Session 2:
Benefits of breastfeeding

Objectives

At the conclusion of this session, participants will be able to:

- List and explain at least three benefits of breastfeeding for each of the following: infant, mother, family, and hospital.
- Describe the benefits of breastfeeding in a hospital setting.
- Give at least three risks related to artificial feeding.

Duration

Session: 1 hour

Teaching methods

Small group work
Lecture and discussion
Video (optional - may also be shown during free time)

Preparation for session

- Review slides. If possible, review references listed in this section, concentrating on the references with data featured on the slides.
- Prepare slides or transparencies and handouts whenever possible that present national data, studies, and surveys. Include photo slides, if possible. Some photo slides that may be appropriate for this session are included in the "slides" PowerPoint file accompanying this course. Consider using them if not enough appropriate photo slides are available locally.
- Decide whether to show a video, such as *Breast is Best* or others. If there is no time during the session itself, consider showing videos during the lunch break or in the evening.

Training materials

Summaries

Available summaries of research studies presented in Session 2

Handouts

2.1 Presentation for session 2

2.2 Infant and young child feeding: Recommendations for practice

2.3 Exclusive Breastfeeding: The Only Water Source Young Infants Need (LINKAGES FAQ Sheet 5)

2.4 Health benefits of breastfeeding: a list of references. (A list of references copied, with permission, from the UNICEF UK Baby Friendly Initiative website, (http://www.babyfriendly.org.uk/health.asp

Slides/Transparencies

2.1-2.28 and photo slides 2a – 2h

The website featuring this Course contains links to the slides and transparencies for this session in two Microsoft PowerPoint files. The photo slides are included in the "slides" file in the order in which they are listed in the Session Plan. The slides (in colour) can be used with a laptop computer and LCD projector, if available. Alternatively, the transparencies (in black and white) can be printed out and copied on acetates and projected with an overhead projector. The transparencies are also reproduced as the first handout for this session, with 6 transparencies to a page.

Video (optional)

One video to consider is *Breast is Best* (35 minutes). This video from Norway has many potential training uses, including a sequence showing a newborn baby crawling along his mother's abdomen and finding the nipple without assistance. It is available in a number of languages from Health Info/Video Vital A/S, P.O. Box 5058, Majorstua, N-0301, Oslo, NORWAY (Tel: [47](22) 699644, Fax: (47)(22) 600789) or e-mail: health-info@videovital.no . It can also be ordered through "Baby Milk Action" at http://www.babymilkaction.org/shop/videos.html

Consider using a locally appropriate video, if one is available. Check with the BFHI authorities, the country or regional UNICEF offices, the local IBFAN organization, La Leche League, or other appropriate national or regional organizations to explore what is available.

Other Materials

Flipchart and markers

Blackboard

References

Aniansson G, Alm B, Andersson B, Hakansson A et al. A prospective coherent study on breast-feeding and otitis media in Swedish infants. *Pediat Infect Dis J, 1994,* 13: 183-188.

Beral V. Breast cancer and breastfeeding: collaborative reanalysis of individual data from 47 epidemiological studies in 30 countries, including 50302 women with breast cancer and 96973 women without the disease. *Lancet*, 2002, 360:187-95.

Betran AP, de Onis M, Lauer JA, Villar J. Ecological study of effect of breast feeding on infant mortality in Latin America. *BMJ,* 2001, 323:1-5.

Fergusson DM, Beautrais AL, Silva PA. Breastfeeding and cognitive development in the first seven years of life. *Soc Sci Med*, 1982, 16:1705-1708. Howie PW, Forsyth JS, Ogston SA, Clark A, Florey CV. Protective effect of breastfeeding against infection. *Br Med J,* 1990, 300:11-15.

Kull I, Wickman M, Lilja G, Nordvall SL, Pershagen G. Breast feeding and allergic diseases in infants - a prospective birth cohort study. *Archives of Disease in Childhood*, 2002, 87:478-481.

Lucas A, Morley R, Cole TJ, Lister G, Leeson-Payne C. Breast milk and subsequent intelligence quotient in children born preterm. *Lancet*, 1992, Feb 1, 339(8788):261-4.

Morrow-Tlucak M, Haude RH, Ernhart CB (1988) Breastfeeding and cognitive development in the first two years of life. *Soc Sci Med* 26:71-82.

Mortensen EL, Michaelsen KF, Sanders SA, Reinisch JM. The association between duration of breastfeeding and adult intelligence. *JAMA*, 2002, 287:2365-2371.

Popkin BM, Adair L, Akin JS, Black R, et al. Breastfeeding and diarrheal morbidity. *Pediatrics,* 1990, 86(6): 874-882.

Riva E, Agostoni C, Biasucci G, Trojan S, Luotti D, Fiori L, et al. Early breastfeeding is linked to higher intelligence quotient scores in dietary treated phenylketonuric children. *Acta Pædiatr*, 1996, 85:56-8.

Rodgers B. Feeding in infancy and later ability and attainment: a longitudinal study. *Devel Med Child Neurol*, 1978, 20:421-6.

Saadeh R, Benbouzid D. Breast-feeding and child spacing: importance of information collection to public health policy. *Bulletin of the World Health Organization*, 1990, 68(5) 625-631.

Scariati PD, Grummer-Strawn LM, Fein SB. A longitudinal analysis of infant morbidity and the extent of breastfeeding in the United States. *Pediatrics*, 1997, 99(6).von Kries R, Koletzko B, Sauerwald T et al. Breast feeding and obesity: cross sectional study. *BMJ,* 1999, 319:147-150.

Breastfeeding counselling: A training course. Geneva, World Health Organization, 1993 (WHO/CDR/93.6).

Breastfeeding and the use of water and teas. Division of Child Health and Development UPDATE No.9, Geneva, World Health Organization, November 1997 (http://www.who.int/child-adolescent-health/New_Publications/ NUTRITION/Water_Teas.pdf).

Outline

Content	Trainer's Notes
1. Introductory discussion Exploration of participants' views of the benefits of breastfeeding	List the following categories in columns on a flipchart or blackboard. • infant • mother • family • hospital Divide the participants into four groups and assign one category to each. Ask each group to take five minutes to list the benefits of breastfeeding for its assigned category. Ask each group to report on their ideas. List their responses under the various headings on the flipchart. Mention that a mini-version of the presentation is reproduced in Handout 2.1 and included in the participants' folder.
2. Benefits of breastfeeding for the infant Slide 2a shows two children from the same family. The older child was hospitalized for dehydration and malnutrition. He had stopped breastfeeding earlier than is recommended because the mother was told by a health worker that his diarrhoea had been caused by her breast milk. Since she was economically disadvantaged, she could not afford the formula, often diluted it and used contaminated water to prepare it. The child had many more diarrhoea episodes and became malnourished. The mother became pregnant and decided to breastfeed this next child. The photo was taken when the older child was hospitalized and the mother sat the younger child in the crib beside him.	Show photo slide 2a or other photo slide with a story.

Content	Trainer's Notes
■ Optimal nutrition ▪ Breast milk provides high quality nutrients that are easily digested and efficiently used by the baby's body. Breast milk also provides all the water a baby needs. There is no need for any additional liquid. Numerous studies indicate that, for infants breastfed exclusively and on demand, the water in the breast milk exceeds water requirements. The solute levels in the urine and blood of these infants - even those living in very hot, dry climates -- were within normal ranges, indicating adequate water intake.	Show slide/transparency 2.1 and refer to handout 2.2. Show slide/transparency 2.2. Highlight the differences between the three types of milk. Show slide/transparency 2.3 and refer participants to Handout 2.3 (LINKAGES Infant Feeding Handout).
▪ Breast milk is a dynamic fluid that changes to meet the infant's needs. Milk composition is influenced by the *gestational age* of the infant (preterm milk is different from full-term milk), *stage of lactation* (colostrum differs from transitional and mature milk, which continues to change as time goes by), and *time frame of the feed* (foremilk differs from hindmilk, which has a higher fat content).	Show slide/transparency 2.4. Highlight the dynamic properties of breast milk. Show photo slide 2b to illustrate how milk composition changes as the infant matures. Show photo slide 2c to show the difference between foremilk and hindmilk.
▪ Colostrum has special properties and is very important to the infant for a variety of developmental, digestive, and protective factors.	Show slide/transparency 2.5. Highlight the main points.
▪ Breast milk is normally the only food that infants need for the first 6 months of life. Safe and appropriate complementary foods should be given from the sixth month of life while breastfeeding continues.	Refer to Handout 2.3.
▪ Breast milk continues to be an important source of energy and high quality nutrients through the second year of life and beyond	Show slide/transparency 2.6.
■ Protective effect of breastfeeding on infant morbidity	Show slide/transparency 2.7.
■ Increased immunity	

Content	Trainer's Notes
Breast milk is a living fluid that protects the baby against infection. During the first year of a baby's life, because the immune system is not fully developed, the baby depends on mother's milk to fight infections.	
■ Reduced risk of diarrhoea. ▪ A study from the Philippines showed that artificially fed babies were up to 17 times more at risk of getting diarrhoea than exclusively breastfed infants. Partially breastfed babies were more likely to have diarrhoea than exclusively breastfed babies, but less likely than babies who received no breast milk *(Popkin).*	Optional: Show photo slide 2d, which shows a baby fed breast-milk substitutes who has been hospitalized for severe diarrhoea. Show slide/transparency 2.8. Stress the importance of continued breastfeeding during diarrhoeal episodes because of its nutritional value and the fact that it ensures a more speedy recovery from illness.
▪ A study in Dundee, Scotland found that breastfed infants had much less diarrhoea. For example, between 0 and 13 weeks of age, almost 20% of bottle-fed infants had diarrhoea compared with only 3.6% of the breastfed infants *(Howie et al.).*	Show slide/transparency 2.9.
▪ A study of 1743 mother infant pairs in the United States found a protective effect against diarrhoeal disease if infants were breastfed compared to infants who were not breastfed. The risk diminished the more breast milk the infant drank (a dose response) *(Scariati et al.).*	Show slide/transparency 2.10.
■ Reduced risk of respiratory infection. ▪ Another study in Dundee, Scotland found that breastfed infants had much less respiratory illness. For example, between 0 and 13 weeks of age, almost 39% of the bottle-fed infants had respiratory illness compared to only 23% of the breastfed infants *(Howie et al.).*	Show slide/transparency 2.11.

Content	Trainer's Notes
■ **Reduced risk of otitis media.** ▪ A study in Sweden found that breastfed infants had less otitis media than artificially fed infants. For example, at one to three months of age, 6% of the weaned infants had otitis media, compared to only 1% of the breastfed infants *(Aniansson et al.)*.	Show slide/transparency 2.12.
▪ A study of 1743 mother infant pairs in the United States found a protective effect against otitis media if infants were breastfed compared to infants who were not breastfed. The risk diminished the more breast milk the infant drank (a dose response) *(Scariati et al.)*.	Show slide/transparency 2.13.
■ Protective effects of breastfeeding on infant mortality	Show slide/transparency 2.14.
■ Diarrhoeal disease and respiratory infections ▪ In a study on the effects of breastfeeding on infant mortality in Latin America the authors conclude that artificially-fed infants 0-3 months of age were over 14 times more likely to die of diarrhoeal disease and 4 times more likely to die of acute respiratory infections than exclusively breastfed infants. Artificially-fed infants 4-11 months of age were almost 2 times more likely to die of both diarrhoeal disease and acute respiratory infection than partially breastfed infants. *(Betran et al.)*	Show slide/transparency 2.15 and 2.16.
■ Breastfeeding reduces the risk of chronic disease.	Show slide/transparency 2.17.
■ Lower risk of allergies ▪ It is generally agreed that allergies are less common in completely breastfed babies. A recent study in Sweden in which a birth cohort of 4089 infants was followed prospectively found that exclusive and partial breastfeeding	Show slide/transparency 2.18. Show photo slide 2e.

Content	Trainer's Notes
reduced the risk of allergic disorders. Children exclusively breastfed during four months or more exhibited less asthma (7.7% v 12%), less atopic dermatitis (24% v 27%) and less allergic rhinitis (6.5% v 9%). *(Kull et al.)*	
■ Lower risk of obesity ▪ A study in Germany found that among 9357 children aged 5 and 6 there was an over 5 times difference in the prevalence of obesity among those children never breastfed compared to those breastfed for over one year. There was a dose effect with the longer an infant had been breastfed the lower prevalence of obesity at the age of 5 and 6 *(von Kries et al.)*.	Show slide/transparency 2.19.
■ Breastfeeding has psychosocial and developmental benefits	Slide/transparency 2.20.
▪ Breastfeeding helps mother and baby to bond. Close contact right after delivery promotes development of a loving relationship between mother and baby. Babies cry less and mothers respond better to their babies' needs.	Show photo slides 2f.
▪ The effects of breastfeeding and breast milk on infant and child development and IQ has been a subject of much interest in the scientific field and the findings over decades of research have found consistently better developmental outcomes and higher IQs if breastfed *(Ferguson et al. and other studies).*	Show slide/transparency 2.21.
▪ Most recent long term study in Copenhagen found that duration of breastfeeding was associated with significantly higher IQ scores at 27.2 years. This study also found a positive dose effect *(Mortensen et al.).*	Show slide/transparency 2.22.

