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Potential economic impacts from improving breastfeeding rates in the UK

S Pokhrel,[1] M A Quigley,[2] J Fox-Rushby,[1] F McCormick,[3] A Williams,[4] P Trueman,[1] R Dodds,[5] M J Renfrew[6]

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For numbered affiliations see end of article.

Correspondence to
Dr S Pokhrel, Health Economics Research Group, Brunel University, Kingston Lane, Uxbridge, London UB8 3PH, UK; Subhash.Pokhrel@brunel.ac.uk

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ABSTRACT

Rationale Studies suggest that increased breastfeeding rates can provide substantial financial savings, but the scale of such savings in the UK is not known.

Objective To calculate potential cost savings attributable to increases in breastfeeding rates from the National Health Service perspective.

Design and settings Cost savings focussed on where evidence of health benefit is strongest: reductions in gastrointestinal and lower respiratory tract infections, acute otitis media in infants, necrotising enterocolitis in preterm babies and breast cancer (BC) in women. Savings were estimated using a seven-step framework in which an incidence-based disease model determined the number of cases that could have been avoided if breastfeeding rates were increased. Point estimates of cost savings were subject to a deterministic sensitivity analysis.

Results Treating the four acute diseases in children costs the UK at least £89 million annually. The 2009–2010 value of lifetime costs of treating maternal BC is estimated at £959 million. Supporting mothers who are exclusively breast feeding at 1 week to continue breast feeding until 4 months can be expected to reduce the incidence of three childhood infectious diseases and save at least £11 million annually. Doubling the proportion of mothers currently breast feeding for 7–18 months in their lifetime is likely to reduce the incidence of maternal BC and save at least £31 million at 2009–2010 value.

Conclusions The economic impact of low breastfeeding rates is substantial. Investing in services that support women who want to breast feed for longer is potentially cost saving.

What is already known on this topic:

- Low rates of breast feeding are associated with increased mortality and morbidity among infants and mothers.
- In the UK and many other high-income countries, breastfeeding rates are low.
- Previous studies reported from countries similar to the UK indicate that increasing breastfeeding rates reduces healthcare costs by improving mother and child health.

What this study adds

- Use of breast milk substitutes is associated with a raised risk of four childhood illnesses and maternal breast cancer; breast feeding reduces the related National Health Services treatment costs.
- Supporting mothers who are exclusively breast feeding 1 week after the birth to continue breast feeding until 4 months could save at least £11 million annually, by reducing three childhood illnesses.
- Doubling the proportion of mothers breast feeding for 7–18 months of their lifetime could save £31 million at present value, by reducing maternal breast cancer and increasing both quantity and quality of life.

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INTRODUCTION

The prevalence of breast feeding (referred to, hereafter, as 'breastfeeding rates') from initiation to 6 months post birth, has been very low in many Western countries for years.[1] There is good quality evidence (see our systematic review[2]) showing the negative impact of using substitutes for breast feeding on five diseases in children and mothers; gastrointestinal (GI) infection, lower respiratory tract infection (LRTI) and acute otitis media (AOM) in infants; necrotising enterocolitis (NEC) in preterm babies and breast cancer (BC) in mothers. Other conditions including cognitive outcomes, early years obesity, Sudden Infant Death Syndrome and markers of longer-term cardiovascular disease have been associated with the use of substitutes for breast feeding, but the evidence available is not in a form appropriate for robust economic analysis.[2]

The economic impact of infant feeding is extensive and multifaceted.[3] Low rates of breast feeding impact on costs borne by the health service and families, through disease and its treatment as well as expenditure on breast milk substitutes. It has also been argued that women who breast feed make a substantive, direct and positive contribution to the national economy through their supply of breast milk.[4] Previous studies show that increasing breastfeeding rates could result in substantial cost savings per year, for example, US$3.37 billion (in 2007) in the USA (of which US$2.2 billion is direct medical costs and US$1.17 billion is indirect costs to include time missed from work and personal expenses excluding the cost of deaths),[5] $A9 million in Australia (in or before 1997)[6] and €50 million in The Netherlands (in or before 2007).[7] The above figures are not like-for-like comparisons due to variation in methods to estimate such

savings. Nevertheless, the evidence from industrialised countries suggests that increasing breastfeeding rates could be a cost-saving policy. Interpreting these estimates in a UK context, nevertheless, requires consideration of British breastfeeding rates, treatment regimens and healthcare-seeking behaviour.

