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The Burden of Suboptimal Breastfeeding in the United States: A Pediatric Cost Analysis

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Pediatrics; originally published online April 5, 2010;
DOI: 10.1542/peds.2009-1616

The Burden of Suboptimal Breastfeeding in the United States: A Pediatric Cost Analysis

WHAT'S KNOWN ON THIS SUBJECT: There have been several US cost analyses, with the last being a 2001 non–peer-reviewed study that showed a potential savings of $3.6 billion to increase current rates to Healthy People goals. All these studies have been somewhat limited in scope.

WHAT THIS STUDY ADDS: This study looked at more illnesses than previous cost analyses, and we used the comprehensive 2007 AHRQ report on the impact of breastfeeding on a variety of illnesses. We conclude that the yearly economic impact is $13 billion.

abstract

BACKGROUND AND OBJECTIVE: A 2001 study revealed that $3.6 billion could be saved if breastfeeding rates were increased to levels of the Healthy People objectives. It studied 3 diseases and totaled direct and indirect costs and cost of premature death. The 2001 study can be updated by using current breastfeeding rates and adding additional diseases analyzed in the 2007 breastfeeding report from the Agency for Healthcare Research and Quality.

STUDY DESIGN: Using methods similar to those in the 2001 study, we computed current costs and compared them to the projected costs if 80% and 90% of US families could comply with the recommendation to exclusively breastfeed for 6 months. Excluding type 2 diabetes (because of insufficient data), we conducted a cost analysis for all pediatric diseases for which the Agency for Healthcare Research and Quality reported risk ratios that favored breastfeeding: necrotizing enterocolitis, otitis media, gastroenteritis, hospitalization for lower respiratory tract infections, atopic dermatitis, sudden infant death syndrome, childhood asthma, childhood leukemia, type 1 diabetes mellitus, and childhood obesity. We used 2005 Centers for Disease Control and Prevention breastfeeding rates and 2007 dollars.

RESULTS: If 90% of US families could comply with medical recommendations to breastfeed exclusively for 6 months, the United States would save $13 billion per year and prevent an excess 911 deaths, nearly all of which would be in infants ($10.5 billion and 741 deaths at 80% compliance).

CONCLUSIONS: Current US breastfeeding rates are suboptimal and result in significant excess costs and preventable infant deaths. Investment in strategies to promote longer breastfeeding duration and exclusivity may be cost-effective. *Pediatrics* 2010;125:e1048–e1056

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KEY WORDS

costs and cost analysis, infant mortality, breastfeeding, infant formula, infant feeding, medical economics, otitis media, enterocolitis, necrotizing, sudden infant death, asthma, diabetes mellitus, precursor cell lymphoblastic leukemia-lymphoma

ABBREVIATIONS

NEC—necrotizing enterocolitis
OM—otitis media
AHRQ—Agency for Healthcare Research and Quality
LRTI—lower respiratory tract infection
AD—atopic dermatitis
SIDS—sudden infant death syndrome
T1D—type 1 diabetes
CDC—Centers for Disease Control and Prevention
OR—odds ratio
EBF—exclusively breastfed
EFF—exclusively formula fed
LBW—low birth weight
VLBW—very low birth weight
ALL—acute lymphocytic leukemia
AML—acute myelogenous leukemia

www.pediatrics.org/cgi/doi/10.1542/peds.2009-1616

doi:10.1542/peds.2009-1616

Accepted for publication Dec 9, 2009

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PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

FINANCIAL DISCLOSURE: *The authors have indicated they have no financial relationships relevant to this article to disclose.*

As health care costs spiral higher, an updated estimate of the economic impact of breastfeeding would help in setting future breastfeeding policies. To date, there has not been a comprehensive pediatric cost analysis on US breastfeeding; most analyses have examined only 3 to 5 diseases and did not include most deaths.[1–5]

The most recent and widely cited US analysis, by Weimer[5] in 2001, examined the economic impact of breastfeeding for 3 diseases: necrotizing enterocolitis (NEC), otitis media (OM), and gastroenteritis. This government study revealed a potential savings of $3.6 billion if breastfeeding rates were increased from current rates to the Healthy People 2010 objectives for initiation and 6-month duration.[6]

