



## Update of the evidence base to support the review of the NSW Health Breastfeeding Policy (PD2006\_012): A rapid appraisal



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## CONTENTS

<b>EXECUTIVE SUMMARY</b> .....	<b>4</b>
<b>1 INTRODUCTION</b> .....	<b>9</b>
1.1 Context .....	9
1.2 Purpose.....	10
<b>2 HEALTH BENEFITS OF BREASTFEEDING</b> .....	<b>11</b>
2.1 Methods .....	11
2.2 Breastfeeding and Infant Health Outcomes .....	11
2.2.1 Weight and Length.....	11
2.2.2 Necrotising Enterocolitis.....	12
2.2.3 Infections .....	12
2.2.4 Leukaemia.....	12
2.2.5 Inflammatory Bowel Disease .....	12
2.2.6 Atopy and Asthma .....	13
2.2.7 Overweight and Obesity .....	13
2.2.8 Type 1 Diabetes .....	14
2.2.9 Type 2 Diabetes .....	14
2.2.10 Blood Pressure and Total Blood Cholesterol in Later Life .....	14
2.2.11 Mental health, Cognition and Behaviour .....	15
2.3 Introduction of Solids and Infant Health Outcomes .....	16
2.4 Breastfeeding and Maternal Health Outcomes .....	17
2.4.1 Post-partum Weight Loss.....	17
2.4.2 Type 2 Diabetes .....	17
2.4.3 Gall Bladder Disease .....	17
2.4.4 Post-partum Depression .....	17
2.4.5 Cancer .....	18
2.5 Summary of the Recent Evidence of Breastfeeding and Health Outcomes .....	18
<b>3 AT-RISK, VULNERABLE GROUPS</b> .....	<b>20</b>
3.1 NSW Population Health Survey.....	20
3.2 Research Studies in NSW and Australia .....	21
3.3 Specific Other Factors associated with Poorer Breastfeeding Practices .....	23
3.3.1 Caesarean Delivery .....	23
3.3.2 Preterm and Low Birth Weight Infants.....	23
3.3.4 Smoking .....	25
3.3.5 Primiparity and Multiple Births.....	25
3.3.6 Postpartum Depression .....	26
3.3.7 Analgesia in Labour.....	26

3.3.8	Early Postnatal Discharge .....	26
3.4	Summary of At-Risk, Vulnerable Groups.....	26
<b>4</b>	<b>INTERVENTIONS TO ENCOURAGE AND SUPPORT BREASTFEEDING .....</b>	<b>28</b>
4.1	Methods .....	28
4.2	Evidence of Intervention Effectiveness.....	28
4.2.1	Hospital Practices.....	29
4.2.2	Education of Health Professionals .....	36
4.2.3	Breastfeeding Support and Maternal Self-Efficacy .....	37
4.2.4	Gaps in the Interventions Evidence .....	42
4.3	Summary of Evidence – Breastfeeding Interventions.....	43
4.3.1	Hospital Practices.....	43
4.3.2	Health Professional Education .....	44
4.3.3	Support and Self-Efficacy of Mothers .....	45
4.3.4	Gaps in the Intervention Evidence.....	46
<b>5</b>	<b>REFERENCES .....</b>	<b>47</b>
	Appendix A: Summary Tables of Recent Evidence of Health Benefits of Breastfeeding .....	59
	Table A1: Summary of included studies: Health outcomes and breastfeeding .....	59
	Table A2: Summary of included studies: Breastfeeding and diabetes.....	65
	Table A3: Summary of included studies: Health outcomes and formula use .....	68
	Table A4: Summary of included studies: Health outcomes and introduction of solid foods.....	70
	Appendix B: Protocols for Cochrane Reviews of Relevant Hospital and Clinical Practices .....	72
	Appendix C: List of Abbreviations used in this Report .....	73

## EXECUTIVE SUMMARY

This report provides the findings from a rapid review and appraisal of the evidence base to support a review of the NSW Health Breastfeeding Policy *Breastfeeding in NSW: Protection, Promotion and Support* (PD2006\_012, NSW Department of Health 2006). This Policy is currently being updated, particularly in consideration of the *Australian National Breastfeeding Strategy 2010-2015* and the associated, forthcoming Implementation Plan.

The development of the NSW Breastfeeding Policy in 2006 was strongly supported by the systematic evidence base that had accumulated at that time. This review therefore includes evidence since the previous evidence summaries, i.e. since 2005. Specifically, it appraises the evidence around the health benefits of breastfeeding, it identifies those sub-groups of the population that are most at risk of poorer breastfeeding practices (not breastfeeding at all, short duration of breastfeeding, low intensity (exclusivity) of breastfeeding), and it examines the evidence, particularly from systematic reviews, of the effectiveness of interventions to promote, encourage and support breastfeeding.

### Health Benefits

A review of systematic reviews, meta-analyses and good quality prospective cohort studies in developed countries has shown that there is very strong evidence of the protective health effects of breastfeeding among infants for: necrotising enterocolitis in pre-term infants, infections of the gastrointestinal tract, respiratory tract and inner ear in infancy and childhood, acute lymphocytic leukaemia and acute myelogenous leukaemia in childhood, overweight and obesity in childhood and later life, and elevated blood pressure and total blood cholesterol in later life. The protective effect of exclusive breastfeeding, particularly, is primarily observed for infectious disease; however, the extent of the effectiveness of exclusive breastfeeding compared to any breastfeeding is limited by poor definition and measurement of different categories of breastfeeding in many studies. Formula use has been associated with an increased risk of ear infections (if introduced before six months) and increased risk of respiratory tract infections (if introduced in the first two to four months). Studies of breastfeeding and asthma and atopy have produced equivocal results, although it is probable that introduction of formula before four months is a risk factor for asthma. Breastfeeding is probably protective against Type 1 diabetes in childhood and Type 2 diabetes in later life; however, there are issues of confounding in the studies.