The number of women starting to breast feed in the UK has risen sharply over the past 20 years, from 62% in 1990 to 81% in 2010.[1] Despite this increase, rates of breast feeding duration and exclusivity have remained low (in 2010, 55% were breast feeding at 6 weeks, 23% exclusively (48% and 21%, respectively, in 2005[8])), and most women who start to breast feed stop before they would like to as a result of problems.[1 9] This has encouraged policy makers to set targets and offer financial support to UK health services to implement the Unicef UK Baby Friendly Initiative and other strategies.

The purpose of this paper is to calculate potential cost savings to the National Health Service (NHS) attributable to increases in breastfeeding rates in the UK through preventing the five diseases for which evidence of health benefit is strongest. It is expected that such information will be useful in planning, commissioning and policy decisions related to breastfeeding support services.

METHODS

The methods of this economic analysis have been described in detail elsewhere[2] and are summarised briefly below.

Identifying priority diseases

The five priority diseases—four acute diseases in infants and BC in women—were identified through an extensive systematic process that examined high-quality systematic reviews and large, high-quality UK studies.[2] Only reviews and studies that met quality criteria including adequate measures of exposure to breast feeding, formula feeding and weaning, and where data existed to allow economic analysis, were included.

Perspective

The perspective of the economic analysis is the NHS in the UK. We did not include any costs associated with not breast feeding that fall on individuals, households and/or any other sectors. Data on treatment costs and potential cost savings are presented in 2009–2010 prices.

Time horizon

For three acute conditions (GI, LRTI and AOM), analysis was limited to the first year of life, whereas maternal BC estimates took a lifetime perspective, and analysis of NEC focussed on the baby's stay in a neonatal unit. Where the time horizon was longer than a year (ie, maternal BC), a discount rate of 3.5% was used.[10]

Economic modelling

Building on methods employed in previous studies,[3 5 6] a seven-step framework was developed (see web appendix figure 1). First, a 'base case', reflecting current levels of breast feeding in the UK, and alternative policy scenarios for each priority outcome were defined and used to assess the impact of achieving potential policy targets. All alternative scenarios were based on breastfeeding rates in the UK. Noting that 90% of women in the UK who stop breast feeding before 6 weeks do so before they wish to,[8] we assumed that women who initiated breast feeding could breast feed for considerably longer than at present with appropriate care and support.[11] This facilitated the use of varied definitions of breast feeding and the time horizon over which costs and benefits would accrue. Table 1 shows these scenarios. For example, scenario A1 envisaged an increase in the exclusive breast feeding rate at 4 months from 7% (observed in 2005) to 21% (observed at 6 weeks in 2005). This assumes a policy in which mothers who are breast feeding at 6 weeks are given appropriate care and support enabling them to breast feed for at least 4 months.

Next, the reference population was selected as: children born in the year 2009 for child diseases and a cohort of 'first-time' (to be meaningful for future policy change) mothers in 2009. Then, the reference population was divided into two feeding groups for each policy scenario: breast fed/breast feeding and non-breast fed/breast feeding, using rates derived from the

Table 1 Policy scenarios developed to model costs and potential savings

	Definition of breast feeding and rate used (base case)*	Alternative policy scenarios modelled		
Gastrointestinal illnesses Lower Respiratory tract infections Acute otitis media	Scenario A0: current rate (base case) for '*exclusive*' breast feeding rate at *4 months* (7%)	Scenario A1: increase from 7% to 21% at 4 months, (21% refers to the rate currently observed at 6 weeks)	Scenario A2: increase from 7% to 45% at 4 months, 45% refers to the rate currently observed at 1 week	Scenario A3: increase from 7% to 65% at 4 months, 65% refers to the rate currently observed at birth
	Scenario B0: current rate (base case) for '*exclusive*' breast feeding rate at *6 months* (0.5%)	Scenario B1: increase from 0.5% to 7%, (7% refers to the rate currently observed at 4 months)		
	Scenario C0: current rate (base case) for '*any* breast feeding' rate at *6 months* (25%)	Scenario C1: increase from 25% to 48%, (48% refers to the rate currently observed at 6 weeks)		
Necrotising enterocolitis	Scenario D0: current rate (base case): Any breast milk feeding rate at discharge from neonatal unit neonatal units (35%)	Scenario D1: increase from 35% to a hypothetical 50%	Scenario D2: increase from 35% to a hypothetical 75%	Scenario D3: increase from 35% to a hypothetical 100%
Maternal breast cancer	Scenario E0: current rates (base case): 32% parous women never breast feeding, 36% breast feeding for ≤6 months, 16% breast feeding for 7–18 months, 16% breast feeding for 18+ months	Scenario E1: Increase rate of breast feeding for ≤6 months to 52%, 16% never, 52% ≤6 months; 16% 7–18 months, 16% 18+ months	Scenario E2: Increase rate of breast feeding for ≤18 months to 32%, 16% never, 36% ≤6 months 32%, 7–18 months, 16% 18+ months	Scenario E3: Increase rate of breast feeding for 18+ months to 32%, 16% never, 36% ≤6 months, 16% 7–18 months, 32% 18+ months