Weimer used breastfeeding rates collected by the infant formula industry (64% in hospital and 29% at 6 months), because his analysis predated the collection of government data.[7] He assumed, incorrectly, that industry rates represented exclusive breastfeeding. In 2007, the Agency for Healthcare Research and Quality (AHRQ) produced a comprehensive analysis of the evidence for the impact of breastfeeding on a host of diseases of children and mothers.[8]

METHODS

We updated Weimer's figures by using the risk ratios from the AHRQ report along with more recent data on breastfeeding rates, disease incidence, and cost. Excluding type 2 diabetes, we analyzed all the diseases in offspring for which the AHRQ report found a risk reduction with any or exclusive breastfeeding: NEC, OM, gastroenteritis, hospitalization for lower respiratory tract infections (LRTIs) during infancy, atopic dermatitis (AD), sudden infant death syndrome (SIDS), childhood leukemia, childhood asthma, type 1 diabetes (T1D) mellitus, and obesity. We excluded type 2 diabetes, because the breastfeeding durations used in the AHRQ analysis were not clearly defined.

Overall Methodology

We used breastfeeding data from the 2005 birth cohort of the National Immunization Survey by the Centers for Disease Control and Prevention (CDC)[7] the most recent year for which final results have been reported. To define any breastfeeding, the survey asks respondents if they have "ever breastfed or fed breast milk." Exclusivity was defined as not having fed anything other than breast milk, including water, infant food, juice, formula, cow's milk, or sugar water. Duration was defined by asking how old the child was when he or she "completely" stopped breastfeeding or being fed breast milk.[9]

Following Weimer and others, those infants not classified as "breastfeeding" were classified as "nonbreastfeeding," 2 mutually exclusive categories.

We obtained the differential incidence of disease in breastfed and nonbreastfed subjects at the current rate of breastfeeding by using the following formula: $x = s/(br + 1 - b)$, where x is the incidence in nonbreastfed subjects, s is the overall incidence of the disease, b is the current breastfeeding rate, and r is the odds ratio (OR) in favor of breastfeeding. The incidence of disease in breastfed subjects is xr.

We used the same overall methods as Weimer. We calculated the numbers of breastfed infants and nonbreastfed infants by multiplying breastfeeding rates and nonbreastfeeding rates by the numbers of births in 2005. We used the 2 disease incidences to calculate the number of cases of disease in breastfed and nonbreastfed subjects, added these figures together, and then multiplied the total number of cases by the cost per case. We repeated all the calculations by using the breastfeeding rates specified in the Healthy People 2010 goals (Table 1) and rates of 80% and 90% compliance with medical recommendations (6 months of exclusive breastfeeding, with continued breastfeeding for at least 1–2 years of life).[10–12] Cost impact was determined by subtracting projected costs from current costs.

We included both direct and indirect costs for each disease, as well as the cost of premature death from NEC, SIDS, childhood asthma, childhood leukemia, LRTI, and T1D during childhood. We used the breastfeeding types and durations from the AHRQ conclusions for each disease. Following the AHRQ conclusions, we used "any breastfeeding" for 5 diseases, "exclusive breastfeeding" for 4

TABLE 1 Healthy People 2010 Goals for Breastfeeding, and Actual US Breastfeeding Rates From 2005 Reported in Final CDC Data From the National Immunization Survey

Type and Duration of Breastfeeding	Healthy People 2010 Goals, %	Actual Rates, 2005, %
Initiation/early postpartum	75	74.10
Exclusive breastfeeding at 2 d	(no goal)	55.60
Any breastfeeding at 6 mo	50	42.90
Any breastfeeding at 12 mo	25	21.50
Exclusive breastfeeding at 3 mo	40	32.10
Exclusive breastfeeding at 6 mo	17	12.30
Extrapolated any breastfeeding at 3 mo	62.50	58.50
Extrapolated exclusive breastfeeding at 4 mo	32.10	25.50
Extrapolated exclusive formula feeding at 3 mo	25	25.90

Shown are extrapolated rates referred to in the text.
Data source: Department of Health and Human Services. Breastfeeding among US children born 1999–2006, CDC National Immunization Survey. Available at: www.cdc.gov/breastfeeding/data/NIS_data/index.htm.

diseases, and both types for 1 disease (OM). For conditions of infancy, we used incidence in the first year of life.