Content	Trainer's Notes
3. Benefits of breastfeeding for the mother	Optional: Show slide 2g.
■ Protection of mother's health ▪ The oxytocin released during breastfeeding helps the uterus to return to its previous size and helps to reduce postpartum bleeding.	Show slide/transparency 2.23.
▪ Breastfeeding reduces the risk of breast and ovarian cancer in mothers. A reanalysis of data from 47 epidemiological studies in 30 countries found that the relative risk of breast cancer decreased by 4.3% for every year of breastfeeding. *(Beral)*	Show slide/transparency 2.24.
■ Delaying new pregnancies ▪ During the first six months after birth, if a woman is amenorrhoeic and fully breastfeeding her infant, she has about 98% protection against another pregnancy.	
▪ The longer the duration of breastfeeding, the longer the duration of postpartum amenorrhoea, which leads to longer birth intervals *(Saadeh and Benbouzid)*	Show slide/transparency 2.25.
■ Dangers of artificial feeding ▪ Interference with bonding ▪ More diarrhoea and respiratory infections ▪ Persistent diarrhoea ▪ Malnutrition - Vitamin A deficiency ▪ More allergy and milk intolerance ▪ Increased risk of some chronic diseases ▪ Increased risk of overweight ▪ Lower scores on intelligence tests (for low-birth-weight babies) ▪ Too frequent pregnancies for the mother ▪ Increased risk of anaemia, ovarian and breast cancer for the mother	Show slide/transparency 2.26. Emphasize the many risks associated with using feeding bottles, water, formula and pacifiers both in the hospital and later when the mother returns home. Stress the fact that the hospital has the responsibility to communicate both the benefits of breastfeeding and the risks of artificial feeding to all mothers.

Content	Trainer's Notes
4. Benefits of breastfeeding for the family ■ Better health and nutrition ■ Breastfeeding benefits the whole family, emotionally and nutritionally. ■ Economic benefits ■ Breastfeeding costs less than artificial feeding. Money spent on buying infant formula can be used to buy nutritious food for mother and family.	Show slide/transparency 2.27.
■ Health care Breastfeeding reduces health-care costs, such as medical consultations, medicines, lab tests, hospitalization, etc.	Mention that data related to the economic benefits of breastfeeding will be covered in Session 6, Costs and savings.
5. Benefits of breastfeeding for the hospital ■ Breastfeeding creates an emotionally warmer and calmer atmosphere. Infants cry less, are calmer; mothers can more easily respond to their babies' needs. ■ There is no need for nurseries when there is rooming-in, which means more space for patients and hospital staff. Special care rooms may still be needed for very sick babies. ■ Rooming-in reduces neonatal infections. Exclusively breastfed infants have fewer infections. ■ Less staff time is needed. Mothers are directly responsible for the care of their babies. ■ Rooming-in and breastfeeding support increases hospital prestige and creates an image of a facility doing its best for mothers and babies. ■ There are fewer abandoned children. Mothers who breastfeed are less likely to abuse or abandon their babies. ■ Breastfeeding is the safest feeding method during emergencies.	Show slide/transparency 2.28.

Content	Trainer's Notes
6. Concluding discussion	Optional: Show photo slide 2h – contented mother and baby. Refer participants to their folder and Handout 2.4 Benefits of Breastfeeding. This handout, which comes from the UNICEF UK Baby Friendly Initiative website, provides further information on scientific studies showing the benefits of breastfeeding. Ask participants for any questions or comments.
7. Video (optional)	Consider showing the video "Breast is Best" if available, and/or other good videos, if time permits. If there isn't time during the session, consider showings during lunch breaks or in the evening.

Summaries of research studies presented during Session 2

Slide/transparency:	*Study:*
2.8	Popkin BM, Adair L, Akin JS, Black R, Briscoe J, Flieger W. Breast-feeding and diarrheal morbidity**.** *Pediatrics,* 1990, Dec, 86(6):874-82.
2.9 and 2.11	Howie PW, Forsyth JS, Ogston SA, Clark A, Florey CD. Protective effect of breast feeding against infection**.** *BMJ,* 1990, Jan 6, 300(6716):11-6.
2.10 and 2.13	Scariati PD, Grummer-Strawn LM, Fein SB. A longitudinal analysis of infant morbidity and the extent of breastfeeding in the United States. *Pediatrics*, 1997, Jun, 99(6):E5.
2.12	Aniansson G, Alm B, Andersson B, Hakansson A, Larsson P, Nylen O, Peterson H, Rigner P, Svanborg M, Sabharwal H, et al. A prospective cohort study on breast-feeding and otitis media in Swedish infants. *Pediatr Infect Dis J,* 1994 Mar 13(3):183-8
2.15 and 2.16	Betran AP, de Onis M, Lauer JA, Villar J. Ecological study of effect of breast feeding on infant mortality in Latin America. *BMJ,* 2001, Aug 11, 323(7308):303-6.
2.18	Kull I, Wickman M, Lilja G, Nordvall SL, Pershagen G. Breastfeeding and allergic diseases in infants – a prospective birth cohort study. *Archives of Disease in Childhood* 2002, 87:478-481.
2.19	von Kries R, Koletzko B, Sauerwald T, von Mutius E, Barnert D, Grunert V, von Voss H. Breast feeding and obesity: cross sectional study**.** *BMJ,* 1999, Jul 17, 319(7203):147-50.
2.21	Lucas A, Morley R, Cole TJ, Lister G, Leeson-Payne C. Breast milk and subsequent intelligence quotient in children born preterm. *Lancet,* 1992, Feb 1, 339(8788):261-4.
2.21	Fergusson DM, Beautrais AL, Silva PA. Breast-feeding and cognitive development in the first seven years of life. *Soc Sci Med*, 1982, 16(19):1705-8.
2.21	Morrow-Tlucak M, Haude RH, Ernhart CB. Breastfeeding and cognitive development in the first 2 years of life**.** *Soc Sci Med*, 1988, 26(6):635-9.
2.21	Riva E, Agostoni C, Biasucci G, Trojan S, Luotti D, Fiori L, Giovannini M. Early breastfeeding is linked to higher intelligence quotient scores in dietary treated phenylketonuric children. *Acta Paediatr,* 1996, Jan, 85(1):56-8.

2.22 Mortensen EL, Michaelsen KF, Sanders SA, Reinisch JM. The association between duration of breastfeeding and adult intelligence. *JAMA,* 2002, May 8, 287(18):2365-71.

2.24 Beral V, Bull D, Doll R, Peto R, Reeves G (Collaborative Group on Hormonal Factors in Breast Cancer). Breast cancer and breastfeeding: collaborative reanalysis of individual data from 47 epidemiological studies in 30 countries, including 50 302 women with breast cancer and 96 973 women without the disease. *Lancet*, 2002, 360: 187-95.

2.25 Saadeh R, Benbouzid D. Breast-feeding and child-spacing: importance of information collection for public health policy**.** *Bull World Health Organ,* 1990, 68(5):625-31.

Breastfeeding and diarrhoeal morbidity

Refers to Slide 2.8

Reference. Popkin BM, Adair L, Akin JS, Black R, Briscoe J, Flieger W. Breast-feeding and diarrheal morbidity**.** *Pediatrics*, 1990, Dec, 86(6):874-82.

Methods. This study used a unique longitudinal survey of more than 3000 mother-infant pairs observed from pregnancy through infancy. The sample is representative of infants from the Cebu region of the Philippines. The sequencing of breastfeeding and diarrhoeal morbidity events was carefully examined in a longitudinal analysis, which allowed for the examination of age-specific effects of feeding patterns. Because the work controlled for a wide range of environmental causes of diarrhoea, the results can be generalized to other populations with some confidence.

Findings. The addition to the breast-milk diet of even water, teas, and other nonnutritive liquids doubled or tripled the likelihood of diarrhoea. Supplementation of breastfeeding with additional nutritive foods or liquids further increased significantly the risk of diarrhoea; most benefits of breastfeeding alone or in combination with nutritive foods/liquids became small during the second half of infancy. Benefits of breastfeeding were slightly greater in urban environments.

Protective effect of breastfeeding against infection

Refers to Slide 2.9 and 2.11

Reference. Howie PW, Forsyth JS, Ogston SA, Clark A, Florey CD. Protective effect of breast feeding against infection**.** *BMJ*, 1990, Jan 6, 300(6716):11-6.

Objective. To assess the relations between breastfeeding and infant illness in the first two years of life with particular reference to gastrointestinal disease.

Design. Prospective observational study of mothers and babies followed up for 24 months after birth.

Setting. Community setting in Dundee.

Methods. 750 pairs of mothers and infants, 76 of whom were excluded because the babies were preterm (less than 38 weeks), low birth weight (less than 2500 g), or treated in special care for more than 48 hours. Of the remaining cohort of 674, 618 were followed up for two years. Detailed observations of infant feeding and illness were made at two weeks, and one, two, three, four, five, six, nine, 12, 15, 18, 21, and 24 months by health visitors. The main outcome measure was the prevalence of gastrointestinal disease in infants during follow up.

Findings. After confounding variables were corrected for babies who were breastfed for 13 weeks or more (227) had significantly less gastrointestinal illness than those who were bottle fed from birth (267) at ages 0-13 weeks (p less than 0.01; 95% confidence interval for reduction in incidence 6.6% to 16.8%), 14-26 weeks (p less than 0.01), 27-39 weeks (p less than 0.05), and 40-52 weeks (p less than 0.05). This reduction in illness was found whether or not supplements were introduced before 13 weeks, was maintained beyond the period of breastfeeding itself, and was accompanied by a reduction in the rate of hospital admission. By contrast, babies who were breastfed for less than 13 weeks (180) had rates of gastrointestinal illness similar to those observed in bottle fed babies. Smaller reductions in the rates of respiratory illness were observed at ages 0-13 and 40-52 weeks (p less than 0.05) in babies who were breastfed for more than 13 weeks. There was no consistent protective effect of breastfeeding against ear, eye, mouth, or skin infections, infantile colic, eczema, or nappy rash.

Conclusions. Breastfeeding during the first 13 weeks of life confers protection against gastrointestinal illness that persists beyond the period of breastfeeding itself.

A longitudinal analysis of infant morbidity and the extent of breastfeeding in the United States

Refers to Slide 2.10 and 2.13

Reference. Scariati PD, Grummer-Strawn LM, Fein SB. A longitudinal analysis of infant morbidity and the extent of breastfeeding in the United States. *Pediatrics*, 1997, Jun, 99(6):E5.

Background. Studies on the health benefits of breastfeeding in developed countries have shown conflicting results. These studies often fail to account for confounding, reverse causality, and dose-response effects. We addressed these issues in analyzing longitudinal data to determine if breastfeeding protects US infants from developing diarrhoea and ear infections.

Methods. Mothers participating in a mail panel provided information on their infants at ages 2, 3, 4, 5, 6, and 7 months. Infants were classified as exclusively breastfed; high, middle, or low mixed breast- and formula-fed; or exclusively formula-fed. Diarrhoea and ear infection diagnoses were based on mothers' reports. Infant age and gender; other liquid and solid intake; maternal education, occupation, and smoking; household size; family income; and day care use were adjusted for in the full models.

Findings. The risk of developing either diarrhoea or ear infection increased as the amount of breast milk an infant received decreased. In the full models, the risk for diarrhoea remained significant only in infants who received no breast milk compared with those who received only breast milk (odds ratio = 1.8); the risk for ear infection remained significant in the low mixed feeding group (odds ratio = 1.6) and among infants receiving no breast milk compared with those who received only breast milk (odds ratio = 1.7).

Conclusions. Breastfeeding protects US infants against the development of diarrhoea and ear infection. Breastfeeding does not have to be exclusive to confer this benefit. In fact, protection is afforded in a dose-response manner.

A prospective cohort study on breastfeeding and otitis media in Swedish infants.

Refers to Slide 2.12

Reference. Aniansson G, Alm B, Andersson B, Hakansson A, Larsson P, Nylen O, Peterson H, Rigner P, Svanborg M, Sabharwal H, et al. A prospective cohort study on breast-feeding and otitis media in Swedish infants. *Pediatr Infect Dis J,* 1994 Mar. 13(3):183-8.

Methods. This study analyzed the effect of breastfeeding on the frequency of acute otitis media. The protocol was designed to examine each child at 2, 6, and 10 months of age. At each visit nasopharyngeal cultures were obtained, the feeding pattern was recorded and the acute otitis media (AOM) episodes were documented. The analysis was based on 400 children from whom complete information was obtained. They represented 83% of the newborns in the study areas.