*Source for base case breastfeeding figures: A0-C0 (IFS 2005[8]); D0 (MOSAIC cohort[19]); E0 (Million Women Study[12]). Note that at the time of this study, 2010 IFS data[1] on breastfeeding rates were not available. Hence, the use of 2005 IFS data for A0-C0.

Table 2 Key disease parameters and values used to model breastfeeding scenarios**

Outcome	Odds ratios in favour of breast feeding	Incidence	Unit costs (2009/2010 prices)
Gastrointestinal illnesses	Exclusive breast feeding: Hospitalisation: 0.39 (0.18–0.85)[20] GP visits: 0.28 (0.11–0.69)[21]Any breast feeding: Hospitalisation: 0.52 (0.30–0.87)[20] GP visits: 0.36 (0.18–0.74)[21]	Hospital admissions: 17.2/1000 live births* Primary care consultations: 4682/100 000 infants <1 year†	Hospital admissions‡: Baseline: £989 per admitted child Lower quartile: £586 Upper quartile: £1206Primary care consultation[22]: Baseline: £36 per GP consultation Upper end cost: £53
Lower respiratory tract infection	Exclusive breast feeding: Hospitalisation: 0.70 (0.49–0.98)[20] GP visits: 0.69 (0.47–1.0)[23]Any breast feeding: Hospitalisation: 0.67 (0.52–0.88)[20] GP visits: 0.65 (0.43–0.96)[24]	Hospital admissions: 59.1/1000 live births* Primary care consultations: 23 433/100 000 infants <1 year†	Hospital admissions‡: Baseline: £1078 per admitted child Lower quartile: £749 Upper quartile: £1290Primary care consultation[22]: Baseline: £36 per GP consultation Upper end cost: £53
Acute otitis media	Exclusive breast feeding: GP visits: 0.50 (0.37–0.70)[25]Any breast feeding: GP visits: 0.40 (0.21–0.76)[24]	Primary care consultations: 136/100 000 infants <1 year†	Primary care consultation[22]: Baseline: £36 per GP consultation Upper end cost: £53
NEC	Any breast milk: 0.19 (0.05–0.73)[26]	NEC cases[27]: 1/100 neonatal admissions Surgical NEC: 31% Medical NEC: 69% Average length of stay: 26.7 days§	Surgery‡: Baseline: £1450 per episode Lower quartile: £689 Upper quartile: £1802 Neonatal unit stay‡: Baseline: £618 per bed-day Lower quartile: £509 Upper quartile: £712
Maternal breast cancer	Ever breast feeding vs never breast feeding: 0.96 (0.92–0.99)[28] Breast feeding for <6 months vs never: 0.98 (0.95–1.01)[28] Breast feeding for 7–18 months vs never: 0.94 (0.91–0.97)[28] Breast feeding for 18+ months vs never: 0.89 (0.84–0.94)[28]	Breast cancer cases: Lifetime incidence of 12 500/100 000 population (ie, a lifetime risk of one in eight)¶	Breast cancer average: Baseline: £11 726 per case[29] Upper end cost: £16 260[30]

*Infant Feeding Profiles 2002/2003–2009/2010. Beta Test V.7 September 2011 from Department of Health.
†Data made available by the Royal College of GPs Research and Surveillance Weekly Returns Service for 2010.
‡Estimated by research team based on the NHS Reference Costs 2009–2010. Available at: http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_123459
§Hospital Episode Statistics 2009–2010: http://www.hesonline.nhs.uk/Ease/servlet/ContentServer?siteID=1937&categoryID=192
¶Breast cancer UK incidence statistics. Cancer Research UK: http://info.cancerresearchuk.org/cancerstats/types/breast/incidence/
**Details of each parameter value can be found in the Appendix to the main report, pp.86–113 available from http://www.unicef.org.uk/Documents/Baby_Friendly/Research/appendices_preventing_disease_saving_resources.pdf
NEC, necrotising enterocolitis; NHS, National Health Service; GP, general practitioner.