Census data for 2005 showed 4.14 million live births and 80.8 million persons younger than 20 years.[13] All costs described here are in 2007 dollars, converted by using the Consumer Price Index.[14] Whenever possible, we used US cost and mortality data. When calculating the cost of years of treatment for chronic disease, we discounted costs to present value by using an inflation-free discount rate of 3%, because costs are expected to grow at least as fast as general inflation. We used the same cost for premature death used by Weimer, adjusted to 2007 dollars, or $10.56 million per death. Weimer used the labor-market approach (revealed-preference model), which reflects higher wages people demand for accepting risky jobs. Cost-of-death estimates vary widely, but our numbers are roughly in the middle of the range surveyed by Hirth et al,[15] adjusted for age and inflation.

Disease-Specific Methodology

Disease-specific methodology for all diseases are listed in Table 2.

Otitis Media

According to the AHRQ report, the OR of OM for exclusive breastfeeding for 3 or 6 months is 0.5 compared with exclusive formula feeding, and 0.77 for any breastfeeding compared with exclusive formula feeding. To be conservative, we used current breastfeeding rates at 3 months.[7] We used recent data that showed that the overall incidence is 1.9 episodes in children 6 to 11 months old.[16]

Recent government estimates of direct and indirect costs of OM average $291 per episode.[17]

We calculated the costs for exclusively breastfed (EBF), exclusively formula-fed (EFF), and the remaining infants (100% − [EFF + EBF]) for 3 months by using the appropriate ORs and then added these costs. For those not EBF or EFF, we used the ORs for "any breastfeeding." Any breastfeeding includes EBF infants, so that any EBF and EFF will total >100%. Our group of remaining infants excluded EBF infants and included weaned infants. Because we could not separate out partially breastfed and weaned infants, we used the conservative "any breastfeeding" ORs, underestimating the current cost.

Gastroenteritis

The AHRQ report highlighted a 2006 study that showed an OR of 0.36, which used almost no mixed-fed infants.[18] Recent data showed that the incidence of ambulatory visits in children younger than 1 year for gastroenteritis is 0.222,[19] with a hospitalization rate of ~0.00298.[20] The average direct costs of a visit and hospitalization are $66.15 and $2395, respectively.[21] Outpatient indirect costs are $273, which includes time missed from work and personal expenses.[22] We conservatively assumed that the indirect costs for hospitalization would be the same. The number of deaths was too small to count reliably.[23]

Necrotizing Enterocolitis

We used the risk ratio of 0.42 from the meta-analysis performed by the AHRQ authors. In 2005, 6.71% of births were at low birth weight (LBW) (1500–2499 g), and 1.49% were at very low birth weight (VLBW) (<1500 g).[24] In 2006, there were 1047 cases of NEC in LBW infants and 2554 in VLBW infants.[25] Hospital stays for NEC averaged 95 (medical) and 142 (surgical) days,[26] so we considered the infants to have been EBF for 3 months and compared that with the Healthy People goal of 40%.

A 2006 study[27] revealed that the initiation rate in infants born at 32 weeks' gestation was only 82% of that for term infants. We assumed that EBF rates in those infants most likely to get NEC are 82% of the EBF rates for term infants, or 26.3%.

We used a 2002 study[26] in which excess direct costs in VLBW infants were shown to be $260 506 for surgical NEC and $140 858 for medical NEC, compared with infants of similar weights without NEC. For the cost of NEC in LBW infants, we used Weimer's figure for surgical NEC: $150 406. Using the proportion of medical/surgical costs found in VLBW infants, we extrapolated the cost of medical NEC in LBW infants to be $81 219. We used an incidence of surgical NEC as 0.4 in LBW infants[28] and 0.43 in VLBW infants.[26] For indirect costs, we assumed that 1 parent would miss a half-day of work for the duration of the stay, at a cost of $38.3 per day (using average young adult wages of $28 000 per year[29]). We used a mortality rate of 5.8% in LBW infants and 20% in VLBW infants,[25] which is consistent with 2005 infant mortality data.[30]

Hospitalization for LRTI

The AHRQ report showed an OR of 0.28 for LRTI hospitalization for infants who were EBF for 4 months. Of 286 739 infectious-disease hospitalizations in infants in 2003, 59% were for LRTI,[20] with median hospital charges of $4338.[31] There were 303 infant deaths from LRTI in 2005.[23] Indirect costs were estimated (in a German study, the direct costs in which were similar[32]) at $342 per case in infants younger than 12 months[32] by using the 2004 currency conversion rate of 0.724€/$.