Strong and consistent evidence shows that mothers who breastfeed, particularly those who breastfeed for a long time, have a reduced risk of breast cancer. The evidence is less strong, but probable, for a protective effect of breastfeeding on ovarian cancer. Evidence from systematic reviews, but for studies with low generalisability, shows a protective effect of breastfeeding on the risk of Type 2 diabetes among mothers, and this evidence is supported by recent findings from a large Australian cohort study. A dose-response relationship was observed in this study, lending strength to the evidence of a protective effect.

## At-risk, Vulnerable Groups

Population level data in NSW, from the NSW Population Health Survey 2007-2008, show that two particular sub-groups of the population have especially poorer breastfeeding practices; these are younger mothers aged less than 25 years, and those who do not have tertiary qualifications. Also, children of mothers from English-speaking backgrounds are less likely to be ever breastfed or breastfeeding at 12 months, than children of mothers from non-English speaking backgrounds. A number of single studies in NSW and Australia also identified these two at-risk groups.

Several research studies also examined the effect of country of birth on breastfeeding and showed that immigrant mothers, including Asian mothers, were more likely to have better breastfeeding outcomes than Australian-born mothers; they were more likely to initiate breastfeeding and breastfeed at 6, 12 and 26 weeks postpartum. No effect on exclusive breastfeeding was identified among mothers of different country of origin, although there is some evidence of a higher rate of supplementation in hospital among Asian women.

Several other factors were highlighted in the literature as being detrimental to breastfeeding, including primiparity and multiple births. Also, obese mothers, mothers who had a caesarean birth, mothers of preterm and low birth weight infants, and women who smoke, were at a significantly increased risk of not breastfeeding or ceasing breastfeeding early. Specific, targeted, additional support is required for these groups of women in order to encourage and support breastfeeding.

Obese pregnant women and mothers require particular support and advice concerning weight gain and breastfeeding, especially as breastfeeding can mitigate the adverse metabolic effects of obesity and associated gestational diabetes mellitus, on both mother and child. Mothers who give birth by caesarean section should not be separated from their infant at birth and should still be given the opportunity for very early skin-to-skin contact. These mothers may need specific advice and support about holding the baby for breastfeeding. Cost-effective interventions for increasing breastfeeding rates in preterm and low birth weight infants have been identified in the literature – including early skin-to-skin contact and kangaroo care, and additional postnatal support in hospital and on-discharge from hospital. Smoking is not contraindicated with breastfeeding, hence mothers who smoke should be encouraged to still breastfeed while encouraged also to cease smoking. Care should be taken to avoid excess weight gain in pregnant or lactating mothers who quit smoking.

Postpartum depression and analgesia in labour may be associated with poorer breastfeeding outcomes but early discharge has not been associated with poorer breastfeeding outcomes, providing there is at least one follow-up visit at home.

## Effective Interventions

Evidence of effectiveness was, as identified in the previous overview, focused on three particular intervention areas: hospital practices, education of health professionals, and breastfeeding support and maternal self-efficacy.

### Hospital Practices

There is strong evidence for the effectiveness of the Baby Friendly Hospital Initiative (BFHI) as a whole, and for many of the individual 'Ten Steps'. The presence of a written breastfeeding policy (non-draft) and communication of the policy to staff (Step 1), early skin-to-skin contact (Step 4) and not giving supplementary fluids while in hospital unless medically indicated (Step 6), appear to be particularly important practices for improving breastfeeding practices. The evidence concerning the latter two practices is especially strong. Supplementation is considered a poor response to maternal fatigue.

There is inadequate evidence about effectiveness of many of the other steps. Step 1b 'communication of written policies to staff', Step 2 'training staff in skills to implement the policy', Step 7 'rooming-in' and Step 10 'informing mothers about breastfeeding support on discharge' are identified as areas for improvement in Australian studies. The evidence to date does not support a causal relationship between pacifier use (Step 9) and poorer breastfeeding practices. It is likely that banning the provision of commercial hospital discharge packs has a strong equity basis.

There are no studies examining the effectiveness of the Baby Friendly Health Initiative in paediatric or community settings, where implementation has been very low, despite it being recommended as core in breastfeeding promotion world-wide. Implementation of the Baby Friendly Hospital/Health Initiative is limited by a lack of management support, a lengthy accreditation process, embedded alternative practices by senior midwives, and time pressures to learn about the policy and its implementation. Enabling factors include the gaining of upper management support and training in BFHI for senior management staff. Specific funding or incentives are likely to be required.

### Education of Health Professionals

There is insufficient evidence surrounding what works best in terms of health professional education. The WHO/UNICEF training package is effective but unlikely to be sufficient. Qualitative evidence stresses the need for education of staff providing community support services. Also, relevant health professionals, including GPs and paediatricians, are likely to benefit from being trained to identify the predictors and barriers to successful breastfeeding, and subsequently to provide targeted anticipatory guidance. There is some evidence to suggest the use of particular 'scales' to assess current knowledge and understanding of breastfeeding by midwives in Australia.