Infant Feeding Survey for child outcomes[8] and estimates of lifetime breastfeeding duration derived for BC.[12] The differential disease incidence was obtained using the formula: x=s/(br+1−b), where x=disease incidence in a non-breastfeeding group, s=overall incidence of the disease in question, b=current breastfeeding rate; r=risk ratio in favour of breast feeding, and xr=incidence of the condition in a breastfeeding group.[5] The risk ratios (or ORs where risk ratios were not available) were abstracted (or calculated) from the primary source, using the most appropriate definition of infant feeding for that particular disease (eg, the time-dependent nature of the exposure and the disease) and were adjusted for confounders including sociocultural factors. The values of these ratios are given in table 2.

The estimated incidence of care episodes was then multiplied by the unit cost of a care episode (eg, hospitalisation). For maternal BC, a cohort of 100 000 women was followed-up over their lifetime, using a simple three-state Markov process (cancer, no cancer, death), to estimate treatment costs. The relevant care episodes and unit costs used in the model are provided in table 2.

Total treatment costs for primary and secondary care were estimated using the relevant UK population for each priority outcome (eg, 788 486 infants in the case of GI) and savings compared with the 'base case' calculated. In the case of BC, the incremental benefit that combines a value of £20 000 per quality-adjusted life year (QALY) gained with treatment costs was estimated. Lifetime costs and QALYs were discounted prior to averaging. Life years were adjusted by a utility value of 0.71.[13] Findings present the potential savings to the NHS that might result from increased rates of breast feeding.

Finally, deterministic sensitivity analyses assessed the impact of uncertainties in key parameters on the predicted cost savings; disease incidence, ORs, unit costs of treating a care episode or disease, discount rate and utility values. Values of parameters were changed one at a time, using the ranges set out in table 2, to identify the impact on costs and potential savings. Life-years were adjusted by a utility value of 0.80 and 0.67[13] in the sensitivity analysis.

RESULTS

Current treatment costs

The NHS cost of treating three childhood diseases (GI, LRTI, AOM) was calculated as £75.5 million per year; the cost of treating NEC in preterm babies was calculated as £13.5 million per year and the lifetime costs of treating BC in parous women was calculated as £960 million at present value (table 3).

Potential cost savings

Increasing the proportion of women breast feeding exclusively for 4 months (7%) to 21% (Policy A1) would reduce hospital cost associated with GI by approximately £1.2 million per annum. Increasing the rate further to 45% (Policy A2) or 65% (Policy A3), would save £3.2 million or £5 m per annum, respectively. The inclusion of primary care costs would provide total potential savings associated with this condition of £1.34–£5.54 million per annum.

Around £2 million per year could be saved in LRTI hospitalisation costs and £0.3 million per annum in general practitioner consultation costs by increasing the exclusive breast feeding rate at 4 months (7%) to 21% (Policy A1) (table 3). Potential cost savings from avoiding the need to treat AOM in primary care is estimated to be between £0.28 and £1.16 million, depending on whether the exclusive breast feeding rates at 6 months increases from the current 7% to 21% (Policy A1) or 65% (Policy A3).

£2.3 million per year could be saved if the proportion of babies fed any breast milk (mother's own or donor milk) until discharge from neonatal units were to increase from 35% to 50% (table 3). These figures suggest that the cost of each

Table 3 Estimated *total* costs of treating five identified diseases and potential savings/benefits associated with increased breastfeeding rates in the UK (£, million, 2009–2010 prices)