Atopic Dermatitis

The AHRQ reports noted an OR of 0.68 for 3 months of exclusive breastfeeding and the development of AD in children younger than 4.5 years. The cumulative incidence is 16.5% up to age 2.[33] In 1 analysis, the annual direct and indirect costs per case totaled $991 per patient-year.[34] In another analysis, annual direct and indirect costs totaled $787.[35] To be conservative, we

TABLE 2 Figures and Assumptions Used in Calculating Cost Impact for Each Disease (2007 Dollars)

	Type and Duration of Breastfeeding	OR in Favor of Breastfeeding	Overall Incidence	Treatment Duration, y	Cost
OM	EBF and any breastfeeding for 3 mo	0.77 for any breastfeeding; 0.5 for EBF	1.9 episodes in first year (reported data are for children 6–11 mo old)	NA	$156 direct case per episode; $291 total cost per episode
Gastroenteritis	EBF for 6 mo	0.36	0.222 ambulatory visits; 0.00298 hospitalizations in infants <1 y old	NA	$66 direct cost per outpatient visit; $2395 direct cost per hospitalization; $339 total costs per outpatient visit; $2668 total cost per hospitalization
NEC	Exclusively breast milk-fed for 3 mo	Risk ratio of 0.42	LBW infants: 0.00308 infants; VLBW infants: 0.0414	NA	LBW: $150 406 direct cost surgical NEC: $81 219 direct cost medical NEC VLBW: $260 506 direct cost surgical NEC; $140 858 direct cost medical NEC LBW: $155 845 total cost surgical NEC; $84 858 total cost medical NEC; VLBW: $265 945 total cost surgical NEC; $144 497 total cost medical NEC
NEC deaths	Exclusively breast milk-fed for 3 mo	0.42	LBW: 0.058 of NEC; VLBW: 0.20 of NEC	NA	$10 560 000 per case
Hospitalization for LRTI	EBF for 4 mo	0.28	0.0409	NA	$4338 direct cost per case; $4680 total cost per case
Deaths from LRTI	EBF for 4 mo	0.28	0.0000732	NA	$10 560 000
AD	EBF for 3 mo	0.68	0.165 cumulative incidence for first 2 y of life	6	$393 direct cost per y; $2131 direct costs per case; $787 total cost per y; $4263 total cost per case
SIDS	Any breastfeeding for 6 mo	0.64	0.00054	NA	$10 560 000
Childhood asthma	Any breastfeeding for 3 mo	0.73	0.127 cumulative incidence during childhood	10	$453 direct cost per y; $3633 direct cost for 10 y; $774 total cost per y; $6602 total cost per case
Childhood deaths from asthma	Any breastfeeding for 3 mo	0.73	0.00000273	NA	$10 560 000
Childhood leukemia	Any breastfeeding for 6 mo	0.81 for ALL; 0.85 for AML	0.0000321 for ALL (74% of cases) 0.0000113 for AML		$136 444 direct cost per case; $153 617 total cost per case
Deaths from leukemia	Any breastfeeding for 6 mo	0.81 for ALL; 0.85 for AML	10.1% mortality in ALL; 39.8% mortality in AML	NA	$10 560 000
T1D	Any breastfeeding for 3 mo	0.77 (average of 2 OR listed in AHRQ: 0.81 and 0.73)	0.000186	40, with 9-y latency	$4390 direct cost per y; $77 463 direct per case; $7378 total cost per y; $130 187 total cost per case
Deaths from T1D	Any breastfeeding for 3 mo	0.75	0.00000121	NA	$10 560 000
Childhood obesity	Any breastfeeding for 3 mo	0.93	0.176 by age 19 y	From midpoint of each age cohort to age 40 y	$1460 direct cost per y; $28 758 direct cost per case; $2285 total per y; $36 040 total cost per case

Direct and indirect costs of illness treatment exclude the costs of premature death, which are noted separately. NA indicates not applicable.

used the lower number and assumed 6 years of treatment.

Sudden Infant Death Syndrome

The AHRQ authors performed their own meta-analysis and found an adjusted OR of 0.64 for any breastfeeding, but durations were not well defined. Given the significant effect of breastfeeding on SIDS and its resultant effect on overall infant death and costs, we felt that it was important to include SIDS in our analysis. A high-quality 2009 German study revealed that exclusively breastfeeding infants at 1 month reduced the risk by half, but any breastfeeding in the month before death reduced the risk by 71%,[36] which supports the hypothesis that lower arousal levels found in actively breastfeeding infants are protective. Approximately three-fourths of SIDS cases occur between 2 and 6 months of age. For these reasons, we used any breast-

feeding at 6 months. To be conservative, we used the AHRQ OR of 0.64.

