. Food items were priced, and the lowest-priced brand of each formula type (powder, concentrate, etc.) was used to calculate formula costs. Also, the lowest-priced brand was used to price maternal foods. A total of 36 different artificial milks and 29 maternal foods were priced. The results show that even the moderate maternal dietary plan was 39% less expensive than the cheapest formula. The difference in cost increased substantially when higher-priced formulas were used. For example, the lowest-priced concentrated formula cost twice as much as the moderate food plan and three times as much as the thrifty food plan over the 2-month period.

Huffman S, Steel A, Toure KM, Middleton E. Economic value of breastfeeding in Belize. *Nature: Center to Prevent Childhood Malnutrition. Washington DC, 1992.*

Country: Belize

In this working paper, a workbook for assessing the economic value of breastfeeding was used to estimate the economic value of breastfeeding in Belize. The total cost of breastfeeding promotion was \$84,000 per year, which did not include the cost of volunteers who work within the program. The costs of bottle-feeding included both the direct costs to households and the public sector in terms of formula and supplies and the indirect costs, which included excess infant morbidity and mortality and maternal fertility that could be averted through optimal breastfeeding practices. The national costs of bottle-feeding were estimated to be \$516,750 (assuming that 25% of imported dried milk was used for infant feeding) and \$62,000 for interest on the external debt. National-level data on the costs of bottles, teats, and other supplies needed to bottle-feed were not available.

Based on national level infant feeding data and the number of births per year, the direct household costs of purchasing breastmilk substitutes were estimated to be \$716,400 for nonbreastfed infants and \$489,000 for partially breastfed infants. Estimates of the annual hospital cost of bottle-feeding in the main hospital, where one-third of all births occur, was \$175,000. Indirect costs associated with excess morbidity from diarrhea and acute respiratory infection were not estimated. However, national data on the prevalence of these illnesses, the treatment rate/illness episode, and the cost of treatment of each illness suggest substantial costs associated with excess morbidity. Costs associated with reduced fertility and environmental damage were not quantified.

Radford A. *The ecological impact of bottle feeding. Baby Milk Action Coalition. 1991. Mimeo.*

Radford A. *Breastmilk: A world resource. World Alliance for Breastfeeding Action. Penang, Malaysia. Undated. Mimeo.*

These papers summarize the ecological impact of bottle feeding and some quantitative data from some countries. The estimates used to calculate cost estimates are not well described and derive from different countries so that overall national and/or global costs cannot be estimated. Breastfeeding is viewed as an ecologically sound activity as it requires no packaging or transport. Breastfeeding does not result in wastage since the mother produces exactly the amount of milk the infant consumes. Breastfeeding is also viewed as a natural, renewable resource.

Bottle-feeding is associated with a large number of products, most of which are not recycled and result in environmental damage to produce. These products/materials are related to those involving waste, the dairy industry, processing and transport, inappropriate use of land and resources, and population. Items related to waste include the following: 1) tin plate for the production of milk tins; 2) plastics, rubber, and silicon for the production of bottles and teats; 3) increased use of feminine hygiene products; and 4) clean water and sterilizing fluids. Examples given in this category of products include 4.5 million plastic bottles sold in Pakistan in 1987, the 3,000 tons of paper that would be saved on feminine hygiene products if every mother in England were to breastfeed her

infant, and the 73 kg of fire wood needed to sterilize water to formula feed an infant for one year.

The environmental costs of the dairy industry are illustrated with respect to the number of cows it would take to replace current breastmilk production. For example, the author cites a study showing that it would take 135 million cows in India to replace current breastmilk output. Cows also need pasture, which requires cutting of trees with the resultant deforestation and erosion. Cattle also produce 100 million tons of methane per year, which is an estimated 20% of total annual methane emissions. Nitrate fertilizers used in dairy feed production also can contaminate ground water.

Processing of infant formula is done under high temperature conditions, which requires fuel and may result in air pollution. Transport of formula in the international market also results in air pollution and fuel use.

Bottle-feeding also contributes to inappropriate use of land and resources. External debt is increased from imported formula and supplies. For example, in Mozambique it was estimated that a 20% increase in bottle-feeding over a two-year period would cost \$10 million for the importation of formula. It was also calculated that the fuel required to boil water would use up the entire resources from a major forestry project. Excess health care costs associated with bottle-feeding are also discussed. The contraceptive effects of breastfeeding are discussed briefly.

Melville BF. Letter to the editor: Can low income women in developing countries afford artificial feeding? J Trop Pediatr 1991;37:141-2.