Findings. By 1 year of age 85 (21%) children had experienced 111 AOM episodes; 63 (16%) had 1 and 22 (6%) had 2 or more episodes. The AOM frequency was significantly lower in the breastfed than in the non-breastfed children in each age group ($P < 0.05$). The first AOM episode occurred significantly earlier in children who were weaned before 6 months of age than in the remaining groups. The frequency of nasopharyngeal cultures positive for Haemophilus influenzae, Moraxella catarrhalis and Streptococcus pneumoniae was significantly higher in children with AOM. At 4 to 7 and 8 to 12 months of age, the AOM frequency was significantly higher in children with day-care contact and siblings ($P < 0.05$ and < 0.01, respectively). The frequency of upper respiratory tract infections was increased in children with AOM but significantly reduced in the breastfed group.

Ecological study of effect of breastfeeding on infant mortality in Latin America

Refers to Slide 2.15 and 2.16

Reference. Betran AP, de Onis M, Lauer JA, Villar J. Ecological study of effect of breast feeding on infant mortality in Latin America. *BMJ*, 2001, Aug 11, 323(7308):303-6.

Objective. To estimate the effect of exclusive breastfeeding and partial breastfeeding on infant mortality from diarrhoeal disease and acute respiratory infections in Latin America.

Design. Attributable fraction analysis of national data on infant mortality and breastfeeding.

Setting. Latin America and the Caribbean.

Main outcome measures. Mortality from diarrhoeal disease and acute respiratory infections and nationally representative breastfeeding rates.

Findings. 55% of infant deaths from diarrhoeal disease and acute respiratory infections in Latin America are preventable by exclusive breastfeeding among infants aged 0-3 months and partial breastfeeding throughout the remainder of infancy. Among infants aged 0-3 months, 66% of deaths from these causes are preventable by exclusive breastfeeding; among infants aged 4-11 months, 32% of such deaths are preventable by partial breastfeeding. 13.9% of infant deaths from all causes are preventable by these breastfeeding patterns. The annual number of preventable deaths is about 52 000 for the region.

Conclusions: Exclusive breastfeeding of infants aged 0-3 months and partial breastfeeding throughout the remainder of infancy could substantially reduce infant mortality in Latin America. Interventions to promote breastfeeding should target younger infants.

Breastfeeding and allergic diseases in infants - a prospective birth cohort study

Refers to Slide 2.18

Reference: Kull I, Wickman M, Lilja G, Nordvall SL, Pershagen G. Breastfeeding and allergic diseases in infants – a prospective birth cohort study. *Archives of Disease in Childhood* 2002, 87:478-481.

Aims: To investigate the effect of breastfeeding on allergic disease in infants up to 2 years of age.

Methods: A birth cohort of 4089 infants was followed prospectively in Stockholm, Sweden. Information about various exposures was obtained by parental questionnaires when the infants were 2 months old, and about allergic symptoms and feeding at 1 and 2 years of age. Duration of exclusive and partial breastfeeding was assessed separately. Symptom related definitions of various allergic diseases were used. Odds ratios (OR) and 95% confidence intervals (CI) were estimated in a multiple logistic regression model. Adjustments were made for potential confounders.

Results: Children exclusively breastfed during four months or more exhibited less asthma (7.7% v 12%, OR(adj) = 0.7, 95% CI 0.5 to 0.8), less atopic dermatitis (24% v 27%, OR(adj) = 0.8, 95% CI 0.7 to 1.0), and less suspected allergic rhinitis (6.5% v 9%, OR(adj) = 0.7, 95% CI 0.5 to 1.0) by 2 years of age. There was a significant risk reduction for asthma related to partial breastfeeding during six months or more (OR(adj) = 0.7, 95% CI 0.5 to 0.9). Three or more of five possible allergic disorders—asthma, suspected allergic rhinitis, atopic dermatitis, food allergy related symptoms, and suspected allergic respiratory symptoms after exposure to pets or pollen—were found in 6.5% of the children. Exclusive breastfeeding prevented children from having multiple allergic disease (OR(adj) = 0.7, 95% CI 0.5 to 0.9) during the first two years of life.

Conclusion: Exclusive breastfeeding seems to have a preventive effect on the early development of allergic disease—that is, asthma, atopic dermatitis, and suspected allergic rhinitis, up to 2 years of age. This protective effect was also evident for multiple allergic disease.

Breastfeeding and obesity: Cross sectional study

Refers to Slide 2.19

Reference. von Kries R, Koletzko B, Sauerwald T, von Mutius E, Barnert D, Grunert V, von Voss H. Breast feeding and obesity: cross sectional study**.** *BMJ*, 1999, Jul 17, 319(7203):147-50.

Objective. To assess the impact of breastfeeding on the risk of obesity and risk of being overweight in children at the time of entry to school.

Design. Cross sectional survey

Setting. Bavaria, southern Germany.

Methods. Routine data were collected on the height and weight of 134 577 children participating in the obligatory health examination at the time of school entry in Bavaria. In a sub sample of 13 345 children, early feeding, diet, and lifestyle factors were assessed using responses to a questionnaire completed by parents.

Subjects. 9357 children aged 5 and 6 who had German nationality.

Main outcome measures. Being overweight was defined as having a body mass index above the 90th centile and obesity was defined as body mass index above the 97th centile of all enrolled German children. Exclusive breastfeeding was defined as the child being fed no food other than breast milk.

Findings. The prevalence of obesity in children who had never been breastfed was 4.5% as compared with 2.8% in breastfed children. A clear dose-response effect was identified for the duration of breastfeeding on the prevalence of obesity: the prevalence was 3.8% for 2 months of exclusive breastfeeding, 2.3% for 3-5 months, 1.7% for 6-12 months, and 0.8% for more than 12 months. Similar relations were found with the prevalence of being overweight. The protective effect of breastfeeding was not attributable to differences in social class or lifestyle. After adjusting for potential confounding factors, breastfeeding remained a significant protective factor against the development of obesity (odds ratio 0.75, 95% CI 0.57 to 0.98) and being overweight (0.79, 0.68 to 0.93).

Conclusions. In industrialised countries promoting prolonged breastfeeding may help decrease the prevalence of obesity in childhood. Since obese children have a high risk of becoming obese adults, such preventive measures may eventually result in a reduction in the prevalence of cardiovascular diseases and other diseases related to obesity.

Breast milk and subsequent intelligence quotient in children born preterm

Refers to Slide 2.21

Reference. Lucas A, Morley R, Cole TJ, Lister G, Leeson-Payne C. Breast milk and subsequent intelligence quotient in children born preterm. *Lancet*, 1992, Feb 1, 339(8788):261-4.

Summary. There is considerable controversy over whether nutrition in early life has a long-term influence on neurodevelopment. We have shown previously that, in preterm infants, mother's choice to provide breast milk was associated with higher developmental scores at 18 months. We now report data on intelligence quotient (IQ) in the same children seen at 7 1/2-8 years.

Methods. IQ was assessed in 300 children with an abbreviated version of the Weschler Intelligence Scale for Children (revised Anglicised).

Findings. Children who had consumed mother's milk in the early weeks of life had a significantly higher IQ at 7 1/2-8 years than did those who received no maternal milk. An 8.3 point advantage (over half a standard deviation) in IQ remained even after adjustment for differences between groups in mother's education and social class (p less than 0.0001). This advantage was associated with being fed mother's milk by tube rather than with the process of breastfeeding. There was a dose-response relation between the proportion of mother's milk in the diet and subsequent IQ. Children whose mothers chose to provide milk but failed to do so had the same IQ as those whose mothers elected not to provide breast milk.

Conclusions. Although these results could be explained by differences between groups in parenting skills or genetic potential (even after adjustment for social and educational factors), our data point to a beneficial effect of human milk on neurodevelopment.

Breastfeeding and cognitive development in the first seven years of life

Refers to Slide 2.21

Reference. Fergusson DM, Beautrais AL, Silva PA. Breast-feeding and cognitive development in the first seven years of life. *Soc Sci Med*, 1982, 16(19):1705-8.

Methods. The relationship between breastfeeding practices and childhood intelligence and language development at ages 3, 5, and 7 years was examined in a birth cohort of New Zealand children.

Findings. The results showed that even when a number of control factors including maternal intelligence, maternal education, maternal training in child rearing, childhood experiences, family socio-economic status, birth weight and gestational age were taken into account, there was a tendency for breastfed children to have slightly higher test scores than bottle-fed infants. On average, breastfed children scored approximately two points higher on scales with a standard deviation of 10 than bottle-fed infants when all control factors were taken into account.

Conclusions. It was concluded that breastfeeding may be associated with very small improvements in intelligence and language development or, alternatively, that the differences may have been due to the effects of other confounding factors not entered into the analysis.

Breastfeeding and cognitive development in the first 2 years of life

Refers to Slide 2.21

Reference. Morrow-Tlucak M, Haude RH, Ernhart CB. Breastfeeding and cognitive development in the first 2 years of life**.** *Soc Sci Med*, 1988, 26(6):635-9.

Method. The relationship between breastfeeding and cognitive development in the first 2 years of life was examined in a cohort of children being followed in a study of risk factors in development.

Findings. A significant difference between bottle-fed children, children breastfed less than or equal to 4 months, and those breastfed greater than 4 months was found on the Mental Development Index of the Bayley Scales at ages 1 and 2 years, favouring the breastfed children. At age 6 months, the direction of the relationship was the same but did not reach significance. Supplementary regression analyses examining the strength of the relationship between duration of breastfeeding and cognitive development similarly showed a small but significant relationship between duration of breastfeeding and scores on the Bayley at 1 and 2 years. Alternative explanations for the results are discussed.

Early breastfeeding is linked to higher intelligence quotient scores in dietary treated phenylketonuric children

Refers to Slide 2.21

Reference. Riva E, Agostoni C, Biasucci G, Trojan S, Luotti D, Fiori L, Giovannini M. Early breastfeeding is linked to higher intelligence quotient scores in dietary treated phenylketonuric children. *Acta Paediatr*, 1996, Jan, 85(1):56-8.

Background. Strict control of phenylalanine intake is the main dietary intervention for phenylketonuric children. Whether other dietary-related factors improve the clinical outcome for treated phenylketonuric children in neurodevelopmental terms, however, remains unexplored.

Methods. We retrospectively compared the intelligence quotient (IQ) score of 26 school-age phenylketonuric children who were either breastfed or formula fed for 20-40 days prior to dietary intervention.

Findings. Children who had been breastfed as infants scored significantly better (IQ advantage of 14.0 points, $p = 0.01$) than children who had been formula fed. A 12.9 point advantage persisted also after adjusting for social and maternal education status ($p = 0.02$). In this sample of early treated term infants with phenylketonuria there was no associated between IQ scores and the age at treatment onset and plasma phenylalanine levels during treatment.

Conclusion. We conclude that breastfeeding in the prediagnostic stage may help treated infants and children with phenylketonuria to improve neurodevelopmental performance.

The association between duration of breastfeeding and adult intelligence

Refers to Slide 2.22

Reference. Mortensen EL, Michaelsen KF, Sanders SA, Reinisch JM. The association between duration of breastfeeding and adult intelligence. *JAMA,* 2002, May 8, 287(18):2365-71.

Content. A number of studies suggest a positive association between breastfeeding and cognitive development in early and middle childhood. However, the only previous study that investigated the relationship between breastfeeding and intelligence in adults had several methodological shortcomings.

Objective. To determine the association between duration of infant breastfeeding and intelligence in young adulthood.

Design, setting and participants. Prospective longitudinal birth cohort study conducted in a sample of 973 men and women and a sample of 2280 men, all of whom were born in Copenhagen, Denmark, between October 1959 and December 1961. The samples were divided into 5 categories based on duration of breastfeeding, as assessed by physician interview with mothers at a 1-year examination.

Main outcome measures. Intelligence, assessed using the Wechsler Adult Intelligence Scale (WAIS) at a mean age of 27.2 years in the mixed-sex sample and the Borge Priens Prove (BPP) test at a mean age of 18.7 years in the all-male sample. Thirteen potential confounders were included as covariates: parental social status and education; single mother status; mother's height, age, and weight gain during pregnancy and cigarette consumption during the third trimester; number of pregnancies; estimated gestational age; birth weight; birth length; and indexes of pregnancy and delivery complications.

Findings. Duration of breastfeeding was associated with significantly higher scores on the Verbal, Performance, and Full Scale WAIS IQs. With regression adjustment for potential confounding factors, the mean Full Scale WAIS IQs were 99.4, 101.7, 102.3, 106.0, and 104.0 for breastfeeding durations of less than 1 month, 2 to 3 months, 4 to 6 months, 7 to 9 months, and more than 9 months, respectively ($P = .003$ for overall F test). The corresponding mean scores on the BPP were 38.0, 39.2, 39.9, 40.1, and 40.1 ($P = .01$ for overall F test).

Conclusion. Independent of a wide range of possible confounding factors, a significant positive association between duration of breastfeeding and intelligence was observed in 2 independent samples of young adults, assessed with 2 different intelligence tests.

Breast cancer and breastfeeding: collaborative reanalysis of individual data from 47 epidemiological studies in 30 countries

Refers to Slide 2.24

Reference. Beral V, Bull D, Doll R, Peto R, Reeves G (Collaborative Group on Hormonal Factors in Breast Cancer). Breast cancer and breastfeeding: collaborative reanalysis of individual data from 47 epidemiological studies in 30 countries, including 50 302 women with breast cancer and 96 973 women without the disease. *Lancet,* 2002, 360: 187-95.