Childhood Asthma

The AHRQ report noted that any breastfeeding for 3 months lowers the overall risk of childhood asthma by 27%. The overall incidence of asthma in children is 0.127,[37] which we used as the cumulative incidence in the 2005 birth cohort, with a yearly cost of $773, excluding costs of deaths.[38] We assumed 10 years of treatment. The CDC has estimated that 200 people younger than 18 die annually,[39] and we assumed that this would be the cumulative incidence of death in the 2005 birth cohort.

Childhood Leukemia

The AHRQ report noted ORs of 0.80 and 0.85, respectively, for 6 months of any breastfeeding and the development of acute lymphocytic leukemia (ALL) and acute myelogenous leukemia (AML). There are now 3500 cases per year in people younger than 20.[40] The report's authors stated that 74% of leukemia is ALL, and for the purpose of this analysis, we assumed the remainder to be AML.[41] To calculate overall incidences, we divided the number of cases of each type of childhood leukemia by the population of persons younger than 20.[42] We used these figures to calculate the number of cases expected in the 2005 birth cohort, with an average direct cost per case of ALL of $136 444.[43] Cost data on AML has been sparse, but the literature suggests it is at least that much,[44] so we used this figure for all childhood leukemia. Indirect costs from lost parental wages were $17 172.[45] Five-year mortality rates for ALL and AML are 10.1% for children younger than 5 and 39.8% for children younger than 15, respectively.[40]

Type 1 Diabetes

The AHRQ reported an OR of 0.75 for any breastfeeding for 3 months. There are 15 000 new cases per year in people younger than 20 years.[46] We used this figure as the number of cases for the 2005 birth cohort. Direct costs are $4390 per year for children.[47] The American Diabetes Association has estimated direct yearly costs for diabetics at $11 744 per year, of which $6649 is attributable to diabetes.[48] The has CDC estimated that the direct and indirect costs for all diabetes is $174 billion/year, and 23.6 million people have the disease, averaging $7378 per person-year.[49] We used the CDC figure. We assumed 40 years of treatment, beginning after a 9-year latency.

In 2005, there were ~97 deaths in persons younger than 20 that resulted from diabetes,[50] which we presumed were all because of T1D, so we assumed 97 deaths expected in the 2005 birth cohort.

Obesity

The AHRQ authors discussed the ORs from 3 meta-analyses in favor of breastfeeding, which ranged from a 4% risk reduction per month of breastfeeding (0.68 for 9 months),[51] to a meta-analysis that showed an OR of 0.93.[52] The latter article heavily depended on 1 very large study that revealed an adjusted OR at 3 to 6 months of 0.91 and 0.76 for more than 12 months.[53] To be conservative, we used 3 months of any breastfeeding with an OR of 0.93, in keeping with the AHRQ's conclusion that the risk reduction is small, and we examined only childhood obesity. However, available research results suggest that the OR would be lower for durations of at least 6 to 12 months.[53] For cost, we used direct medical costs of childhood obesity, totaling $14 billion/year.[54,55] To obtain the incidence of childhood obesity, we used data from the National Health and Nutrition Examination Survey, which breaks down the prevalence according to 3 age groups: 2 to 5, 6 to 11, and 11 to 19 months.[56] For each age cohort, we took the present value of a payment stream of $1460 per year ($14 billion divided by the total number of obese persons younger than 20), beginning at the midpoint of the cohort age range and ending at age 40. We prorated those present values by the population in each cohort, resulting in a total cost per patient of $36 040. Although only 80% of obese children become obese adults, the costs of adult obesity are ~20% higher than those for children, resulting in the same overall cost if one counts all obese children to the age of 40. We used the cumulative incidence of 0.176 by age 19. There are few data on indirect costs of childhood obesity, but total indirect costs are estimated to be $65.6 billion,[57,58] which we divided by the number of obese persons (63.6 million),[57] or $1031, and multiplied by 80% to reflect lower costs in childhood. This may be conservative, because obese adolescents have annual incomes of more than $9000 lower than their peers 7 years later.[59] We found insufficient data on death rates in children from obesity to include mortality costs.