COUNTRY: Jamaica

This letter examines the monthly cost of artificially feeding a 3-month-old infant and expresses the results as a percentage of the net monthly salaries for selected jobs. Data were collected during the first 4 months of 1990. The cost was calculated at \$43.30/month (more than 90% of which can be attributed to purchasing infant formula). The cost of bottles, cooking pot for sterilization, and fuel added another \$3.40/month. These costs constituted 90%, 78%, 36%, 22%, and 26% of monthly salaries for a household helper or minimum wage worker, community health aide, clerk, registered nurse, and teacher, respectively. The author estimates that the economic cost of lost breastmilk because of the 17-percentage-point drop in the number of women fully breastfeeding at 6 weeks was more than \$200,000 per month worth of foreign exchange. The authors also cite a study showing that artificial feeding costs as much as feeding a family of 5 with the basic food basket. This letter also discusses the risks of contaminated and diluted formulas to infant health but does not quantify these risks.

Levine RE, Huffman SL. The economic value of breastfeeding, the national, public sector, hospital, and household levels: A review of the literature. Center to Prevent Childhood Malnutrition. Washington, D.C. 1990.

COUNTRY: Multicountry

This paper develops a framework for analyzing the economic value of breastfeeding and, to the extent that data are available, discusses the actual costs of breastfeeding versus

formula-feeding from 4 perspectives: national, public sector, hospital, and household. It also identifies data gaps in the literature and recommends future research directions. The paper focuses on the economic consequences of infant feeding decisions rather than on the economic considerations that are involved in infant feeding decisions. The authors argue that the relative costs of breastfeeding and bottle-feeding are experienced at distinct levels and differ depending on the perspective being examined. They conclude that data are inadequate to provide quantitative estimates of a number of components of their economic framework.

At the national level, the costs of breastfeeding include the potential loss of women's productivity and economic contribution (the opportunity cost of breastfeeding because of the time involved and the need for the mother to be in close proximity to her infant) and the potential loss of revenues from the sale of locally produced breastmilk substitutes. The costs of bottle-feeding include the aggregate expenditures on breastmilk substitutes and supplies and the infant and child lives lost because of increased morbidity. Although no data were available on the costs of breastfeeding, the costs of bottle-feeding were well documented in terms of the cost of replacing breastmilk. Since these costs were estimated in different ways and used different assumptions, it is difficult to draw straightforward comparisons. (To derive comparable estimates, the cost of breastmilk substitutes would need to be calculated as a function of the number of women breastfeeding and the durations of exclusive and partial breastfeeding; the cost of substitutes, which involves assumptions about what the replacement product actually is; and the nutrient cost of producing the breastmilk.) Estimates for the costs of replacing breastmilk ranged from \$1.8 million in Singapore (based on a decline in breastfeeding prevalence over a 9-year period) to \$16 million in the Philippines (based on a decline in breastfeeding prevalence over a 10-year period). Other authors have estimated the cost of breastmilk substitutes if all breastmilk were to be eliminated, such as the estimate of \$500 million annually for Indonesia. Most of these estimates do not include the savings in reduced nutrient cost to the mother of producing breastmilk.

At the public-sector level, the costs of breastfeeding include the costs of breastfeeding promotion and the potential loss of tax revenues from local breastmilk substitute manufacturers. The costs of bottle-feeding include public expenditures for breastmilk substitutes and supplies, public health care costs, family planning costs, and interest on debt incurred by importation of substitutes. The evaluation of public-sector costs was limited by the paucity of data on public expenditures related to breastfeeding and required assumptions about the health and fertility benefits to derive costs. No data were available on the potential loss of tax revenues from local breastmilk substitute manufacturers or on the debt incurred by the importation of substitutes. Breastfeeding promotion campaigns have been associated with costs of \$1–\$11 per mother. In Indonesia, \$40 million per year would be required for diarrhea treatment if breastfeeding prevalence declined by 25%. The authors estimate that if breastfeeding currently accounts for a 20% reduction in total world wide fertility, this is worth \$65 million. In Indonesia, it is estimated that an additional \$80 million per year would have to be spent on family planning if breastfeeding were to cease.

At the hospital level, the costs of breastfeeding include staff training, education and support of new mothers, and modifications to permit rooming-in. The costs of bottle-feeding include staff time for preparation and feeding; expenditures on breastmilk substitutes, bottles, and other equipment; pharmaceutical supplies; and increased health care costs. The data available to quantify these costs were not comparable, which made it impossible to arrive at net cost calculations. However, data were available to show that

direct savings realized from such changes offset the costs associated with changes in hospital practices to promote breastfeeding. For example, the following costs were summarized: lobbying/conferences (\$51–\$600 per participant); staff training (\$10–\$860 per participant); lactation counseling \$.35–\$4.00 per participant; and rooming-in (no cost). The savings were summarized as follows: reduced staff time because of rooming-in (\$4.20 per delivery in the Philippines, and a 34% reduction in personnel costs in Chile); less infant formula (\$0.50–\$0.82/delivery); fewer bottles (\$0.32–\$0.60); and less oxytocin (\$0.10–\$0.32/delivery).