	Gastrointestinal			Lower respiratory tract infection			Acute otitis media		Necrotising enterocolitis (NEC)	Maternal breast cancer (BC)		
	H	p Values	*Total*	H	p Values	*Total*	p Values	*Total- acute diseases*	Treatment costs	Treatment costs	Value health gains*	*Total*
Current treatment costs	13.42	1.33	14.75	50.25	6.65	56.90	3.85	75.5	13.54	959.50	NA	959.50
Savings with												
Policy A1	1.20	0.14	1.34	2.16	0.30	2.46	0.28	4.08				
Policy A2	**3.25**	**0.38**	**3.63**	**5.85**	**0.80**	**6.65**	**0.76**	**11.04**				
Policy A3	4.96	0.58	5.54	8.93	1.22	10.25	1.16	16.95				
Policy B1	0.56	0.07	0.63	1.00	0.14	1.14	0.13	1.9				
Policy C1	1.68	0.23	1.91	4.16	0.59	4.75	0.62	7.28				
Policy D1									2.30			
Policy D2									**6.12**			
Policy D3									9.95			
Policy E1										15.34	7.42	22.76
Policy E2										**21.17**	**10.25**	**31.42**
Policy E3										27.80	13.46	41.26
Total savings from mid-level policy scenario (Policy A2)—acute diseases										11.04		
Total savings from mid-level policy scenario (Policy D2)—NEC										6.12		
Total savings from mid-level policy scenario (Policy E2)—BC (without value of health gains)										21.17		
Total benefits from mid-level policy scenario (Policy E2)—BC (with value of health gains)										31.42		

The italics face is used to differentiate table 3 from table 4. One provides 'total', the other provides 'average' figures. The bold face highlight policies that are recommended as realistic targets in the discussion section.
*Monetary value of health (QALY) gains @ £20 000/QALY;
NA, Not applicable.
H, hospitalisation costs; P, primary care costs.

Table 4 Estimated *average* costs per individual of treating identified diseases and potential cost savings associated with increased breastfeeding rates in the UK (£, 2009–2010 prices)

	Gastrointestinal illnesses*	Lower respiratory tract infection*	Acute otitis media*	Necrotising enterocolitis†	Maternal breast cancer‡
Current treatment costs	17.02	75.52	4.88	171.13	3057.51
Savings with:					
Policy A1	0.92	3.12	0.35		
Policy A2	2.49	8.48	0.96		
Policy A3	3.81	12.94	1.47		
Policy B1	0.43	1.45	0.16		
Policy C1	1.52	6.05	0.79		
Policy D1				29.02	
Policy D2				77.39	
Policy D3				125.75	
Policy E1					48.88
Policy E2					67.46
Policy E3					88.59

*Cost per infant.
†Cost per neonatal admission.
‡Cost per primiparous woman.

neonatal unit admission could be reduced, on average, by at least £30.

Over £15 million, for a total of 313 817 first-time mothers (the annual cohort in 2009), could be saved in treatment costs for BC over their lifetime, if half the women who currently do not breast feed were enabled to breast feed for up to 6 months during their lifetime (table 3). If the proportion of those 'never breast feeding' was halved, and 32% of women were enabled to breast feed for a lifetime total of 7–18 months, the net present value of predicted savings from BC would be over £21 million over the lifetime of 313 817 first-time mothers.

QALY gain

A total of 371 QALYs would also be gained from the reduction in incidence of BC across the lifetime of 313 817 first-time mothers, if half the number of those not breast feeding currently were supported to breast feed for up to 6 months in their lifetime. Given a willingness to pay £20 000 per QALY as recommended by the National Institute for Health and Care Excellence, the net present value of these gains, when combined with savings from treatment costs, are £23 million, £31 million and £41 million, respectively, for the three policy scenarios.

Average cost savings

For comparative purposes, these results are also presented as average costs in table 4. For example, GI in the UK costs the NHS a total of £17 per infant per year, but potential savings if exclusive breast feeding increased from 7% to 21% at 4 months could be £0.92 per infant per year. The potential savings from NEC could be £77 per neonatal admission per year if the current rate of breast milk feeding in the neonatal units were to increase to 75% at discharge.

Sensitivity analysis

Table 5 presents results from the sensitivity analysis showing sensitivity. The results were most sensitive to the value of ORs used. For example, the lowest estimate of GI-related cost savings under policy scenario A1 (£0.34 million) was the result of using a higher value of OR than the baseline OR (hence less effective). The use of the lower value of the OR (rather than the baseline OR) yielded the highest estimate of GI-related savings under policy scenario A1 (£1.78 million).