Background. Although childbearing is known to protect against breast cancer, whether or not breastfeeding contributes to this protective effect is unclear.

Methods. Individual data from 47 epidemiological studies in 30 countries than included information on breastfeeding patterns and other aspects of childbearing were collected, checked and analysed centrally, for 50,302 women with invasive breast cancer and 96,973 controls. Estimates of the relative risk for breast cancer associated with breastfeeding in parous women were obtained after stratification by fine divisions of age, parity, and women's ages when their first child was born, as well as by study and menopausal status.

Findings. Women with breast cancer had, on average, fewer births than did controls (2.2 vs 2.6) Furthermore, fewer parous women with cancer than parous controls had ever breastfed (71% vs 79%), and their average lifetime duration of breastfeeding was shorter (9.8 vs 15.6 months). The relative risk of breast cancer decreased by 4.3% (95% CI 2.9-5.8; p<0.0001) for every 12 months of breastfeeding in addition to a decrease of 7.0% (5.0-9.0; p<0.0001) for each birth. The size of the decline in the relative risk of breast cancer associated with breastfeeding did not differ significantly for women in developed and developing countries, and did not vary significantly by age, menopausal status, ethnic origin, and number of births a woman had, her age when her first child was born, or any of nine other personal characteristics examines. It is estimated that the cumulative incidence of breast cancer in developed countries would be reduced by more than half, from 6.3 to 2.7 per 100 women by age 70, if women had the average number of births and lifetime duration of breastfeeding that had been prevalent in developing countries until recently. Breastfeeding could account for almost two-thirds of this estimated reduction in breast cancer incidence.

Interpretation. The longer women breastfeed the more they are protected against breast cancer. The lack of or short lifetime duration of breastfeeding typical of women in developed countries makes a major contribution to the high incidence of breast cancer in these countries.

Breastfeeding and child-spacing: Importance of information collection for public health policy

Refers to Slide 2.25

Reference. Saadeh R, Benbouzid D. Breast-feeding and child-spacing: importance of information collection for public health policy**.** *Bull World Health Organ,* 1990, 68(5):625-31.

Summary. The presence of lactational amenorrhoea cannot be fully relied upon to protect the individual mother against becoming pregnant. Nevertheless, the use of breastfeeding as a birth-spacing mechanism has important implications for global health policy. This article identifies the information that should be collected and examined as a basis for developing guidelines on how to reduce the dual protection afforded by postpartum lactational amenorrhoea and other family planning methods, and discusses when such methods should be introduced.

Handout 2.1

Presentation for session 2

Benefits of breastfeeding for the infant

- Provides superior nutrition for optimum growth.
- Provides adequate water for hydration.
- Protects against infection and allergies.
- Promotes bonding and development.

Transparency 2.1

Summary of differences between milks

	Human milk	Animal milks	Infant formula
Protein	correct amount, easy to digest	too much, difficult to digest	partly corrected
Fat	enough essential fatty acids, lipase to digest	lacks essential fatty acids, no lipase	no lipase
Water	enough	extra needed	may need extra
Anti-infective properties	present	absent	absent

Adapted from: Breastfeeding counselling: A training course. Geneva, World Health Organization, 1993 (WHO/CDR/93.6).

Transparency 2.2

No water necessary

Country	Temperature °C	Relative Humidity %	Urine osmolarity (mOsm/l)
Argentina	20-39	60-80	105-199
India	27-42	10-60	66-1234
Jamaica	24-28	62-90	103-468
Peru	24-30	45-96	30-544

(Normal osmolarity: 50-1400 mOsm/l)

Adapted from: *Breastfeeding and the use of water and teas.* Geneva, World Health Organization, 1997.

Transparency 2.3

Breast milk composition differences (dynamic)

- Gestational age at birth (preterm and full term)
- Stage of lactation (colustrum and mature milk)
- During a feed (foremilk and hindmilk)

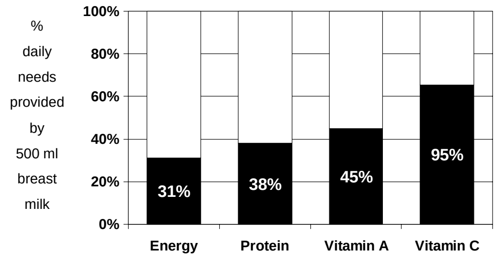
Transparency 2.4

Colostrum

Property	Importance
Antibody-rich	protects against infection and allergy
Many white cells	protects against infection
Purgative	clears meconium; helps prevent jaundice
Growth factors	helps intestine mature; prevents allergy, intolerance
Vitamin-A rich	reduces severity of some infection (such as measles and diarrhoea); prevents vitamin A-related eye diseases

Transparency 2.5

Breast milk in second year of life



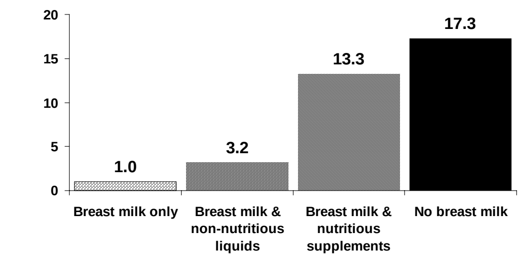
From: Breastfeeding counselling: A training course. Geneva, World Health Organization, 1993 (WHO/CDR/93.6).

Transparency 2.6

Protective effect of breastfeeding on infant morbidity

Transparency 2.7

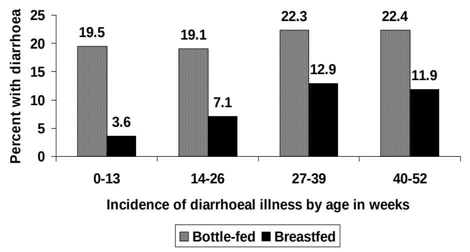
Risk of diarrhoea by feeding method for infants aged 0-2 months, Philippines



Adapted from: Popkin BM, Adair L, Akin JS, Black R, et al. Breastfeeding and diarrheal morbidity. *Pediatrics,* 1990, 86(6): 874-882.

Transparency 2.8

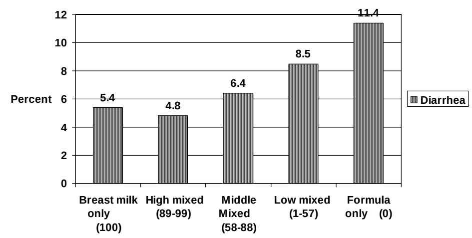
Percentage of babies bottle-fed and breastfed for the first 13 weeks that had diarrhoeal illness at various weeks of age during the first year, Scotland



Adapted from: Howie PW, Forsyth JS, Ogston SA, Clark A, Florey CV. Protective effect of breastfeeding against infection. *Br Med J,* 1990, 300: 11-15.

Transparency 2.9

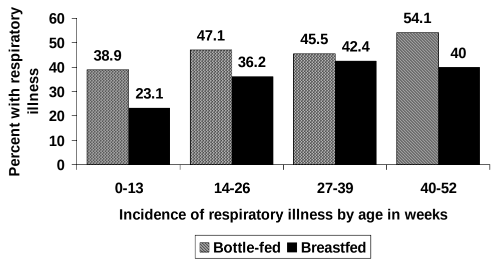
Percentage of infants 2-7 months of age reported as experiencing diarrhoea, by feeding category in the preceding month in the U.S.



Adapted from: Scariati PD, Grummer-Strawn LM, Fein SB. A longitudinal analysis of infant morbidity and the extent of breastfeeding in the United States. *Pediatrics,* 1997, 99(6).

Transparency 2.10

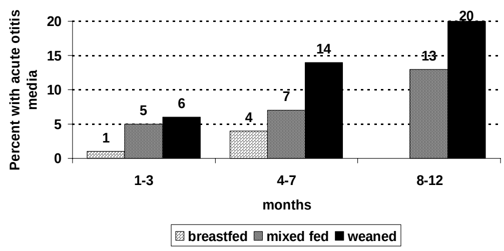
Percentage of babies bottle-fed and breastfed for the first 13 weeks that had respiratory illness at various weeks of age during the first year, Scotland



Adapted from: Howie PW, Forsyth JS, Ogston SA, Clark A, Florey CV. Protective effect of breastfeeding against infection. *Br Med J,* 1990, 300: 11-15.

Transparency 2.11

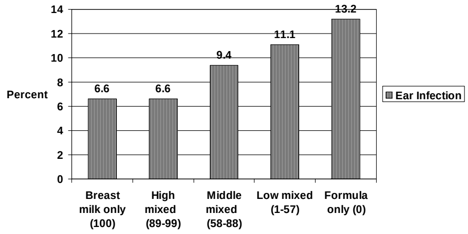
Frequency of acute otitis media in relation to feeding pattern and age, Sweden



Adapted from: Aniansson G, Alm B, Andersson B, Hakansson A et al. A prospective coherent study on breast-feeding and otitis media in Swedish infants. *Pediat Infect Dis J, 1994,* 13: 183-188.

Transparency 2.12

Percentage of infants 2-7 months of age reported as experiencing ear infections, by feeding category in the preceding month in the U.S.



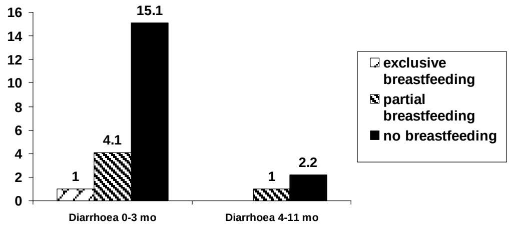
Adapted from: Scariati PD, Grummer-Strawn LM, and Fein SB. A longitudinal analysis of infant morbidity and the extent of breastfeeding in the United States. *Pediatrics,* 1997, 99(6).

Transparency 2.13

Protective effect of breastfeeding on infant mortality

Transparency 2.14

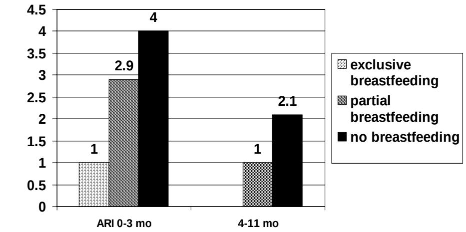
Relative risks of death from diarrhoeal disease by age and breastfeeding category in Latin America



Adapted from: Betran AP, de Onis M, Lauer JA, Villar J. Ecological study of effect of breast feeding on infant mortality in Latin America. *BMJ,* 2001, 323: 1-5.

Transparency 2.15

Relative risks of death from acute respiratory infections by age and breastfeeding category in Latin America



Adapted from: Betran AP, de Onis M, Lauer JA, Villar J. Ecological study of effect of breast feeding on infant mortality in Latin America. *BMJ,* 2001, 323: 1-5.

Transparency 2.16

Breastfeeding reduces the risk of chronic disease

Transparency 2.17

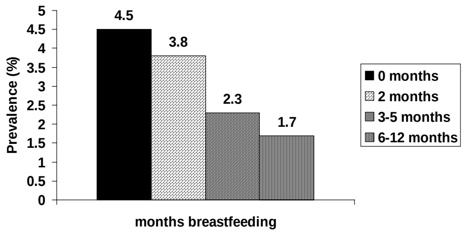
Breastfeeding decreases the risk of allergic disorders – a prospective birth cohort study

Type of feeding	Asthma	Atopic dermatitis	Allergic rhinitis
Children exclusively breastfed 4 months or more	7.7%	24%	6.5%
Children breastfed for a shorter period	12%	27%	9%

Adapted from Kull I. et al. Breastfeeding and allergic diseases in infants - a prospective birth cohort study. *Archives of Disease in Childhood* 2002: 87:478-481.

Transparency 2.18

Breastfeeding decreases the prevalence of obesity in childhood at age five and six years, Germany



Adapted from: von Kries R, Koletzko B, Sauerwald T et al. Breast feeding and obesity: cross sectional study. *BMJ,* 1999, 319:147-150.

Transparency 2.19

Breastfeeding has psychosocial and developmental benefits

Transparency 2.20

Intelligence quotient by type of feeding

BF 2 points higher than FF Study in 3-7 year-olds 1982

BF 2.1 points higher than FF Study in 6 months to 2 year- olds 1988

BM 7.5 points higher than no BM Study in 7.5-8 year-olds 1992

BF 12.9 points higher than FF Study in 9.5 year-olds 1996

BF 8.3 points higher than FF Study in 7.5-8 year-olds 1992

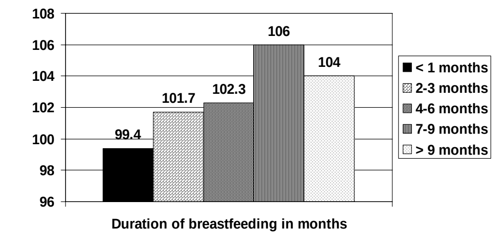
References:

- *Fergusson DM et al. Soc SciMed 1982*
- *Morrow-Tlucak M et al. SocSciMed 1988*
- *Lucas A et al. Lancet 1992*
- *Riva Eet al. Acta Paediatr 1996*

BF = breastfed
FF = formula fed
BM = breast milk

Transparency 2.21

Duration of breastfeeding associated with higher IQ scores in young adults, Denmark



Adapted from: Mortensen EL, Michaelsen KF, Sanders SA, Reinisch JM. The association between duration of breastfeeding and adult intelligence. *JAMA,* 2002, 287: 2365-2371.