At the household level, the costs of breastfeeding include maternal time, lost employment opportunities, and increased maternal food consumption to support breastfeeding. The costs of bottle-feeding include expenditures on formula and other supplies, caretaker's time for bottle preparation and feeding, expenditures on health care for ill children, caretaker's time for care of ill child, loss of the child's potential productivity and economic contribution to the household, and expenditures associated with higher fertility or increased use of contraceptives. While data were not available to quantify the opportunity costs of breastfeeding, maternal employment outside the home was related to early supplementation of bottle-feeding in some urban settings. The time costs of breastfeeding also need to be balanced against the time costs of bottle-feeding, which one study has found to be 3 times as time-intensive as breastfeeding. The costs of increased maternal diet to produce a given volume of breastmilk were less than the cost of formula. The costs of breastmilk substitutes were well documented and ranged from 8% of the minimum wage in Yemen to 264% of the minimum wage in Nigeria. These estimates assume that an adequate amount of formula was provided, which may not be a realistic assumption. None of the costs includes the cost of additional supplies needed to bottle-feed. Data are not available to quantify what may be the most important economic aspects of breastfeeding—lower costs associated with caring for a sick child and purchasing medicines—as well as the savings associated with reduced fertility.

Huffman S, et al. Assessment of infant feeding in Peru. Chapter XIV. Economic value of breastfeeding. Wellstart International. Washington, DC . 1992.

COUNTRY: Peru

The assessment includes a chapter that compares the costs in 1991 to the public sector of breastfeeding promotion to the costs of inadequate breastfeeding practices. A workbook for assessing the economic value of breastfeeding in Peru is provided in an appendix. Overall, the authors estimate that \$742,300 was spent in the public sector on breastfeeding promotion, and \$463,200 was derived from tax revenues from the domestic production of infant formula. In contrast, current public-sector expenditures on health care costs associated with suboptimal infant feeding were as follows: \$946,750 for treatment of diarrhea and acute respiratory infection; \$50,400 for institutional bottle-feeding; \$541,400 for oxytocin and glucose; and \$35,800 for interest on the external debt to import substitutes. Overall, conservative estimates of public expenditures associated with suboptimal infant feeding exceeded \$800,000 per year.

The costs of inadequate breastfeeding practices were derived estimates of “excess morbidity and mortality.” Using the relative risks associated with breastfeeding versus bottle-feeding for diarrhea and acute respiratory infection, the authors calculated 7,012 excess deaths due to inadequate breastfeeding practices for these two illnesses.

Calculations of excess morbidity from diarrhea and acute respiratory infection were based on national-level data on the prevalence of these illnesses and the relative risks of becoming ill. Treatment costs associated with this excess morbidity were estimated from national-level data showing that treatment is sought for 25% of diarrhea cases and 50% of respiratory cases, and from data on treatment costs for the two illnesses. These calculations show the total cost of treating excess cases of diarrhea and acute respiratory infection was \$4,733,750. Assuming that 20% of these costs were borne by the public sector, the authors calculate that this represented a cost of \$946,750 or 3.7% of the country's Maternal and Child Health budget.

The cost of bottle-feeding infants in public institutions was estimated to be \$58,660, which included \$17,700 for formula for newborns and \$40,960 for formula for hospitalized infants. Costs for oral glucose tolerance tests and methergine, which may be unnecessary for newborns who are breastfed immediately after birth, were estimated to be \$541,420. The interest for the payment of external debt to purchase infant formula, subsidized by the Swiss government, was \$35,777. The monetary value of deaths averted through optimal infant feeding practices and births averted because of lactational amenorrhea was not quantified.

Daga SR, Daga AS. Impact of breast milk on the cost-effectiveness of the special care unit for the newborn. J Trop Pediatr 1985;31:121-3.