DISCUSSION

Main findings

Supporting mothers who are exclusively breast feeding at 1 week to continue breast feeding until 4 months could save at least £11 million per year by reducing the incidence of three acute infections in children. Additionally, increasing the current rate of breast milk feeding in the neonatal units from 35% to 75% could save £6.12 million per year in treatment costs by reducing the incidence of NEC. If the proportion of mothers currently breast feeding for 7–18 months in their lifetime were to double, a net present value of £21 million savings could be realised by reducing the incidence of BC over the lifetime of each annual cohort of first-time mothers (plus a further £10

Table 5 Selected results from the sensitivity analyses for policies A1, D1 and E1 (£, million, 2009–2010 prices)

	Gastrointestinal illnesses	Lower respiratory tract infection	Acute otitis media	Necrotising enterocolitis	Maternal breast cancer
Mean estimate	1.20	2.16	0.28	2.30	22.8
Lowest estimate	0.34	0.44	0.17	0.61	6.00
Highest estimate	1.78	4.50	0.35	2.90	40.0

Cost savings figures are for low-level policy scenario (ie, A1s—E1s) and include only hospitalisation costs for gastrointestinal, lower respiratory tract illnesses and acute otitis media and treatment costs for necrotising enterocolitis and maternal breast cancer. This sensitivity analysis relates to estimates provided in table 3.

million value attributed to QALY gains). These equated to £14 per infant in the first year of life, £77 per neonatal admission and £100 per first-time mother, respectively.

Strengths and weaknesses

This is the first study to quantify, nationally, the burden of illness associated with the low breastfeeding rates in the UK and potential gains to the NHS (from reduced illness, saved costs and increased quality of life) achievable through increased breast feeding. We made assumptions about a realistic increase in breastfeeding rates, but consider these achievable given that 80% of Norwegian mothers,[14] 68% of Swedish mothers[15] and 60% of Australian mothers[16] breast feed at 6 months. In fact, the target rates we have applied to estimate cost savings are lower than those seen in other European countries. While a number of alternative scenarios are presented for evaluation, the mid-level scenarios (Policies A2, D2 and E2) could serve as realistic policy targets for interventions.

Comparison with other studies

Our study adds to the global empirical database on the scale of potential cost savings achievable through increasing breastfeeding rates. In Italy, the difference in treatment costs between 'fully' breast fed (exclusively or predominantly for 3 months) and 'partially' breast fed (complementary feeding or no breast feeding) children was estimated at €160 per infant per year.[17] Increasing the exclusive breastfeeding rate at 6 months to 90% was estimated to save US$3.37 billion per year in treatment costs in the USA[5] and, assuming a 100% breastfeeding rate, €250 per newborn per year in the Netherlands.[7] Achieving an exclusive breastfeeding rate of 80% at 3 months was estimated to save SA$9 million per year.[6]

By contrast, our estimates were based upon relatively small increments in the prevalence of breast feeding. We took account of rates achieved in other European countries[14 15] as well as the encouraging trends observed in the UK over the past 25 years.[1 18] Greater economic gains would be made were rates to increase further. Focussing purely on the five diseases associated with the strongest evidence base increases the robustness of results, but also indicates that the calculated savings may be underestimates.

Implications

It is very important to note that achieving the savings we describe does not depend upon persuading more women to breast feed after the birth. Rather it envisages that those women who have chosen to breast feed will receive better early support through investment in proactive, accessible, high-quality services. This is very important because national statistics indicate that 80% of women who stop breast feeding in the early weeks would have liked to have breast fed for longer.[1] Our study should reassure policymakers, service planners and commissioners that a rapid return on investment is realistic and feasible, supported by cost savings that can be realised in the first year of infants' lives.

Future research

High-quality evaluations of the effectiveness and cost effectiveness of interventions that support women to breast feed longer are now needed. Our findings can contribute to these studies through robust estimates of both robust short-term and long-term effects.

CONCLUSION

Increasing the current breastfeeding rates is likely to generate substantial cost savings to the NHS in the UK; the actual amounts saved will depend on the extent of the increase and the effectiveness of interventions. While the cost of these interventions must be considered, the potential savings indicate that substantial further investment has a strong economic case.

Author affiliations
[1]Health Economics Research Group, Brunel University London, Uxbridge, UK
[2]National Perinatal Epidemiology Unit, University of Oxford, Oxford, UK
[3]Department of Health Sciences, University of York, York, UK
[4]Department of Child Health, St. George's, University of London, London, UK
[5]NCT (formerly National Childbirth Trust), London, UK
[6]Mother and Infant Research Unit, School of Nursing and Midwifery, University of Dundee, Dundee, UK

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