The provision of consistent advice and empathetic communication skills should be distinctive outcomes of any health professional training in this area.

## Support and Self-efficacy of Mothers

Support in any form has been identified as a core component of programs to ensure good breastfeeding outcomes; the evidence is very strong.

The evidence for the provision of professional support alone is mixed, and is stronger for postnatal than antenatal support. Specific breastfeeding support from a single professional should be targeted to women of lower socio-economic background in order to increase their rate of exclusive breastfeeding. Practical, hands-off teaching with professional support and encouragement has been shown to be effective. Encouragement by health professionals is identified as being crucial to breastfeeding success. In order to be successful, professional support must be breastfeeding-specific, while empathetic, listening support by health professionals is likely to be useful.

There is overwhelmingly strong evidence that peer counselling is effective in improving all aspects of breastfeeding. Scaling-up experience suggests that it should not be offered as a stand-alone intervention and would benefit from being a part of an existing health professional program or initiative. Also, a single session of informal, small group and discursive breastfeeding education should be delivered in the antenatal period. This education should include topics such as the prevention of nipple pain and trauma.

There is good evidence that a mixture of professional and peer support is likely to be most effective, particularly support which spans all periods, i.e. antenatal, perinatal and postnatal. A clear working arrangement and relationship should be established between peer counsellors and professionals to ensure the success of any combined support program.

Attendance at parent groups, where peers are breastfeeding infants of a similar age, is effective at improving breastfeeding. Several studies have shown that targeted peer counselling and social support, combined with professional support, are particularly important for younger mothers.

Complementary telephone support should be provided to all breastfeeding women. Technology (internet, SMS, mobile phones) could be a potentially important mode for providing support in the current generation of mothers.

Overall, any breastfeeding promotion efforts should aim at enhancing mothers' self-efficacy and confidence with respect to breastfeeding. There is no strong evidence for how this might be achieved, although expert opinion suggests that pregnant women and mothers should be taught the challenges of breastfeeding, to examine their thought processes so that they are not defeated but rather persevere through difficulties, i.e. that breastfeeding-specific, practical and problem-solving support be provided. Mothers need to understand ways to solve the problems as and if they arise; which could be addressed through anticipatory guidance.



The Breastfeeding Self-Efficacy Scale has been suggested as useful for identifying women at risk of early cessation of breastfeeding and, together with various birth factors, socio-demographic factors such as young age and lack of tertiary qualifications, and other health factors such as obesity, can be used to identify those women who require pro-active, additional support.

### **Gaps in the Evidence**

The majority of the evidence remains in the areas of development of personal skills (education and support of mothers) and hospital and health services (e.g. hospital practices and health professional training). There remains a dearth of evidence of effectiveness, particularly in the systematic evidence base, in the areas of public policy initiatives, supportive environments and community action; no media campaigns were identified. Limited emerging evidence was identified in the area of workplace support.

No single intervention alone is likely to increase breastfeeding rates at the population level. As such, effectiveness of single intervention studies might be better assessed in terms of their effect on specific enablers or barriers to breastfeeding, rather than rates of breastfeeding alone.

In order to be successful, a portfolio of interventions needs to be implemented within public health policy, mainstream clinical practice and at the local level. System-level interventions with senior support may be more likely to be sustained over time.

# 1 INTRODUCTION

## 1.1 Context

The NSW Health Breastfeeding Policy, *Breastfeeding in NSW: Protection, Promotion and Support* (PD 2006\_012), was the first evidence-based policy in Australia with specific actions to promote and support breastfeeding within a state health system.

Research evidence was used instrumentally, as opposed to symbolically, in the development of this Policy (Hector et al 2008). Evidence from a synthesis of interventions to promote and support breastfeeding was available at the beginning of the policy development (Hector et al 2004). This and other research evidence on 'Breastfeeding' was also summarised in a series of papers published in a special edition of the NSW Public Health Bulletin (Vol 16(3-4) 37-49; March-April 2005). In addition, a 'Case Studies' report provided more detailed examples of interventions, including interventions in strategy areas not included in the systematic literature (King et al 2005).

The overall conclusion from the systematic and compellingly strong evidence base was:

*'There is a substantial body of evidence that provides a sound basis to proceed with evidence-based programs and practices in a number of areas, particularly those areas addressed by mainstream health services. These action areas comprise the organisation of hospital services, and prenatal and postnatal community-based education and support services for women.'*

The research evidence was not considered in isolation during the development of the Policy. Other stakeholders provided their own forms of evidence – knowledge, experience, ideas, and opinion – which was incorporated in an iterative, interactive manner with the research evidence to produce the policy and practice guidelines that comprise the Policy. Emerging evidence, e.g. from the NICE briefing (National Institute for Health and Clinical Excellence, 2006), was also incorporated through ongoing linkage between the researchers and the policy-makers.

Policy at the national level has been adopted recently: The *Australian National Breastfeeding Strategy 2010-2015* was endorsed at the Australian Health Ministers' Conference in November 2009, and the Implementation Plan is currently being developed.