RESULTS

If 90% of US families could comply with the medical recommendations to breastfeed exclusively for 6 months, the United States could save $13 billion/year and prevent an excess 911 deaths annually, 95% of which would be of infants (see Table 3 and Figs 1, 2, and 3). With 80% compliance, savings would be $10.5 billion, with 741 deaths prevented. If the Healthy People 2010 goals were met, savings would be $2.2 billion, with 142 deaths prevented. The biggest costs (74%) are for premature deaths. Costs of OM, atopic dermatitis, and childhood obesity also are substantial. Of the $13 billion, 17% ($2.2 billion) are direct medical costs and 9% are indirect costs.

TABLE 3 Excess Costs and Excess Deaths at Current Breastfeeding Rates Compared With Projected Costs if 90% or 80% of US Parents Could Comply With the Medical Recommendation to Breastfeed Exclusively for 6 mo

	Excess Costs Compared With 90% Compliance (Excess Deaths), 2007 $US	Excess Costs Compared With 80% Compliance (Excess Deaths), 2007 $US
Total	12 974 676 651 (911)	10 491 841 489 (741)
SIDS	4 725 328 464 (447)	3 722 074 013 (352)
NEC deaths	2 631 165 267 (249)	2 218 109 495 (210)
LRTI deaths	1 820 102 146 (172)	1 537 915 767 (146)
OM	908 793 396	765 766 295
AD	601 358 918	497 497 274
Childhood obesity	592 100 121	404 195 504
LRTI hospitalization	451 592 572	381 578 219
Childhood asthma	335 796 234	229 194 255
NEC	266 536 884	219 843 084
Childhood asthma deaths	216 869 872 (21)	148 022 294 (14)
Gastroenteritis	186 016 678	162 076 307
Childhood leukemia deaths	133 422 239 (13)	133 422 239 (13)
Childhood T1D deaths	95 231 472 (9)	64 999 258 (6)
T1D	8376 168	5717 067
Childhood leukemia	1986 220	1430 416

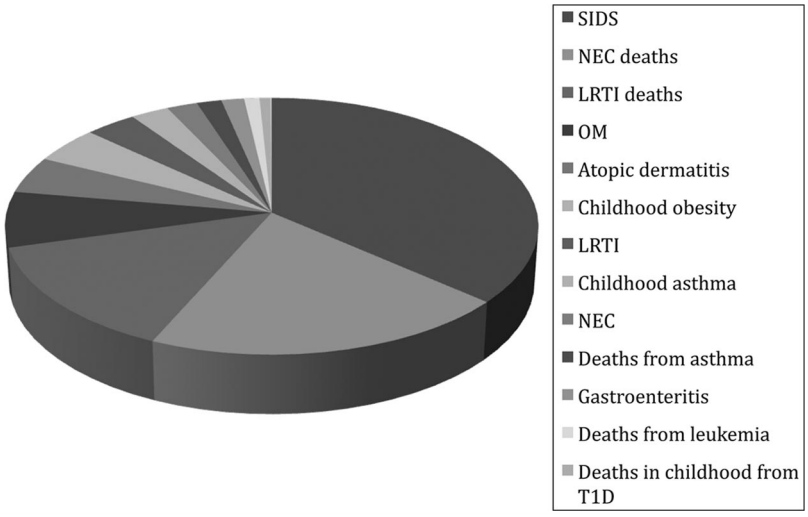

FIGURE 1
Excess costs resulting from pediatric disease at current breastfeeding rates compared with projected costs if 90% of US families could comply with medical recommendations to breastfeed exclusively for 6 months (total: $12.97 billion [2007 dollars]).

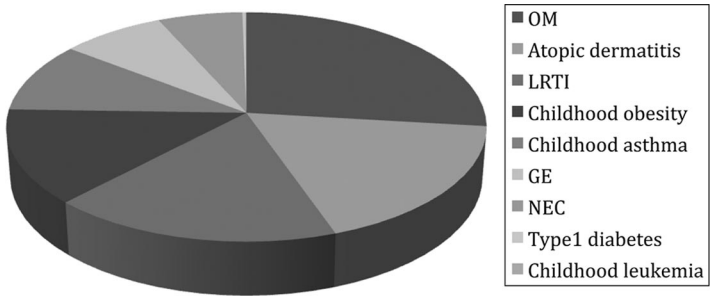

FIGURE 2
Excess costs from pediatric disease, excluding deaths, at current US breastfeeding rates compared with projected costs if 90% of US families could comply with the medical recommendation to breastfeed exclusively for 6 months (total: $3.35 billion [2007 dollars]).