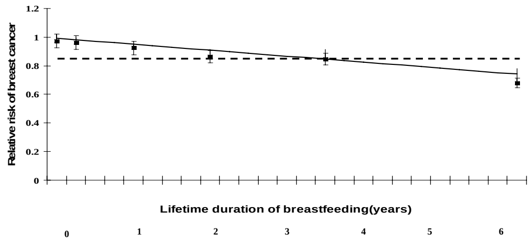
Transparency 2.22

Benefits of breastfeeding for the mother

- Protects mother's health
  - helps reduces risk of uterine bleeding and helps the uterus to return to its previous size
  - reduces risk of breast and ovarian cancer
- Helps delay a new pregnancy
- Helps a mother return to pre-pregnancy weight

Transparency 2.23

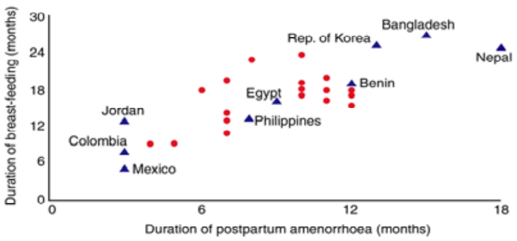
Breast cancer and breastfeeding: Analysis of data from 47 epidemiological studies in 30 countries



Adapted from: Beral V et al. (Collaborative group on hormonal factors in breast cancer). Breast cancer and breastfeeding: collaborative reanalysis of individual data from 47 epidemiological studies in 30 countries… *Lancet* 2002; 360: 187-95.

Transparency 2.24

Relationship between duration of breastfeeding and postpartum amenorrhoea (in months)



Adapted from: Saadeh R, Benbouzid D. Breast-feeding and child spacing: importance of information collection to public health policy. *Bulletin of the WHO*, 1990, 68(5) 625-631.

Transparency 2.25

Risks of artificial feeding

- Interferes with bonding
- More diarrhoea and respiratory infections
- Persistent diarrhoea
- Malnutrition
  Vitamin A deficiency
- More likely to die

Mother

- More allergy and milk intolerance
- Increased risk of some chronic diseases
- Overweight
- Lower scores on intelligence tests
- May become pregnant sooner
- Increased risk of anaemia, ovarian and breast cancer

Adapted from: Breastfeeding counselling: A training course. Geneva, World Health Organization, 1993 (WHO/CDR/93.6).

Slide 2.26

Benefits of breastfeeding for the family

- Better health, nutrition, and well-being
- Economic benefits
  - breastfeeding costs less than artificial feeding
  - breastfeeding results in lower medical care costs

Transparency 2.27

Benefits of breastfeeding for the hospital

- Warmer and calmer emotional environment
- No nurseries, more hospital space
- Fewer neonatal infections
- Less staff time needed
- Improved hospital image and prestige
- Fewer abandoned children
- Safer in emergencies

Transparency 2.28

Handout 2.2

Infant and young child feeding: Recommendations for practice[1]

The Expert Consultation recommends exclusive breastfeeding for 6 months, with introduction of complementary foods and continued breastfeeding thereafter. This recommendation applies to populations. The Expert Consultation recognizes that some mothers will be unable to, or chose not to, follow this recommendation. These mothers should also be supported to optimize their infants' nutrition.

The proportion of infants exclusively breastfed at 6 months can be maximized if potential problems are addressed:

- The nutritional status of pregnant and lactating mothers.
- Micronutrient status of infants living in areas with high prevalence of deficiencies such as iron, zinc, and vitamin A.
- The routine primary health care of individual infants, including assessment of growth and of clinical signs of micronutrient deficiencies.

The Expert Consultation also recognizes the need for complementary feeding at 6 months of age and recommends the introduction of nutritionally adequate, safe, and appropriate complementary foods, in conjunction with continued breastfeeding.

The Expert Consultation recognizes that exclusive breastfeeding to 6 months is still infrequent. However, it also notes that there have been substantial increases over time in several countries, particularly where lactation support is available. A prerequisite to the implementation of these recommendations is the provision of adequate social and nutritional support to lactating women.

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[1] From *The optimal duration of exclusive breastfeeding, Report of an expert consultation, Geneva, Switzerland 28-30 March 2001,* Department of Nutrition for Health and Development and Department of Child and Adolescent Health and Development, Geneva, World Health Organization, 2001, page 2 (WHO/NHD/01.09, WHO/FCH/CAH/01.24) (http://www.who.int/child-adolescent-health/publications/NUTRITION/WHO_FCH_CAH_01.24.htm).

Handout 2.3

Exclusive breastfeeding:
The only water source young infants need

FAQ Sheet 5 Frequently Asked Questions (FAQ) October 2002

Healthy newborns enter the world well hydrated and remain so if breastfed exclusively, day and night, even in the hottest, driest climates. Nevertheless, the practice of giving infants water during the first six months—the recommended period for exclusive breastfeeding—persists in many parts of the world, with dire nutritional and health consequences. This FAQ discusses these consequences and the role of breastfeeding in meeting an infant's water requirements.

Q *Why is exclusive breastfeeding recommended for the first six months?*

International guidelines recommend exclusive breastfeeding for the first six months based on scientific evidence of the benefits for infant survival, growth, and development. Breast milk provides all the energy and nutrients that an infant needs during the first six months. Exclusive breastfeeding reduces infant deaths caused by common childhood illnesses such as diarrhea and pneumonia, hastens recovery during illness, and helps space births.

Q *Is early supplementation with water a common practice? And if so, why?*

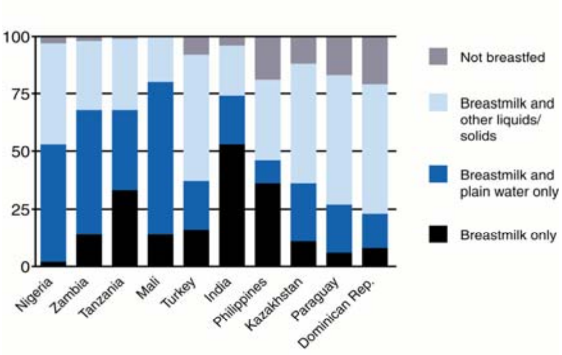
T The practice of giving water and other liquids such as teas, sugar water, and juices to breastfed infants in the first months is widespread throughout the world, as illustrated in Figure 1. This practice often begins in the first month of life. Research conducted in the outskirts of Lima, Peru showed that 83 percent of infants received water and teas in the first month. Studies in several communities of the Gambia, the Philippines, Egypt, and Guatemala reported that over 60 percent of newborns were given sugar water and/or teas.

The reasons given for water supplementation of infants vary across cultures. Some of the most common reasons are:

- necessary for life
- quenches thirst
- relieves pain (from colic or earache)
- prevents and treats colds and constipation
- soothes fretfulness

Cultural and religious beliefs also influence water supplementation in early infancy. Proverbs passed down from generation to generation advise mothers to give babies water. Water may be viewed as the source of life—a spiritual and physiological necessity. Some

Figure 1. Feeding Practics Among Young Infants



Source: Demographic and Health Surveys, 1990-1995.
Based on 24 hour recall for respondents' children under 4 months of age at time of survey

cultures regard the act of offering water to the newborn as a way of welcoming the child into the world.

The advice of health care providers also influences the use of water in many communities and hospitals. For example, a study in a Ghanaian city found that 93 percent of midwives thought that water should be given to all infants beginning on the first day of life. In Egypt many nurses advised mothers to give sugar water after delivery.

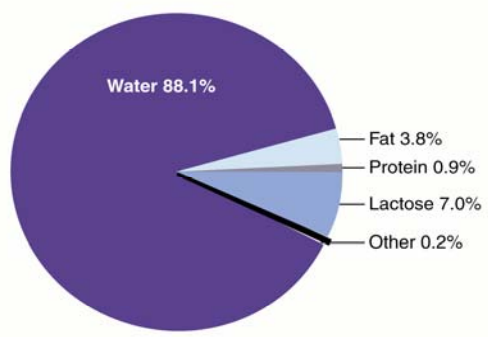
Q How do breastfed babies get enough water?

Depending on temperature, humidity, and the infant's weight and level of activity, the average daily fluid requirements for healthy infants ranges from 80–100 ml/kg in the first week of life to 140–160 ml/kg between 3–6 months. These amounts are available from breast milk alone if breastfeeding is exclusive and unrestricted (on-demand day and night) for two reasons:

Breast milk is 88 percent water. The water content of breast milk consumed by an exclusively breastfed baby meets the water requirements for infants and provides a considerable margin of safety. Even though a newborn gets little water in the thick yellowish first milk (colostrum), no additional water is necessary because a baby is born with extra water. Milk with higher water content usually "comes in" by the third or fourth day. Figure 2 shows the principal components of breastmilk.

Breastmilk is low in solutes. One of the major functions of water is to flush out, through the urine, excess solutes. Dissolved substances (for example, sodium, potassium, nitrogen, and chloride) are referred to as solutes. The kidneys—though immature up to the age of approximately three months—are able to concentrate excess solutes in the urine to maintain a healthy, balanced body chemistry. Because breastmilk is low in solutes, the infant does not need as much water as an older child or adult.

Figure 2. Composition of Breastmilk



Source: Lawrence R. *Breastfeeing: A guide for the medical profession.* 4th ed. St. Louis:Mosby-Year Book, Inc. 1994.

Q What about infants in hot, dry climates?

Water in breast milk exceeds the infant's water requirements in normal conditions and is adequate for breastfed infants in hot, dry climates. Studies indicate that healthy, exclusively breastfed infants in the first six months of life do not require additional fluids even in countries with extremely high temperatures and low humidity. Solute levels in the urine and blood of exclusively breastfed babies living in these conditions were within normal ranges, indicating adequate water intakes.

Q Can giving water to an infant before six months be harmful?

Offering water before the age of six months can pose significant health hazards.

Water supplementation increases the risk of malnutrition. Displacing breast milk with a fluid of little or no nutritional value can have a negative impact on an infant's nutritional status, survival, growth, and development.

Consumption of even small amounts of water or other liquids can fill an infant's stomach and reduce the baby's appetite for nutrient-rich breast milk. Studies show that water supplementation before the age of six months can reduce breast milk intake by up to 11 percent. Glucose water supplementation in the first week of life has been associated with greater weight loss and longer hospital stays.

Water supplementation increases the risk of illness. Water and feeding implements are vehicles for the introduction of pathogens. Infants are at greater risk of exposure to diarrhea-causing organisms, especially in environments with poor hygiene and sanitation. In the least developed countries, two in five people lack access to safe drinking water. Breast milk ensures an infant's access to an adequate and readily available supply of clean water.

Research in the Philippines confirms the benefits of exclusive breastfeeding and the harmful effect of early supplementation with non-nutritive liquids on diarrheal disease. Depending on age, an infant was two to three times more likely to experience diarrhea if water, teas, and herbal preparations were fed in addition to breast milk than if the infant was exclusively breastfed.

Q *Should water be given to breastfed infants who have diarrhea?*

In the case of mild diarrhea, increased frequency of breastfeeding is recommended. When an infant has moderate to severe diarrhea, caregivers should immediately seek the advice of health workers and continue to breastfeed, as recommended in the Integrated Management of Childhood Illness (IMCI) guidelines. Infants that appear dehydrated may require Oral Rehydration Therapy (ORT), which should only be given upon advice of a health worker.[2]

Q ***How can programs address the common practice of water supplementation?***

To address the widespread practice of water supplementation in early infancy, program managers should understand the cultural reasons for this practice, analyze existing data, conduct household trials of improved practices, and develop effective communication strategies for targeted audiences. Health care providers and community volunteers need to be informed that breast milk meets the water requirements of an exclusively breastfed baby for the first six months. They may also require training on how to communicate messages and negotiate behavior change. Examples of messages developed in breastfeeding promotion programs that address local beliefs and attitudes about the water needs of infants are shown in the box.

Providing accurate information, tailoring messages to address the beliefs and concerns of different audiences, and negotiating with mothers to try out a new behavior can help establish exclusive breastfeeding as a new community norm

[2]Oral Rehydration Solution (ORS), used in ORT, helps replace water and electrolytes lost during episodes of diarrhea. Super ORS, with a carbohydrate base of rice or cereal for better absorption, has been developed to improve treatment.

Communicating the Message “Don’t Give Water”

The following messages have been used in programs to convince mothers, their families, and health workers that exclusively breastfed infants do not need to be given water in the first six months. The most effective ways of communicating the messages depend on the audience and the practices, beliefs, concerns, and constraints to good practices in a particular setting.