## 1.2 Purpose

The NSW Health Breastfeeding Policy is undergoing review at the present time. To support this review PANORG was commissioned to provide an update of the systematic evidence base in three specific areas:

- the health benefits of breastfeeding
- the vulnerable groups who are at risk of poorer breastfeeding practices
- the effectiveness of breastfeeding interventions.

There was only limited time in which to conduct this review; hence, it is comprehensive rather than exhaustive.

The findings from this current review will be considered by NSW Health, together with 'evidence' from practitioners, service users and user representatives, to develop an updated NSW Health Breastfeeding Policy.

## 2 HEALTH BENEFITS OF BREASTFEEDING

A review of the health benefits of breastfeeding was conducted in 2005 to support the NSW Health Breastfeeding Project (Allen and Hector 2005). The current review was conducted in September 2010 and considers the evidence, primarily from systematic reviews and meta-analyses, since June 2005. The findings should be interpreted in association with the earlier evidence.

### 2.1 Methods

Inclusion criteria were: systematic reviews or meta-analyses of the literature, published in English, and published from June 2005 to the present date. Search terms used included: 'breastfeeding' or 'breast milk', and 'health' or 'prevention' or 'risk'. At the request of NSW Health a particular search was conducted for 'breastfeeding OR breast milk' and 'diabetes'.

Databases included in the review were: CINAHL, PubMed (Includes MEDLINE), SCOPUS, Proquest 5000, EMBASE, Cochrane Library (includes Cochrane Database of systematic reviews and central register of controlled trials).

The search was also expanded under the following conditions:

1. High quality prospective control trials conducted in the last two years
2. Replacement of the term *breastfeeding* or *breast milk* with 'solids' or 'formula'.

### 2.2 Breastfeeding and Infant Health Outcomes

#### 2.2.1 Weight and Length

There are no statistical differences in weight and length gain between infants exclusively breastfed for six months versus three or four months, although larger samples are required to rule out the effects of modest differences in risk of under-nutrition (Level I evidence; Kramer and Kakuma 2009). However, a recent German cohort study of infants aged six to seven months found those infants with the highest weight-for-length z-scores were those exclusively breastfed for less than four months, compared with infants exclusively breastfed for four to six months or for six months or longer (Level III-2; Rebhan et al. 2009). This finding may, however, be an effect of formula feeding, which has been shown in earlier literature to promote weight gain in early infancy. More recent evidence suggests this may be due to the 'early protein hypothesis' whereby introducing infant formula (which has a higher protein content than breast milk) in place of breast milk may promote weight gain in early infancy (Koletzko et al. 2009). In the long term, this early weight gain may increase the risk of higher body mass index in adulthood (Stettler et al. 2005). It has been hypothesised that this carry-on effect into adulthood may be due to negative effects of formula feeding on self-regulation of intake (Bartok and Ventura 2009).

Evidence from a prospective controlled trial (Level III-2) found provision of any breast milk, compared with no breast milk, to low birth weight infants had no effect on children's growth parameters but was associated with higher neurodevelopment scores and reduced hospitalisations after discharge (Vohr et al. 2007).

### **2.2.2 Necrotising Enterocolitis**

A meta-analysis of four randomised controlled trials found a marginally significant reduced risk of necrotising enterocolitis in pre-term infants who were ever breastfed (Ip et al. 2007).

### **2.2.3 Infections**

Level I evidence confirms that there is a reduced risk of non-specific gastrointestinal infection in the first year of life, and of acute otitis media in infancy, in those infants who were ever breastfed compared with never breastfed (Ip et al. 2007; Vohr et al. 2007). A Greek cohort study showed that those infants exclusively breastfed to six months had a significantly lower incidence of acute respiratory infections, compared with infants not exclusively breastfed to six months (i.e. < 6 months exclusive breastfeeding or partial breastfeeding) (Level III-2; Ladomenou et al. 2010). A lower risk of infections in the upper respiratory tract, lower respiratory tract and gastro-intestinal tract was also shown in infants exclusively breastfed until four months with partial breastfeeding thereafter, compared with those never breastfed (Duijts et al. 2010). This finding suggested exclusive breastfeeding until four months may be adequate for prevention. In a prospective German cohort study, risk of gastrointestinal infection in the first 1-9 months of life was also shown to be significantly reduced with exclusive breastfeeding to six months or longer, compared with no breastfeeding or breastfeeding for less than four months (Rebhan et al. 2009).

In summary, exclusive breastfeeding to at least four months is protective against infections of the gastrointestinal tract and respiratory tract. Any breastfeeding appears to be protective of inner ear infections.

### **2.2.4 Leukaemia**

Infants who are breastfed for at least the first six months of life have a reduced risk of acute lymphocytic leukaemia and acute myelogenous leukaemia (Level I; Ip et al. 2007). Evidence from a large prospective cohort study in Australia and Canada also showed that any breastfeeding for longer than six months, compared with no breastfeeding, was protective of acute lymphocytic anemia before 15 years of age, after adjusting for maternal race, education, and family income (Guise et al. 2005).

### **2.2.5 Inflammatory Bowel Disease**

Radovic and colleagues showed a significantly reduced risk of coeliac disease in the first year of life with increased duration of breastfeeding in a cross-sectional study of a small cohort of infants in Belgrade (Radlovic et al. 2010). Weak evidence suggests a potential role of breastfeeding in the early onset of inflammatory bowel diseases (Barclay et al. 2009).