COUNTRY: India

This article evaluates the cost-effectiveness of a special care unit for low birth weight newborns over 2 1-year periods: one during which newborns were breastfed from 8 a.m. until 8 p.m. and formula-fed during the night, and one during which more than 95% of infants were exclusively breastfed and the remaining 5% were given breastmilk for most of their feeds. Only mortality after 3 days was considered. A reduction in costs associated with the purchase of formula and medicines, from \$0.75 to \$0.40 per bed per day, was found. The average stay in the hospital declined from 11.4 to 9.06 days. Total mortality declined from 38% to 16%, as did the mortality rate by birth weight category. The authors argue that the improvements seen were due to increased breastfeeding because no new diagnostic or therapeutic equipment was purchased, and the time period was too short for improvements in staff experience to have resulted in reduced mortality.

Rohde JE. Mother milk and the Indonesian economy: A major national resource. J Trop Pediatr 1982;28:166-74.

COUNTRY: Indonesia

This article, and the one that follows, estimate the economic value of breastmilk to the Indonesian economy and conclude that breastfeeding currently contributes \$520 million/year to the economy, which amounts to 10% of the value of all exports, 2.5% of the total national budget, and about 1.5% of gross national product. To arrive at these estimates, the author estimates the following: the volume of breastmilk produced by breastfeeding mothers/year; the cost of purchasing the extra nutrients (calories and protein) to produce this breastmilk; the cost of purchasing an equivalent volume of

formula; the cost of reduced medical treatment for diarrhea cases prevented/year; and the cost of more family planning services/year needed to replace the contraceptive effect of lactational amenorrhea provided by current breastfeeding practices.

The volume of breastmilk produced per year is estimated by multiplying the average daily milk volume by the duration of breastfeeding for urban and rural women. This volume of milk is compared with the cost of purchasing infant formula, which would be about \$500 million. To arrive at the net value of this breastmilk, the protein and calorie cost of producing this breastmilk is subtracted. Using a figure for the efficiency of conversion of 90% for calories and 55% for protein, and rice and tempe as the food source, the author calculates that it costs about \$100 million/year to produce breastmilk. Thus, the net value of breastmilk produced/year was calculated at \$400 million. The cost of bottles, teats, fuel, formula spoilage, and refrigeration are not included in these costs, nor are the opportunity costs associated with breastfeeding or formula-feeding, which, the author argues, are similar.

The author estimates the cost of reduced medical treatment for diarrhea by assuming that a 25% reduction in the prevalence of breastfeeding would double the total cases of diarrhea, which currently accounts for one-third of pediatric admissions to the hospital. Applying the cost per diarrhea treatment, the author estimates that \$40 million/year is saved by current breastfeeding practices, a figure that is considered to be very conservative.

The cost of increased family planning services per year needed to replace the contraceptive effect of lactational amenorrhea is calculated as a function of current mean durations of lactational amenorrhea for urban and rural women and the number of urban and rural women currently breastfeeding, which provides an estimate of the couple-protection-years provided. This estimate shows that 4.5 million couple-years of contraception are provided annually. Using the cost of providing a year of contraceptive protection, an annual savings of \$80 million is estimated.

Rohde JE. *Mother milk and the Indonesian economy: A major national resource. Indian J Pediatr 1981;48:125–32.*

(The results of this study were the same as the one preceding it; therefore, we chose to summarize only one of them, while making reference to both.)

Fallot ME, Boyd JL, Oski FA. *Breast-feeding reduces incidence of hospital admissions for infections in infants. Pediatrics 1980;65:1121–4.*

COUNTRY: United States

This article compares the prevalence of exclusive breastfeeding among infants < 3 months of age in the community with the prevalence of exclusive breastfeeding in similarly aged infants hospitalized during the course of 1 year (n = 136). The prevalence of exclusive breastfeeding among 2 groups of infants was examined: those attending a hospital clinic and those attending private practices. The prevalence of exclusive breastfeeding was higher among infants cared for in private practice (38.0%) than among those attending a hospital clinic (13.5%). At the time of admission, the prevalence of

exclusive breastfeeding among clinic and private-practice infants was 8.5% and 13.8%, respectively. Of the 136 infants admitted, only 15 were being exclusively breastfed. Chi-square analysis showed a significant underrepresentation of exclusively breastfed infants among the hospitalized infants. The authors estimate that exclusive breastfeeding could have prevented 75 hospital admissions over 1 year at a savings of \$50,000.

This study does not control for other factors that could be related to both infant feeding mode and risk of disease, such as exposure to household smoke, use of day care, and other preventive and caregiving measures. It also has been suggested that physicians may be less likely to hospitalize a breastfed infant.

Almroth S, Greiner T. FAO Food and Nutrition Paper. The economic value of breastfeeding. Food and Agriculture Organization, Rome, Italy. 1979.