Make clear the meaning of exclusive breastfeeding

- Exclusive breastfeeding means giving only breast milk. This means no water, liquids, teas, herbal preparations, or foods through the first six months of life. (It is important to name the drinks and foods commonly given in the first six months. One program found that women did not think the advice “do not give water” applied to herbal teas or other fluids.)

Take ideas often associated with water and apply them to colostrum

- Colostrum is the welcoming food for newborns. It is also the first immunization, protecting a baby from illness.

- Colostrum cleans the newborn’s stomach. Sugar water is not needed.

Explain why exclusively breastfed babies do not need water

- Breast milk is 88 percent water.

- Every time a mother breastfeeds, she gives her baby water through her breast milk.

- Breast milk has everything a baby needs to quench thirst and satisfy hunger. It is the best possible food and drink that can be offered a baby so the baby will grow to be strong and healthy.

Point out the risks of giving water

- Giving water to babies can be harmful and cause diarrhea and illness. Breast milk is clean and pure and protects against disease.

- An infant’s stomach is small. When the baby drinks water, there is less room left for the nourishing breast milk that is necessary for the infant to grow strong and healthy.

Link good breastfeeding practices to adequate fluid intake

- When a mother thinks her baby is thirsty, she should breastfeed immediately. This will give the baby all the water that is needed.

- The more often a woman breastfeeds, the more breast milk is produced, which means more water for the baby.

Q *What are the water needs of children after six months of age?*

Guidelines for water intake after six months are less clear than for the first half of infancy. At six months complementary foods—foods given in addition to breast milk to meet an infant's increased nutrient requirements—should be introduced. The types of foods a child consumes will affect the child's water needs. For the most part, the water requirements of infants 6–11 months can be met through breast milk. Additional water can be provided through fruits or fruit juices, vegetables, or small amounts of *boiled* water offered after a meal.

Caution should be taken to ensure that water and other liquids do not replace breast milk. Water can also replace or dilute the nutrient content of energy-dense complementary foods. Gruels, soups, broths, and other watery foods given to infants usually fall below the recommended energy density for complementary foods (0.6 kcal/g). Reducing the amount of water added to these foods could improve the nutritional status of children in this age group.

Related LINKAGES Publications

- Facts for Feeding: Birth, Initiation of Breastfeeding, and the First Seven Days after Birth, 2002
- Facts for Feeding: Breastmilk: A Critical Source of Vitamin A for Infants and Young Children, 2000
- Facts for Feeding: Recommended Practices to Improve Infant Nutrition during the First Six Months, 2001
- Quantifying the Benefits of Breastfeeding: A Summary of the Evidence, 2002
- Recommended Feeding and Dietary Practices to Improve Infant and Maternal Nutrition, 2001

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Armelini PA, Gonzalez CF. Breastfeeding and fluid intake in a hot climate. *Clin Pediatr* 1979; 18: 424–5.

Brown K, et al. (1989). Infant-feeding practices and their relationship with diarrheal and other diseases in Huascar (Lima), Peru. *Pediatrics* 1989 Jan;83(1):31–40.

Glover J and Sandilands M. Supplementation of breastfeeding infants and weight loss in hospital. *J Hum Lact* 1990 Dec;6(4):163–6.

Goldberg NM, Adams E. Supplementary water for breast-fed babies in a hot and dry climate – not really a necessity.*Arch Dis Child* 1983; 58:73–74.

Hosssain M et al. Prelacteal infant feeding practices in rural Egypt. *J Trop Pediatr* 1992 Dec; 38(6):317–22.

Popkin BM et al. Breast-feeding and diarrheal morbidity. *Pediatrics* 1990 Dec;86(6):874–82.

Sachdev HPS et al. Water supplementation in exclusively breastfed infants during summer in the tropics. *Lancet* 1991 April ; 337:929–33.

Victora C et al. Infant feeding and deaths due to diarrhea: A case-control study. *Am J Epidemiol* 1989 May;129(5):1032–41.

World Health Organization. Breastfeeding and the use of water and teas. Division of Child Health and Development Update, No. 9 (reissued Nov. 1997).

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Handout 2.4

UNICEF UK BABY-FRIENDLY INITIATIVE: Health benefits of breastfeeding

There has been significant reliable evidence produced over recent years to show that breastfeeding has important advantages for both infant and mother, even in the industrialised countries of the world.

Below is a selected list of recently-published studies describing differences in health outcome associated with method of infant feeding. The studies have all adjusted for social and economic variables. All were conducted in an industrialised setting.

We also provide a list of additional health issues with which breastfeeding has been associated by some researchers. Many of these require further investigation to clarify any protective effect of breastfeeding and are included here for the interest and information of readers.

To receive updates by e-mail from the Baby Friendly Initiative on research into breastfeeding click here.

This page was last updated on 3 March 2004

Artificially-fed babies are at greater risk of:

gastro-intestinal infections
respiratory infections
necrotising enterocolitis
urinary tract infections
ear infections
allergic disease (eczema, asthma and wheezing)
insulin-dependent diabetes mellitus

and breastfed babies may have better:

neurological development

Other studies of health and breastfeeding:

cardiovascular disease in later life
childhood cancer
breastfeeding, bed sharing and cot death
breastfeeding and HIV transmission
breastfeeding and dental health

Women who breastfed are at lower risk of:

breast cancer
ovarian cancer
hip fractures and bone density

Other potential protective effects of breastfeeding (more research needed):
for the infant:

multiple sclerosis
acute appendicitis
tonsillectomy

for the mother:

rheumatoid arthritis

Source: http://www.babyfriendly.org.uk/health.asp

Gastro-intestinal infections

Howie PW et al. (1990). Protective effect of breastfeeding against infection. *BMJ* 300: 11-16.
674 infants were investigated for the relationship between infant feeding and infectious illness. The incidence of gastro-intestinal illness in infants who were exclusively breastfed for 13 weeks or more was 2.9% (after adjusting for confounders). Those who were partially breastfed had an incidence of 15.7% and those who were exclusively artificially fed 16.7%. Therefore bottle-fed infants were at five times the risk of developing gastro-intestinal illness. Interestingly, the study also noted that breastfeeding exclusively for 13 weeks or more was associated with significant protection beyond the period of breastfeeding itself. However, no significant reduction in the incidence of otitis media was found.

Respiratory infections

Wilson AC et al. (1998). Relation of infant diet to childhood health: seven year follow up cohort of children in Dundee infant feeding study. *BMJ*316: 21-25.
This study followed infants from the above cohort into childhood. Subjcts were studied at 7 years of age. After adjustment for significant confounding variables, the estimated probability of ever having respiratory illness was 17% [95% CI: 15.9%-18.1%] for those children exclusively breastfed for at least 15 weeks, 31% [26.8%-35.2%] for those partially breastfed and 32% [30.7%-33.7%] for those who were artificially fed. This means that the bottle-fed infants were at almost twice the risk of developing respiratory illness at any time during the first 7 years of life. This study also found solid feeding before 15 weeks was associated with an increased probability of wheeze during childhood (21.0% [19.9% to 22.1%] v 9.7% [8.6% to 10.8%]) as well as increased percentage body fat and weight in childhood. Systolic blood pressure was raised significantly in children who were exclusively bottle fed compared with children who received breast milk (mean 94.2 (93.5 to 94.9) mm Hg v 90.7 (89.9 to 91.7) mm Hg).

Oddy WH et al (2003). Breast feeding and respiratory morbidity in infancy: a birth cohort study. Archives of Disease in Childhood. 88:224-228 [Abstract]
This study of 2602 children in Australia has found that hospital, doctor, or clinic visits and hospital admissions for respiratory illness and infection in the first year of life are significantly lower among babies who are predominantly breasfed. Stopping predominant breastfeeding before six months and stopping breastfeeding before eight months was associated with a significantly increased risk of wheezing lower respiratory illnesses. Upper respiratory tract infections were significantly more common if predominant breastfeeding was stopped before 2 months or if partial breastfeeding was stopped before 6 months.

Galton Bachrach VR et al (2003). Breastfeeding and the risk of hospitalisation for respiratory disease in infancy. A meta-analysis. Arch Pediatr Adolesc Med 157:237-243 [Abstract]
This meta-analysis of studies from developed countries concludes that the risk of severe respiratory tract illness resulting in hospitalisation is more than tripled among infants who are not breastfed, compared with those who are exclusively breastfed for 4 months (relative risk = 0.28; 95% CI 0.14 - 0.54).

See also:
Wright AL et al. (1989) Breast feeding and lower respiratory tract illness in the first year of life. *BMJ* 299: 946-9

Necrotising Enterocolitis (NEC)

Lucas A & Cole TJ (1990). Breast milk and neonatal necrotising enterocolitis. *Lancet* 336: 1519-1522.
926 preterm infants were studied, 51 of whom developed NEC. Exclusively formula fed infants were 6 to 10 times more likely to develop NEC than those who received breastmilk. Although NEC is rare in babies over 30 weeks gestation, it was 20 times more common if the baby had received no breastmilk.

Urinary tract infection

Pisacane A, Graziano L & Zona G (1992). Breastfeeding and urinary tract infection. *J Pediatr* 120: 87-89.
128 hospitalised infants with urinary tract infection were compared with 128 hospitalised control infants. All infants were less than 6 months old. The infants were matched for age, gender, social class, birth order and maternal smoking habits, Infants who were exclusively bottle fed at the time of admission to the hospital were more than five times as likely to have urinary tract infections compared to those who were breastfed.

Ear infections

Duncan B et al. (1993). Exclusive breast feeding for at least 4 months protects against otitis media. *Pediatrics* 5: 867-872.
1013 infants were studied during the first year of life to assess the relationship between infant feeding and acute and recurrent otitis media. 467 infants had at least one episode and 169 had recurrent otitis media. Infants exclusively breastfed for at least 4 months had 50% fewer episodes of otitis media and those partially breastfed had 40% fewer episodes.

Aniansson G et al. (1994). A prospective cohort study on breast feeding and otitis media in Swedish infants. *Pediatr Infect Dis J* 13: 183-188
400 infants were studied at 2, 6, 10 and 12 months of age. Breastfed babies had significantly lower incidence of acute otitis media at every stage.

See also:
Paradise JL, Elster BA, Tan L (1994) Evidence in infants with cleft palate that breast milk protects against otitis media. *Pediatrics* 94: 853-60
Niemelä M et al (2000) Pacifier as a risk factor for acute otitis media: a randomized, controlled trial of parental counseling. *Pediatrics* 106: 483-488

Allergic disease (eczema, asthma and wheezing)

Saarinen UM & Kajosaari M (1995). Breastfeeding as prophylaxis against atopic disease: prospective follow-up study until 17 years old. *Lancet* 346: 1065-1069.
150 children were studied up to the age of 17 years to determine the effect on atopic disease of breastfeeding. The subjects were divided into three groups: prolonged (>6 months) intermediate (1-6 months) and short or no (<1 month) breastfeeding. They were followed up at 1, 3, 5, 10 and 17 years. The prevalence of manifest atopy throughout follow-up was highest in the group who had little or no breastfeeding. Breastfeeding for longer than 1 month without other milk supplements was associated with a significant reduction in the incidence of food allergy at 3 years of age, and also respiratory allergy at 17 years of age. Six months of breastfeeding was associated with significantly less eczema during the first 3 years and less substantial atopy in adolescence.

Lucas A et al. (1990). Early diet of preterm infants and development of allergic or atopic disease: Randomised prospective study. *BMJ* 300: 837-840.
Preterm infants were randomly allocated to receive preterm formula or banked human milk, alone or as supplements to the mother's own milk. The use of human milk was associated with a significantly-reduced incidence of allergic disease, particularly eczema at 18 months in those with a family history of atopic disease. In those without a family history there was no effect.

Oddy WH et al. (1999) Association between breastfeeding and asthma in 6 year old children: findings of a prospective birth cohort study. *BMJ* 319: 815-819.
An Australian study followed 2187 children from birth to age 6 years and found that the introduction of milk other than breastmilk before 4 months of age was a significant risk factor for asthma (odds ratio 1.25; 95% CI 1.02-1.52) after adjustment for confounders. It was also a risk factor for wheeze three or more times since 1 year of age (1.41; 1.14-1.76), wheeze in the past year (1.31; 1.05 to 1.64), sleep disturbance due to wheeze within the past year (1.42; 1.07-1.89) and positive skin prick test reaction to at least one common aeroallergen (1.30; 1.04-1.61).

Oddy WH et al (2002). Maternal asthma, infant feeding, and the risk of asthma in childhood. *J Allergy Clin Immunol* 110: 65-7.
Children aged 6 years were more likely to be asthma sufferers if they had not been exclusively breastfed for at least 4 months, regardless of their mother's asthma status (odds ratio, 1.35; 95% CI 1.00-1.82).