### 2.2.6 Atopy and Asthma

Level I evidence from Australia, Finland and Belarus confirms that there is no difference in the risk of atopic eczema, asthma or other atopic outcomes (i.e. food allergy) between infants exclusively breastfed to six months versus infants exclusively breastfed to three or four months (Kramer and Kakuma 2009). However, there is some evidence that, in those infants with a family history of atopic conditions, there is a reduced risk of atopic dermatitis associated with exclusive breastfeeding to at least three months of age, compared with less than three months (Ip et al. 2007), although this was shown to be not significant in meta-analysis (Yang et al. 2009). Recent Level III-2 evidence from a German cohort also found this association to be non-significant. However, when the data were analysed by parental versus maternal family history, risk of asthma and atopic dermatitis at two years of age was lower in children with a paternal history but higher in children with a maternal history of atopy (Pohlabeln et al. 2010). These researchers also found that the risk of asthma and atopic dermatitis in children without a parental history of allergic diseases was increased by exclusive breastfeeding of longer than four months duration.

In a large prospective cohort study, Nagel and colleagues showed that any breastfeeding was significantly associated with less non-atopic wheeze and higher predicted forced expiratory volume in one second (Nagel et al. 2009). Breastfeeding was not associated with atopic wheeze and objective measures of allergy (Nagel et al. 2009). Level III-2 evidence from a large prospective cohort study in Belarus showed that longer duration of any breastfeeding and exclusive breastfeeding was significantly associated with a reduced risk of a history of eczema at 6.5 years of age (Kramer et al. 2007). A history of positive skin prick tests was significantly more common in children who were exclusively breastfed for three to less than six months, or  $\geq 6$  months, compared with less than three months (Kramer et al. 2007); however, this study did not account for a family history of atopic conditions.

In summary, there is insufficient evidence to confirm an association, in either direction, between any or exclusive breastfeeding and risk of atopy or allergy. Atopic outcomes in children may be more influenced by the timing of introduction of solids than breastfeeding (see below), although high quality studies are also required to clarify this relationship. Breastfeeding during the period that foods are first introduced may help prevent the development of allergy to those foods and is therefore currently recommended by The Australian Society for Clinical Immunology and Allergy.

### 2.2.7 Overweight and Obesity

Bartok and Ventura (2009) propose three main mechanisms by which breastfeeding may reduce the risk of obesity in later life: encouraging an infant's emerging capabilities of self-regulation of intake; reducing problematic feeding behaviours on the part of caregivers; and providing bio-active factors that regulate energy intake, energy expenditure and cellular chemistry.

A dose-response relationship, which lends strength to the evidence, has been observed between duration of breastfeeding and risk of overweight and obesity in later life (Level I; Ip et al. 2007; Horta et

al. 2007; Huang 2009). Level III-2 evidence from an Australian prospective cohort study of infants at risk of atopic conditions showed that duration of exclusive breastfeeding or any breastfeeding was not associated with an above-healthy BMI at 10 years of age; however, the timing of introduction of solids significantly increased the risk of overweight and obesity (Seach et al. 2010). Cross-sectional data from 2232 children surveyed in the 2007 National Children's Nutrition and Physical Activity Survey found that children breastfed to six months of age (reported retrospectively and not necessarily exclusively breastfed) were less likely to be overweight (adjusted odds ratio (AOR) 0.55, 95% CI 0.38 0.78) (Scott et al. 2010). In a study of Dutch children, the protective effect of breastfeeding on overweight in later life was found to be independent of dietary intake (Level III-2; Scholtens et al. 2008).

The issue of bottle feeding, including that of expressed breast milk, has not been particularly considered in the literature. Researchers from the US have shown that bottle feeding with either breast milk or infant formula has a negative influence on children's self-regulation of milk intake at one year of age, which may have implications in the regulation of food intake in later life (Li et al. 2010).

In summary, any breastfeeding to at least six months of age reduces the risk of overweight and obesity in later life. There is some evidence of a dose-response relationship.

### **2.2.8 Type 1 Diabetes**

There is some evidence for a protective effect of breastfeeding for more than three months on type 1 diabetes in offspring (Ip et al. 2007). There is evidence from one non-systematic review of a possible increased risk of type 1 diabetes with early introduction of cow's milk formula (Peng and Hagopian 2007). Most studies suggest that the early introduction of complex foreign proteins may be a risk factor for beta cell autoimmunity (Knip et al. 2010). Clear conclusions are limited due to studies being underpowered, the presence of confounding exposures and imprecise or infrequent exposure estimates (Peng and Hagopian 2007).

### **2.2.9 Type 2 Diabetes**

There is good evidence of a reduced risk of type 2 diabetes in later life among children who have been breastfed. A quantitative analysis of published studies by Owen et al (2006) found that breastfeeding in infancy is associated with a reduced risk of type 2 diabetes, with marginally lower insulin concentrations in later life, and with lower blood glucose and serum insulin concentrations in infancy. Another meta-analysis by the World Health Organization also found that breastfeeding in infancy reduced the risk of type 2 diabetes in later life (Horta et al. 2007). Systematic reviews have produced similar conclusions (Ip et al. 2007; Taylor et al. 2005).

### **2.2.10 Blood Pressure and Total Blood Cholesterol in Later Life**

As part of two systematic reviews of the evidence, mostly from high income (Horta et al. 2007) or developed countries (Ip et al. 2007), researchers found a small but significant effect of being breastfed on systolic and diastolic blood pressure in later life (Level I).