COUNTRY: Ivory Coast and Ghana

This report summarizes the costs of breastfeeding and bottle-feeding in 2 African countries. The costs associated with breastfeeding were related to increased maternal nutrient intake and opportunity costs. Those associated with bottle-feeding—related to the costs of breastmilk substitutes, other supplies, and time—were quantified at both the household and national levels. Due to data limitations, the same estimates for household costs were used for both countries. Of interest is the methodology used to estimate the time costs of breastfeeding and formula-feeding, which was based on national-level data on wages and assumptions about the amount of time needed to prepare safe bottles, and observations on the length of time spent breastfeeding. The results show that the cost of increased maternal consumption to produce breastmilk ranged from \$51 to \$100 over a 2-year period, depending on the foods chosen. The costs of formula-feeding over an equivalent period, based on the costs of substitutes, supplies, and fuel, ranged from \$310 to \$390, depending on the type of substitute chosen. The estimated opportunity costs for breastfeeding and artificial feeding were \$210 and \$600 over the 2-year period, respectively. Thus, breastfeeding rather than artificial feeding for 2 years could save the average family between \$600 and \$730.

At the national level, the authors show that imports of breastmilk substitutes accounted for only 1% of the total volume of breastmilk produced. Estimates were made for the economic impact of a hypothetical change in feeding patterns in terms of increases in cost and foreign exchange used to purchase substitutes. Estimates of the number of children malnourished as a result of suboptimal practices were calculated. The actual costs of rehabilitation were not made.

The authors note that the most important national-level indirect costs of bottle-feeding, because of increased morbidity and fertility, cannot be quantified in monetary terms. Overall, this paper contributes to the theoretical development of a model to estimate economic impacts. In particular, it points out that the costs and benefits of breastfeeding differ at different levels of analysis, and it attempts to quantify the opportunity cost of breastfeeding and bottle-feeding. The data used are outdated and no longer useful.

Lamm E, Delaney J, Dwyer J. Economy in the feeding of infants. *Pediatric Clinics of North America* 1977;24(1):71–84.

COUNTRY: United States

This article examined the cost of feeding various breastmilk substitutes during infancy versus the cost of feeding a breastfeeding mother. The costs of breastmilk substitutes ranged from \$133/year for evaporated milk-corn syrup to \$276/year for ready-to-serve Similac. The costs of purchasing food to meet the additional daily recommended dietary intakes for a lactating woman ranged from \$156 to \$281/year, depending on the diet chosen. Food costs associated with breastfeeding depend on the choice of foods purchased to meet the caloric demands of lactation. The costs associated with breastmilk substitutes depend on type and form of the product and source of supply rather than on brand name. Powdered or concentrated formulas are less expensive than ready-to-serve formulas. Overall, food costs of different infant feeding patterns vary by as much as 100%; however, according to the data presented in this paper, the ranges are similar for formula-fed and breastfed infants. Both this and the previous article look at the costs of breastfeeding based on high estimates of what lactating women need to consume to meet their additional recommended dietary allowances rather than on the additional calories lactating women actually consume. To the extent that breastfeeding women actually consume fewer additional calories/day than recommended, this would reduce the cost of the foods needed to provide those calories.

The calculation for the cost of feeding formula ignores the cost of bottles, sterilizers, fuel, soap, and other items needed to serve formula in a safe and hygienic manner. The cost of mother's time for both breastfeeding and formula-feeding are not addressed, nor are the medical and time costs associated with different morbidity rates between breastfed and bottle-fed infants.

McKigney J. Economic aspects. *Amer J Clin Nutr* 1971;24:1005–12.

COUNTRY: Jamaica

This article compares the cost of purchasing infant formula with the nutrient costs of producing an equivalent amount of breastmilk. Three different diets are used to estimate the cost of producing breastmilk: a low-, intermediate-, and high-cost diet. Likewise, 3 different artificial infant feeding modes are used for estimating the cost of infant formula. The estimates show that the cost of breastfeeding ranges from \$0.54 to \$3.78 per week, while the cost of purchasing an equivalent amount of breastmilk ranges from \$0.76 to \$5.54 per week. The author argues that there is a definite nutrient cost advantage to breastfeeding over artificial feeding, which, although small on a weekly basis, is significant on an annual basis, especially for poor families. These estimates also used an extra 1,000 calories/day calories needed to support lactation rather than the current figure of 600 calories/day, which would reduce the nutrient cost of breastfeeding by another 40%. The author suggests that “economy” in the nutrient cost of breastfeeding can be achieved by purchasing cheaper foods that would not have nutritional costs to the mother. However, “economy” in infant artificial feeding can be achieved only through overdilution of formula, which would have serious adverse effects on the infant.