See also:

Kull I et al (2002). Breast feeding and allergic diseases in infants--a prospective birth cohort study. *Arch Dis Child* 87: 478-481.
Wilson AC et al. (1998). Relation of infant diet to childhood health: seven year follow up cohort of children in Dundee infant feeding study. *BMJ* 316: 21-25.(summarised above)
Wright AL et al (1995) Relationship of infant feeding to recurrent wheezing at age 6 years. *Arch Pediatr Adolesc Med* 149: 758-63

Insulin-dependent diabetes mellitus

Gerstein HC (1994). Cows' milk exposure and type 1 diabetes mellitus. *Diabetes Care* 17: 13-19.
This analysis pooled results from 19 studies of the relationship between infant feeding and insulin dependent diabetes mellitus (IDDM) selected to minimise bias. It concluded that early onset IDDM patients were more likely than healthy controls to have been breastfed for less than 3 months. In separate analyses it also found the IDDM patients were more likely to have been exposed to cows' milk protein before 4 months of age. It estimated that up to 30% of type 1 diabetes cases could be prevented by removing cows' milk products from the diet of 90% of the population in the first 3 months.

Karjalainen J et al. (1992). A bovine albumin peptide as a possible trigger of insulin-dependent diabetes mellitus. *New Engl J Med* 327: 302-307.
This study found that newly diagnosed diabetic children had a much higher level of IgG anti-BSA (bovine serum albumin) than controls. This antibody to a cows' milk protein, BSA, has some structural homology with the pancreatic islet b-cell surface antigen p69. The authors speculated that anti-BSA antibodies attack b-cells in genetically-predisposed children.

Virtanen SM et al. (1991). Infant feeding in children <7 years of age with newly diagnosed IDDM. *Diabetes Care* 14: 415-417.
This case-control study involving nearly 700 diabetic children found that the risk of insulin dependent diabetes was doubled in children who were exclusively breastfed for less than 2 months and doubled among those introduced to dairy products at less than 2 months of age. The risk was lowest in those exclusively breastfed for longest. In multivariate analyses, the introduction of cows' milk products was the most important risk factor. This suggests, along with the previous study, that formula feeding in infancy plays a part in the pathogenesis of juvenile onset diabetes mellitus.

See also:
Paronen J et al (2000) Effect of cow's milk exposure and maternal type 1 diabetes on cellular and humoral immunization to dietary insulin in infants at genetic risk for type 1 diabetes. Finnish Trial to Reduce IDDM in the Genetically at Risk Study Group. *Diabetes* 49: 1657-65.
Young TK et al (2002). Type 2 Diabetes Mellitus in Children: Prenatal and Early Infancy Risk Factors Among Native Canadians. *Arch Pediatr Adolesc Med* 156: 651-655.
Mayer EJ et al (1988) Reduced risk of IDDM among breast-fed children. The Colorado IDDM Registry. *Diabetes* 37: 1625-32.

Other studies of interest (requiring further substantiation) on health benefits for the infant:
Pisacane A et al (1994) Breast feeding and multiple sclerosis. *BMJ* 308: 1411-2
Pisacane A et al (1995) Breast feeding and acute appendicitis. *BMJ* 310: 836-7
Pisacane, A et al. (1996) Breast feeding and tonsillectomy. *BMJ* 312: 746-747

Neurological development

Anderson JW et al (1999) Breastfeeding and cognitive development: a meta-analysis. *Am J Clin Nutr* 70: 525-35.
A meta-analysis of observed differences from 20 studies in cognitive development between breast-fed and formula-fed children, which found - after adjustment for appropriate key cofactors - that breastfeeding was associated with significantly higher scores for cognitive development and that the developmental benefits of breastfeeding increased with duration of feeding. After adjustment for covariates, the increment in cognitive function was 3.16 (95% CI: 2.35, 3.98) points. Significantly higher levels of cognitive function were seen in breastfed than in formula-fed children at 6-23 months of age and these differences were stable across successive ages. Low-birth-weight infants showed larger differences (5.18 points; 95% CI: 3.59, 6.77) than did normal-birth-weight infants (2.66 points; 95% CI: 2.15, 3.17).

Lucas A et al. (1992). Breastmilk and subsequent intelligence quotient in children born preterm. *Lancet* 339: 261-264.
300 children who had been born preterm were studied at the age of 7-8 years. After controlling for social class, maternal education, birth weight, gestational age, birth rank, infant sex and maternal age it was discovered that those children who had been fed breastmilk in the early weeks of life had an 8.3 point advantage in intelligence quotient (I.Q.) over those who had received artificial milk. This advantage was associated with being fed mother's milk by tube rather than with the process of breastfeeding. There was a dose-response relation between the proportion of breastmilk in the diet and subsequent I.Q. Children whose mothers chose to provide breastmilk but failed to do so had the same I.Q. as those whose mothers elected to feed artificially.

Morrow-Tlucak M, Haude RH & Ernhart CB (1988). Breastfeeding and cognitive development in the first two years of life. *Soc Sci Med* 26: 71-82.
This study measured cognitive development in children at the age of 2 years. It adjusted for ethnic group, smoking, alcohol consumption, maternal intelligence quotient and attitude. Using the Bayley scale, it showed that those breastfed for four months or less had a 3.7 point advantage over those artificially fed. Those fed for over four months were at a 9.1 point advantage. As with the above study, this study shows a dose response relationship between the duration of breastfeeding and the subsequent I.Q.

Vestergaard M et al (1999) Duration of breastfeeding and developmental milestones during the latter half of infancy. *Acta Paediatr* 88: 1327-32.
Aiming to reduce the role of environmental influence, this study examined infants before 1 year of age. Motor skills and early language development were evaluated at 8 months of age in 1656 healthy, singleton, term infants, with a birthweight of at least 2500g. The proportion of infants who mastered the specific milestones increased consistently with increasing duration of breastfeeding. The relative risk for the highest versus the lowest breastfeeding category was 1.3 (95% CI: 1.0-1.6) for crawling, 1.2 (95% CI: 1.1-1.3) for pincer grip and 1.5 (95% CI: 1.3-1.8) for polysyllable babbling. Little change was found after adjustment for confounding.

Mortensen EL et al (2002). The association between duration of breastfeeding and adult intelligence. *JAMA* 287: 2365-71.
Babies who are breastfed for longest grow up to have significantly increased intelligence as adults according to this study among two samples of Danish adults born between 1959 and 1961.

See also:
Uauy and Peirano (1999) Breast is best: human milk is the optimal food for brain development. *Am J Clin Nutr* 70: 433-434
Fewtrell MS et al (2002). Double-blind, randomized trial of long-chain polyunsaturated fatty acid supplementation in formula fed to preterm infants. *Pediatrics* 110: 73-82.

Breast cancer

Collaborative Group on Hormonal Factors in Breast Cancer (2002). Breast cancer and breastfeeding: collaborative reanalysis of individual data from 47 epidemiological studies in 30 countries, including 50 302 women with breast cancer and 96 973 women without the disease. *Lancet* 360: 187-95.
A review of 47 breast cancer studies that included information on breastfeeding patterns found that the longer women breastfeed, the more they are protected against breast cancer. The relative risk of breast cancer decreased by 4·3% (95% CI 2·9-5·8; p<0·0001) for every 12 months of breastfeeding. The relative risk remained after controlling for developed versus developing country location, women's age, menopausal status, ethnic origin, parity, her age when her first child was born, or any of nine other personal characteristics examined.
The study group estimate that the cumulative incidence of breast cancer in developed countries would be reduced by more than half (from 6·3 to 2·7 per 100 women by age 70) if women had the average number of births and lifetime duration of breastfeeding that had been prevalent in developing countries until recently. Breastfeeding could account for almost two-thirds of this estimated reduction in breast cancer incidence.

United Kingdom National Case-Control Study Group (1993). Breast feeding and risk of breast cancer in young women. *BMJ* 307: 17-20.
This study of women living in 11 UK health districts matched 755 cases with 675 controls. It showed that the risk of developing breast cancer before the age of 36 was negatively correlated with both the duration of breastfeeding and number of babies breastfed. Adjustment was made for use of oral contraceptives, nulliparity, age at first birth, family history and age at menarche. Cases and controls were similar in respect of marital status, age at leaving school and alcohol consumption.

Newcomb PA et al. (1994). Lactation and a reduced risk of premenopausal breast cancer. *New Engl J Med* 330: 81-87.
This multi-centre trial in the USA included more than 14000 pre- and post-menopausal women. It concluded that breast cancer risk was 22% lower among pre-menopausal women who had ever breastfed than among those who had not. Total duration of lactation was also associated with a reduction in the risk of breast cancer among the pre-menopausal women. The authors of the study estimated that if all women with children breastfed for a total of 4-12 months, breast cancer among pre-menopausal women could be reduced by 11%. In addition, they suggested that if women with children breastfed for a lifetime total of 24 months or longer, the incidence of this form of breast cancer might be reduced by almost 25%.

See also:
Furberg H et al (1999). Lactation and breast cancer risk. *Int J Epidemiol* 28: 396-402.
Layde PM et al (1989) The independent associations of parity, age at first full term pregnancy, and duration of breastfeeding with the risk of breast cancer. Cancer and Steroid Hormone Study Group. *J Clin Epidemiol* 42: 963-73.
Michels KB et al (1996) Prospective assessment of breastfeeding and breast cancer incidence among 89,887 women. *Lancet* 347: 431-6. (this study found no reduced risk)

Ovarian cancer

Rosenblatt KA et al. (1993). Lactation and the risk of epithelial ovarian cancer - The WHO Collaborative Study of Neoplasia and Steroid Contraceptives. *Int J Epidemiol* 22: 499-503.
This multinational study showed a 20-25% decrease in the risk of ovarian cancer among women who lactated for at least 2 months per pregnancy, compared to those who had not. Little or no further decrease in risk was seen with increasing duration of lactation.

See also:
Gwinn ML et al (1990) Pregnancy, breast feeding, and oral contraceptives and the risk of epithelial ovarian cancer. *J Clin Epidemiol* 43: 559-68.

Hip fractures and bone density

Cumming RG & Klineberg RJ (1993). Breastfeeding and other reproductive factors and the risk of hip fractures in elderly women. *Int J Epidemiol* 22: 684-691.
In this study of 311 cases of hip fracture in women over the age of 65 years, it was found that parous women who had not breastfed had twice the risk of hip fracture as nulliparous women and those who had breastfed (after controlling for confounders).

Polatti F et al (1999). Bone mineral changes during and after lactation. *Obstet Gynecol* 94: 52-6.
Among 308 women who breastfed fully for 6 months, bone mineral density decreased during this time, but had increased by 18 months to a level higher than baseline.

See also:
Melton LJ 3d et al (1993) Influence of breastfeeding and other reproductive factors on bone mass later in life. *Osteoporos Int* 3: 76-83.
Sowers M et al (1993) Changes in bone density with lactation. *JAMA* 269: 3130-5.
Kalkwarf HJ, Specker BL (1995) Bone mineral loss during lactation and recovery after weaning. *Obstet Gynecol* 86: 26-32.
Sowers M et al (1995) A prospective study of bone density and pregnancy after an extended period of lactation with bone loss. *Obstet Gynecol* 85: 285-9.
Kalkwarf HJ (1999) Hormonal and dietary regulation of changes in bone density during lactation and after weaning in women. *J Mammary Gland Biol Neoplasia* 4: 319-29.

Other studies of interest (requiring further substantiation) on health benefits for the mother:
Brun JG, Nilssen S, Kvale G (1995) Breast feeding, other reproductive factors and rheumatoid arthritis. A prospective study. *Br J Rheumatol* 34: 542-6.

Risk factors for cardiovascular disease

Toscke AM et al. (2001) Overweight and obesity in 6- to 14-year-old Czech children in 1991: Protective effect of breast-feeding. *J Pediatr* 141: 764-9.
Data were collected in 1991 on 33768 children aged 6 to 14 years in the Czech Republic. Children who had ever been breastfed were less likely to be obese or overweight than those who had never been breastfed. After controlling for parental education, parental obesity, maternal smoking, high birth weight, watching television, number of siblings and physical activity, the adjusted odds ratio for breastfeeding were 0.80 for being overweight (95% CI, 0.71 to 0.90) and 0.80 for being obese (95% CI, 0.66 to 0.96).

von Kries R et al. (1999) Breastfeeding and obesity: cross sectional study. *BMJ* 319: 147-150.
In a study of 9357 German five and six year old children, those who had never been breastfed were more likely to be overweight or obese than those who had been breastfed. A dose response effect was identified - 4.5% of children who had never been breastfed were obese compared with 2.3% of children breastfed for 3-5 months, 1.7% of children breastfed for 6-12 months and 0.8% of children breastfed for more than 12 months. After adjusting for potential confounding factors, breastfeeding remained a significant protective factor against the development of obesity (odds ratio 0.75, 95% CI 0.57 to 0.98) and being overweight (0.79, 0.68 to 0.93). The study authors note that obese children have a high risk of becoming obese adults and suggest that increased breastfeeding duration may eventually result in a reduction in the prevalence of cardiovascular diseases and other diseases related to obesity.