A more detailed meta-analysis of the influence of breastfeeding on blood pressure in later life showed that breastfeeding has a small but significant effect on systolic blood pressure (pooled difference -1.4mmHg,  $p=0.001$ ) and, to a lesser degree, diastolic blood pressure (-0.05,  $p=0.03$ ) (Martin et al 2005). These researchers also showed that the size of the effect of breastfeeding on systolic blood pressure was lower in larger samples (-0.6mmHg), and that being breastfed for at least two months' duration, compared with being breastfed for less than two months, had an effect on systolic blood pressure (-2.0mmHg and -0.4mmHg respectively).

Compared with formula feeding, breastfeeding during infancy is associated with a reduced risk of total blood cholesterol in adulthood (mean difference -0.18mmol/L), but not in childhood (Level I; Horta et al 2007). This difference was greater and more consistent in those >16 years of age who were exclusively breastfed (odds ratio (OR) -0.15, 95%CI -0.23 -0.06), compared with those partially breastfed (OR -0.01, 95%CI -0.06 -0.03; Owen et al 2008).

In summary, breastfeeding has a small but significant effect on blood pressure and on total blood cholesterol in adult life, which is likely to be of clinical importance at the population level. The protective effect is larger for systolic than diastolic blood pressure, and the effect on cholesterol is larger for exclusive versus partial breastfeeding.

### **2.2.11 Mental health, Cognition and Behaviour**

Level I evidence has shown that any breastfeeding, compared with no breastfeeding, increases cognitive development and intelligence scores in childhood and, possibly, adolescence (Horta et al 2007). Any breastfeeding for less than six months' duration, compared with more than or equal to six months, was shown to be an independent predictor of mental health problems through childhood and into adolescence (Level III-2; Oddy et al. 2010). Mechanisms and causal pathways of this association remain unclear; for example, infants with a more difficult temperament may cause early discontinuation of breastfeeding (Oddy et al. 2010). While maternal post-natal depression was adjusted for in the analysis, other conditions such as aggression, anxiety and attention/social problems may have genetic tendencies. Level III-2 evidence from a large prospective cohort study in Belarus showed higher intelligence scores among children aged 6.5 years who had been breastfed (Kramer et al. 2008). Verbal intelligence, performance IQ and full-scale IQ were all shown to increase with duration of exclusive breastfeeding from three to <six months and  $\geq$ six months, compared with <three months. Results of this study were reported to be similar, after adjusting for maternal and paternal education.

In summary, there is good evidence that breastfeeding supports cognitive development and intelligence scores in childhood, particularly exclusive breastfeeding to at least three months of age. However, these findings are limited by the fact that breastfeeding intention may be affected by maternal intelligence and education level, which is not adjusted for in most studies.



## 2.3 Introduction of Solids and Infant Health Outcomes

Much of the evidence regarding the timing of introducing solids on infant health outcomes has focused on allergy and other atopic conditions, particularly atopic dermatitis. In these studies, there may be an effect of reverse causality, i.e. parents who notice early skin or allergic symptoms in their child might start feeding solids later, resulting in "false" positive association between late introduction of solids and atopic outcomes.

One systematic review, conducted in 2006, concluded that the introduction of solids before four months of age may increase the risk of eczema but not of other allergic conditions (Tarini et al 2006). However, these findings did not include use or duration of breast milk or formula (Tarini et al 2006). Evidence from prospective cohort studies has revealed conflicting evidence. In a Belgian birth cohort, followed prospectively to four years of age, exposure to solid foods within the first four months of age was significantly associated with a reduced risk of eczema in those infants with a parental history of atopy (Sariachvili et al 2010).

Evidence from a high quality German prospective birth cohort study (Level III-2) showed no evidence of a protective effect of delaying the introduction of solids past four to six months on asthma, allergic rhinitis or sensitisation against food or inhalant allergens (Zutavern et al. 2008). Conversely, avoidance of solid feeding for the first four or six months, and less diverse diet within the first four months, were positively associated with an IgE mediated response to food allergens (Zutavern et al. 2008). Importantly, this effect further increased when only children without early skin or allergic symptoms or children with parental atopic history were examined (Zutavern et al. 2008).

Level III-2 evidence from a small prospective cohort study in Melbourne showed a significant association between overweight and age at the introduction of solid foods, whereby delaying the introduction of solids from 20 to 24 weeks was associated with a crude risk reduction rate of 15.3% (Seach et al. 2010). Evidence from a Brazilian study (Level III-2) showed a lower risk of obesity at age 11 years, if solids are introduced at or before four months; however, this was not statistically significant (Neutzling et al. 2009).

In summary, the most recent evidence suggests that, in terms of risk of allergic conditions, the gradual introduction of a variety of foods between four and six months of age, but no later than six months, is recommended. However, delaying the introduction of solid foods to six months is recommended for other health benefits, including probable reduced risk of overweight and obesity.

## **2.4 Breastfeeding and Maternal Health Outcomes**

### **2.4.1 Post-partum Weight Loss**

In Honduran women, weight loss has been found to be more rapid with exclusive breastfeeding to six months, compared with exclusive breastfeeding of only three to four months' duration (Kramer and Kakuma 2009). Evidence from prospective cohort studies in developed countries shows that the effect of exclusive breastfeeding on post-partum weight loss to be negligible and that other factors, such as household income, baseline BMI, ethnicity, gestational weight gain and energy intake, to have larger effects (Ip et al 2007).