DISCUSSION

To our knowledge, this is the first peer-reviewed US cost analysis on breastfeeding since 1999 and the only analysis to include as many as 10 diseases. Riordan[1] analyzed 4 illnesses of infancy in the United States, and Ball and Wright [2] analyzed 3 by using US and Scottish subjects. Australian costs were analyzed in 2 studies.[60,61] Labbok[4] examined 5 types of diseases and the cost-effectiveness of breastfeeding, including costs of paid maternity leave, lactation support, and infant formula.

There remains a marked gap between medical recommendations around infant feeding and current US rates, which results in substantial economic impact, most of which comes from direct effects on the health and mortality of infants, along with a significant contribution from childhood obesity. Framed another way, the United States incurs $13 billion in excess costs annually and suffers 911 preventable deaths per year because our breastfeeding rates fall far below medical recommendations. Substantial gains could be made with exclusive breastfeeding for 4 months and any breastfeeding at 6 months.

Gastroenteritis was the only disease entity for which our cost analysis was based on exclusive breastfeeding for 6 months.

Although the United States is making progress toward the Healthy People 2010 objectives, a national coordinated effort to reach more ambitious breastfeeding objectives may be justified. Our Healthy People savings are lower than are Weimer's, in part because we are closer to some of the Healthy People goals and in part because Weimer overestimated the numbers of deaths from NEC, which comprised nearly $3.2 billion (89%) of the $3.6 billion in his analysis.

Our study was limited by inconsistencies in some of the data used for our

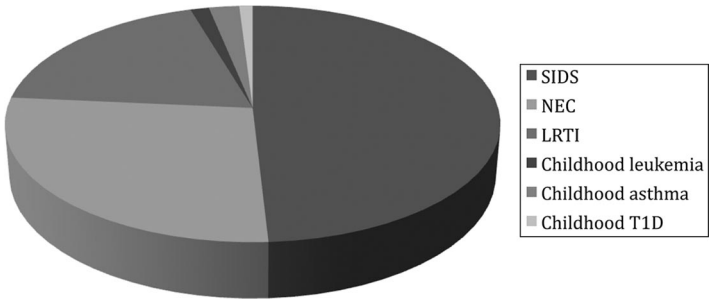

FIGURE 3
Excess pediatric deaths at current US breastfeeding rates, compared with projected deaths if 90% of US families could breastfeed exclusively for 6 months (total: 911 deaths).

assumptions, especially around costs and breastfeeding durations. To compensate, we erred on the side of conservative estimates. In addition, for the 4 diseases analyzed that used exclusive breastfeeding, we were unable to incorporate the effects of mixed feeding. We believe that true costs are higher, and excess deaths from SIDS are likely higher, given the compelling data published after the AHRQ report.[36] Following the AHRQ report, our study does not include costs for illnesses that are too mild to require a doctor's visit, which can nonetheless result in substantial parental time missed from work.[62] We omitted adult deaths from childhood asthma, T1D, and obesity, costs of childhood asthma that persist into adulthood, and other adult disability. We also could not include type 2 diabetes, although these costs are partially represented in the obesity analysis. The strength of our study comes largely from our analysis of a large number of diseases in a manner consistent with the most widely cited previous study while using the AHRQ data set.

Future analyses that examine outcomes of mixed feeding and former breastfeeding, as opposed to "any breastfeeding," would be useful. A cost analysis that includes maternal disease, lactation support, paid maternity leave, and formula is warranted.

CONCLUSIONS

By allowing breastfeeding rates to continue at their current levels, rather than implementing supports to help more families follow medically recommended guidelines, the United States incurs billions of dollars in excess costs and hundreds of preventable infant deaths. Action to improve breastfeeding rates, duration, and exclusivity, including creation of a national infrastructure to support breastfeeding, could be cost-effective.

ACKNOWLEDGMENTS

We thank Audrey Naylor, Julie Smith, Marsha Walker, Linda Smith, and Miriam Labbok.

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Pediatrics; originally published online April 5, 2010;
DOI: 10.1542/peds.2009-1616