Ravelli AC et al (2000) Infant feeding and adult glucose tolerance, lipid profile, blood pressure, and obesity. *Arch Dis Child* 82: 248-52.
Of 625 subjects aged 48-53 years born around the time of a severe period of famine in Amsterdam (1944-45), those were bottle fed at hospital discharge had greater risk factors for cardiovascular disease than those who were exclusively breast fed. They had a higher mean 120 minute plasma glucose concentration after a standard oral glucose tolerance test, a higher plasma low density lipoprotein (LDL) cholesterol concentration, a lower high density lipoprotein (HDL) cholesterol concentration, and a higher LDL/HDL ratio. Systolic blood pressure and body mass index were not

affected by the method of infant feeding.

Armstrong J et al (2002). Breastfeeding and lowering the risk of childhood obesity. *Lancet* 359: 2003-04.
A study of 32200 Scottish children aged 39-42 months found that the prevalence of obesity was significantly lower among those who had been breastfed, after adjusting for socioeconomic status, birthweight and gender (odds ratio 0.70, 95% CI 0.61-0.80).

See also:
Gillman MW et al (2001). Risk of overweight among adolescents who were breastfed as infants. *JAMA* 285: 2461-7.
Hediger ML et al (2001). Association between infant breastfeeding and overweight in young children. *JAMA* 285: 2453-60.
Wilson AC et al. (1998). Relation of infant diet to childhood health: seven year follow up cohort of children in Dundee infant feeding study. *BMJ* 316: 21-25. (summarised above)
Marmot MG et al (1980) Effect of breast-feeding on plasma cholesterol and weight in young adults. *J Epidemiol Community Health* 34: 164-7.
Stettler N et al (2002). Infant weight gain and childhood overweight status in a multicenter, cohort study. *Pediatrics* 109: 194-9.

Childhood cancers

Shu XO et al (1999) Breast-feeding and risk of childhood acute leukemia. *J Natl Cancer Inst* 91: 1765-72.
Information regarding breastfeeding was obtained through telephone interviews with mothers of 1744 children with acute lymphoblastic leukaemia (ALL) and 1879 matched control subjects, aged 1-14 years, and of 456 children with acute myeloid leukaemia (AML) and 539 matched control subjects, aged 1-17 years. Ever having breastfed was found to be associated with a 21% reduction in risk of childhood acute leukaemia (odds ratio [OR] for all types combined = 0.79; 95% confidence interval [CI] = 0.70-0.91). The inverse associations were stronger with longer duration of breastfeeding. The authors acknowledge the need for further investigation.

Mathur GP et al (1993) Breastfeeding and childhood cancer. *Indian Pediatr* 30: 651-7.
Total duration of breastfeeding and of exclusive breastfeeding was studied and compared in 99 childhood cancer cases and 90 controls. The difference between the average duration of breastfeeding in cases and controls was significant for all cancers ($p<0.05$) and for lymphoma ($p<0.01$). When average duration of exclusive breastfeeding was compared, the difference was highly significant for all cancers ($p<0.001$) and for lymphoma ($p<0.001$). Cases and controls were not different with respect to their age, sex, birth year, birth order, age and educational status of mothers, smoking of fathers and socioeconomic status but a positive family history of cancer was present in 4 cases compared with only 1 control.

See also:
Davis MK (1998) Review of the evidence for an association between infant feeding and childhood cancer. *Int J Cancer Suppl* 11: 29-33.

Breastfeeding, bed-sharing and cot death (SIDS)

Research has found associations between breastfeeding and reduced risk of Sudden Infant Death Syndrome (SIDS or cot death) as well as between bed-sharing and successful breastfeeding. Babies sharing a bed with their mother are at greater risk of cot death if a parent smokes, but there is no increased risk for non-smokers.

Blair PS et al (1999) Babies sleeping with parents: case-control study of factors influencing the risk of sudden infant death syndrome. *BMJ*319: 1457-62.
A three year, case-control study of 325 babies who died and 1300 control infants concluded that there

is no association between infants sharing the parental bed and an increased risk of sudden infant death syndrome among parents who do not smoke or infants older than 14 weeks.
There was an increased risk for infants who shared the bed for the whole sleep or were taken to and found in the parental bed (9.78, 95% CI: 4.02 - 23.83), but which was not significant for infants of parents who did not smoke or for older infants (>14 weeks). This risk also became non-significant after adjustment for recent maternal alcohol consumption (>2 units), use of duvets (>4 togs), parental tiredness (infant slept 4 hours for longest sleep in previous 24 hours), and overcrowded housing conditions (>2 people per room of the house). Infants who slept in a separate room from their parents were at greater risk (10.49; 4.26 - 25.81), as were infants who co-slept with a parent on a sofa (48.99; 5.04 - 475.60).

See also:
Klonoff-Cohen H, Edelstein SL (1995) Bed sharing and the sudden infant death syndrome. *BMJ* 311: 1269-72.

Ford RP et al (1993) Breastfeeding and the risk of sudden infant death syndrome. *Int J Epidemiol* 22: 885-90.
The New Zealand Cot Death Study reviewed data on 356 infant deaths classified as SIDS and 1529 control infants over 3 years. Cases stopped breastfeeding sooner than controls: by 13 weeks, 67% controls were breastfed versus 49% cases. A reduced risk for SIDS in breastfed infants persisted during the first 6 months after controlling for confounding demographic, maternal and infant factors. Infants exclusively breastfed at discharge from hospital (OR = 0.52, 95% CI: 0.35-0.71) and during the last 2 days (OR = 0.65, 95% CI: 0.46-0.91) had a significantly lower risk of SIDS than infants not breastfed.

Klonoff-Cohen HS et al (1995) The effect of passive smoking and tobacco exposure through breast milk on sudden infant death syndrome. *JAMA* 273: 795-8.
A total of 200 parents of infants who died of SIDS between 1989 and 1992 were compared with 200 control parents who delivered healthy infants. There was an increased risk of SIDS associated with passive smoking (OR = 3.50 [95% CI, 1.81 to 6.75]). Breast-feeding was protective for SIDS among nonsmokers (OR = 0.37) but not smokers (OR = 1.38), after adjusting for potential confounders.

See also:
Alm B et al (2002). Breast feeding and the sudden infant death syndrome in Scandinavia, 1992-95. *Arch Dis Child* 86: 400-402.
Gilbert RE et al (1995) Bottle feeding and the sudden infant death syndrome. *BMJ* 310: 88-90. (bottle feeding found not to be associated with increased risk)
McVea KLSP et al (2000) The role of breastfeeding in sudden infant death syndrome. *J Hum Lact* 16: 13-20.

Hooker E, Ball HL, Kelly PJ (2001). Sleeping like a baby: attitudes and experiences of bedsharing in northeast England. *Med Anthropol* 19: 203-222.
An anthropological investigation in the north-east of England found that 65% of parents practiced co-sleeping with their infants, finding it a convenient care strategy. Breastfeeding was significantly associated with co-sleeping.

McKenna JJ, Mosko SS, Richard CA (1997). Bedsharing promotes breastfeeding. *Pediatrics*100: 214-9.
The effect of mother-infant bed-sharing on nocturnal breastfeeding behaviour was studied in 20 routinely bedsharing and 15 routinely solitary sleeping mother-infant pairs when the infants were 3 to 4 months old. All pairs were healthy and exclusively breastfeeding at night. The most important finding was that routinely bed-sharing infants breastfed approximately three times longer during the night than infants who routinely slept separately: this reflected a two-fold increase in the number of breastfeeding episodes and 39% longer episodes. The authors suggest that, by increasing breastfeeding, bedsharing might be protective against SIDS, at least in some contexts.

See also:
Mosko S, Richard C, McKenna J (1997). Infant arousals during mother-infant bed sharing: implications

for infant sleep and sudden infant death syndrome research. *Pediatrics* 100: 841-9.
Ball HL, Hooker E, Kelly PJ (1999). Where will the baby sleep? Attitudes and practices of new and experienced parents regarding co-sleeping with their newborn infants. *American Anthropologist* 101: 143-51.
UNICEF UK Baby Friendly Initiative's Sample policy on bed sharing

HIV-1 transmission

The HIV virus can be transmitted through breastfeeding. Unfortunately, most research has failed to define exclusive breastfeeding properly, with many studies comparing risk of infection between formula fed babies and babies receiving *any* breastmilk. The first study to compare properly-defined exclusive breastfeeding with mixed feeding and artificial feeding found no significant difference in HIV infection between breastfed and artificially-fed babies.

Coutsoudis A et al. (1999) Influence of infant-feeding patterns on early mother-to-child transmission of HIV-1 in Durban, South Africa: a prospective cohort study. *Lancet* 354: 471-476.
Babies born to 549 HIV-1-infected South African women were assessed at 3 months of age. After adjustment for potential confounders, exclusive breastfeeding carried a significantly lower risk of HIV-1 transmission than mixed feeding (hazard ratio 0.52 [95% CI 0.28-0.98]) and a similar risk to no breastfeeding (0.85 [0.51-1.42]). The authors call for further research but point out that exclusively breastfed babies had a (non-significant) lower probability of infection than those never breastfed and suggest that this may be due to virus acquired during delivery being neutralised by immune factors in breastmilk. They propose that mixed feeding carries the highest risk due to the beneficial immune factors in breastmilk being counteracted by damage to the infant's gut and disruption of immune barriers caused by contaminants in mixed feeds.

There is an editorial on this subject in the same issue of the Lancet (Newell M-L (1999) Infant feeding and HIV-1 transmission. *Lancet* 354: 442-3) and correspondence in a subsequent issue (Infant feeding patterns and HIV-1 transmission. *Lancet*354: 1901-1904).

Coutsoudis A et al. (2001) Method of feeding and transmission of HIV-1 from mothers to children by 15 months of age: prospective cohort study from Durban, South Africa. *AIDS* 15: 379-87.
Babies of HIV-infected mothers who were breastfed exclusively for three months or more were found to be at no greater risk of HIV infection during the first six months than those never breastfed. 551 HIV-infected mothers and their babies were included in the study. Exclusive breastfeeding, defined as a time dependent variable, carried a significantly lower risk of HIV infection than mixed feeding (hazard ratio 0.56, 95% CI 0.32-0.98, p=0.04) and a similar risk to no breastfeeding (HR 1.19, 95% CI 0.63-2.22, p=0.59). The authors suggest that other foods and fluids introduced to the gut of mixed-fed babies damage the bowel and facilitate the entry into the body tissues of the HIV present in these mothers' breastmilk. This is supported by the finding that, if mothers continued to breastfeed along with other foods once the period of exclusive breastfeeding had ended, new HIV infections began to occur. The investigators call for further research.

See also:
Coutsoudis A et al (2002). Free formula milk for infants of HIV-infected women: blessing or curse? *Health Policy and Planning* 17: 154-160.
Nicoll A, Newell ML, Peckham C, Luo C, Savage F (2000) Infant feeding and HIV-1 infection. *AIDS* 14: Suppl 3: S57-74.
Latham MC, Preble EA (2000) Appropriate feeding methods for infants of HIV infected mothers in sub-Saharan Africa. *BMJ* 320: 1656-1660.
Information on single bottle pasteurisers

Dental health

Labbok MH, Hendershot GE (1987) Does breastfeeding protect against malocclusion? An analysis of the 1981 Child Health Supplement to the National Health Interview Survey. *Am J Prev Med* 3: 227-32.
Data on 9698 children aged between 3 and 17 years were analysed retrospectively to assess the association between breastfeeding and dental malocclusion. After controlling for confounding factors, increased duration of breastfeeding was associated with a decline in the prevalence of malocclusion.

Palmer B (1998) The influence of breastfeeding on the development of the oral cavity: a commentary. *J Hum Lact* 14:93-8.
An investigation of 600 skulls preserved from ancient cultures in US museums found that nearly all had perfect occlusions (correct alignment of teeth, allowing a proper bite). As the skulls were from people living before the advent of artificial feeding, they would all have been breastfed. The author notes that good occlusion and well formed dental arches were much less common among his own dental patients and among a sample of modern skulls studied.

See also:
Paunio P, Rautava P & Sillanpaa M. (1993) The Finnish Family Competency Study: the effects of living conditions on sucking habits in 3-year old Finnish children and the association between these habits and dental occlusion. *Acta Odontol Scand* 51: 23-29.
Ogaard B, Larsson E & Lindsten R (1994) The effect of sucking habits, cohort, sex, intercanine arch widths and breast or bottle feeding on posterior crossbite in Norwegian and Swedish 3-year old children. *Amer J Ortho & Dentofac Orthopedics* 106: 161-66.
Valaitis R et al. (2000) A systematic review of the relationship between breastfeeding and early childhood caries. *Can J Public Health* 91: 411-7.

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American Academy Work Group on Breastfeeding (1997). Policy Statement on Breastfeeding and the use of human milk. *Pediatrics* 100: 1035-9.

Heinig M J & Dewey K G (1997). Health effects of breastfeeding for mothers: a critical review. *Nutrition Research Reviews* 10: 35-56.

Heinig M J & Dewey K G (1996). Health advantages of breastfeeding for infants: a critical review. *Nutrition Research Reviews* 9: 89-110.

Standing Committee on Nutrition of the British Paediatric Association (1994). Is breastfeeding beneficial in the UK? *Arch Dis Child* 71: 376-380.