### **2.4.2 Type 2 Diabetes**

There is consistent evidence from systematic reviews of a reduced risk of type 2 diabetes among mothers' with a history of breastfeeding (Ip et al. 2007). Effects of breastfeeding on the mother include immediate effect on glucose tolerance and lasting post-weaning effect on metabolic profiles (Gunderson 2007).

A recent large Australian cohort study, 45 and Up, examined the effects of parity and breastfeeding on the risk of developing type 2 diabetes in women (Liu et al. 2010). This study showed that women who did not breastfeed were 50% more likely to develop diabetes later in life, compared with women who hadn't had children (OR 1.48, 95% CI 1.26 1.73). However, women who had had children and breastfed each child for at least three months had no increased risk of type 2 diabetes. The benefit of breastfeeding increased with longer duration and this association was consistent regardless of body mass index. A recent large population-based study in the US showed that risk of diabetes in mothers increases when term pregnancy is followed by more than one month of lactation, also independent of physical activity and body mass index in later life (Schwartz et al. 2010).

### **2.4.3 Gall Bladder Disease**

While women's risk of cholecystitis (gall bladder disease) increases with parity, breastfeeding appears to be protective. In a very large prospective cohort study in the UK, women who breastfed had a reduced risk of cholecystitis, with the relative risk decreasing by 7% per year of breastfeeding, i.e. there was a dose-response relationship (Liu et al. 2009).

### **2.4.4 Post-partum Depression**

An association exists between post-partum depression and never breastfeeding or short duration of breastfeeding (Level I; Ip et al. 2007; Dennis and McQueen 2009). However, the direction of this association is uncertain. Mothers with depressive symptoms are less likely to initiate breastfeeding and more likely to discontinue breastfeeding early (Level I; Dennis and McQueen 2009). These associations may be due to lower self-efficacy to breastfeed among mothers with maternal depressive symptoms.

Bottle feeding was also associated with a higher risk of maternal depression in this study (Dennis and McQueen 2009).

Further research is necessary to establish a causal relationship between breastfeeding and maternal depression.

#### **2.4.5 Cancer**

There is strong and substantial evidence that the risk of breast cancer, particularly premenopausal breast cancer, is reduced in mothers who have breastfed. Breastfeeding may also reduce the risk of maternal ovarian cancer, compared with mothers who have never breastfed (Ip et al. 2007).

### **2.5 Summary of the Recent Evidence of Breastfeeding and Health Outcomes**

This review of the health benefits of breastfeeding and, conversely, the health risks of infant formula feeding, has concentrated on recent evidence from systematic reviews, meta-analyses and methodologically strong prospective studies over the past two years. The recent evidence, combined with that reviewed in 2005 (Allen and Hector 2005), continues to show consistent benefits for breastfeeding across a wide range of short-term and longer-term health outcomes in infants and mothers.

The health benefits most strongly associated with breastfeeding in infants include a reduced risk of overweight and obesity in childhood and later life, type 2 diabetes in later life, elevated blood pressure and elevated total blood cholesterol in later life, infections of the gastrointestinal tract and inner ear and respiratory tract infections in infancy, necrotising enterocolitis in pre-term infants, and acute lymphocytic leukaemia and acute myelogenous leukaemia in childhood

Benefits of exclusive breastfeeding to six months include a reduced risk of infections of the gastrointestinal tract and acute respiratory infections.

Benefits of any breastfeeding to six months of age include a reduced risk of overweight and obesity in later life, and reduced risk of acute lymphocytic leukaemia and acute myelogenous leukaemia in childhood.

Mothers who breastfeed their children have a reduced risk of breast cancer and type 2 diabetes; as well as a probable reduced risk of gall bladder disease and ovarian cancer.

The only health risks associated with breastfeeding exclusively to six months may include an increased risk of IgE mediated sensitisation to food allergens, although, if present, appears to be more significant for infants with parental history of allergic conditions. Further evidence on this issue is required. Evidence from one good quality German cohort study supports the introduction of solids between four and six months of age to reduce risk of IgE mediated sensitisation to food allergens in children at risk of

atopic conditions (i.e. allergy, dermatitis and eczema). Risk of developing atopic conditions may also be reduced through use of partially hydrolysed formulas, although there is no evidence that this outweighs the benefits of breastfeeding rather than formula feeding overall.

In those infants at risk of allergic conditions, breastfeeding is recommended to at least four months of age. The particular benefits of exclusive breastfeeding suggest that this should be exclusive breastfeeding. The Australian Society for Clinical Immunology and Allergy currently recommends that solids not be introduced before 4 months of age, but be introduced no later than six months of age, while continuing breastfeeding. However, no population studies have examined the relationship between breastfeeding and asthma and allergy among infants exclusively breastfed for six months and then given solids – in all studies to date infants received infant formula and/or solids before six months.

Formula use is associated with an increased risk of inner ear infections (if introduced before six months of age), lower respiratory tract infections (if introduced in the first two to four months of age), type 1 diabetes (if introduced before three to six months) and asthma (if introduced before four months of age).

Some of the evidence remains limited by inconsistencies in terminology relating to various infant feeding practices. Future studies on health outcomes of breastfeeding should consider the exclusivity of breastfeeding and the various combinations of mixed breastfeeding with solids, fluids including watery drinks, cow's milk and infant formula (hydrolysed, partially hydrolysed and cow's milk based). For studies investigating the protective effect of breastfeeding on overweight and obesity, it may be pertinent to distinguish bottle feeding of breast milk and breastfeeding. Other limitations of many studies include the likelihood of confounders such as maternal weight, infant birth weight and under powering of studies. Particularly for diabetes, the use of fasting blood glucose may not be a sufficiently sensitive diagnostic test.

Despite some limitations, there is a strong body of evidence showing clear and consistent health benefits of breastfeeding to infants and mothers, and health risks of formula feeding to infants. The health risks of formula feeding have been shown to be clinically significant and costly to the health system (Bartick and Reinhold 2010; Smith et al. 2002).

It is important that accurate communication of this evidence occurs in a consistent manner, especially to health professionals. Martin-Bautista et al. (2010) compared the content of policy documents relating to infant feeding in five European countries and found that there was no consistency in the way the health outcomes were cited in the recommendations for breast- rather than formula-feeding. Health outcomes were linked to exclusive breastfeeding in only 25% of statements in 26 documents. These issues may limit effective breastfeeding promotion by health professionals.

### 3 AT-RISK, VULNERABLE GROUPS

This section identifies those population sub-groups that are likely to be most at risk of poorer breastfeeding outcomes. These at-risk groups of mothers are identified from a number of different sources:

- NSW Population Health Survey: Breastfeeding practices in the NSW Population Health Survey are described for a number of different sub-groups of the NSW population
- A number of individual research studies in NSW and Australia also provide data on rates of breastfeeding among different population sub-groups
- There are a number of significant groups of mothers who exhibit different breastfeeding outcomes due to birth factors, existing clinical conditions or who have particular other adverse health behaviours. Information on these factors is determined from research studies in Australia.

#### 3.1 NSW Population Health Survey

Data on infant feeding practices have been collected on an ongoing basis by the NSW Population Health Survey since 2001. Data are presented in the most recent summary report comparing breastfeeding practices in NSW overall in 2001, 2003-2004, 2005-2006 and 2007-2008, and for particular sub-groups for 2007-2008. The following data refer to all of the significant differences identified in the 2007-2008 survey.

Although there were apparent differences between area health services in various breastfeeding indicators, none of these were significant differences.

##### *Ever breastfed*

- A higher proportion of children in the first or least disadvantaged quintile had ever been breastfed (compared with the overall NSW population) (95.2% vs. 89.8%)
- A lower proportion of children in the following sub-groups of mothers were ever breastfed:
  - aged < 25 years (compared to ≥ 25 years) (76.5% vs. 92.4%)
  - without tertiary qualifications (compared to with tertiary qualifications) (85.7% vs. 97.3%)
  - from English speaking countries (compared to non-English-speaking countries) (89.0% vs. 97.1%)

##### *Breastfed at 12 months*

- A higher proportion of children of mothers in the second quintile of least disadvantage (39.9% vs. 28.3%)
- A lower proportion of children of mothers:
  - aged < 25 years (5.1% vs. 32.8%)
  - without tertiary qualifications (20.8% vs. 41.2%)
  - from English-speaking countries (26.0% vs. 40.6%)

##### *Fully breastfed to six months*

- A lower proportion of children of mothers:
  - aged < 25 years (17.3% vs. 27.6%)
  - without tertiary qualifications (18.6% vs. 37.7%)

There has been a significant increase in the proportion of children aged 0-23 months who were fully breastfed to six months between 2001 (14.5%) and 2007-2008 (26.3%).

*Exclusively breastfed to six months:*

- A lower proportion of children of mothers
  - in the most disadvantaged quintile (10.4% vs. 16.7%)
  - aged < 25 years (8.4% vs. 17.4%)
  - without tertiary qualifications (11.9% vs. 23.0%)

*Introduction of solids before six months:*

- A higher proportion of children of mothers
  - without tertiary qualifications (56.4% vs. 42.4%)

There has been a significant decrease between 2001 (69.4%) and 2007-2008 (48.3%) in the proportion of children aged 0-23 months who were introduced to solids before six months. The decrease has been significant in urban and rural health areas.

*Introduction of breast milk substitutes before six months:*

- A higher proportion of children of mothers
  - in the most disadvantaged quintile (68.8% vs. 54.4%)
  - aged < 25 years (75.6% vs. 50.5%)
  - without tertiary qualifications (64.3% vs. 37.5%)

There has been a significant decrease between 2001 (59.4%) and 2007-2008 (54.4%) in the proportion of children aged 0-23 months who were introduced to breast milk substitutes before six months. The decrease was significant in urban health areas.

## **3.2 Research Studies in NSW and Australia**

These studies are presented in chronological order.

- Dahlen and Homer (2010) examined infant feeding practices in the first 12 weeks among 235 Asian and 462 non-Asian first-time mothers in two Sydney hospitals. They found that, contrary to popular belief, Asian women were more likely than non-Asian women to be giving their baby some breast milk at six and 12 weeks postpartum, however this was when partial breastfeeding was taken into account.
- Forde and Miller (2010) surveyed mothers of 3828 mothers of infants in Perth. They found that factors increasing the likelihood of formula in hospital were:
  - Low birth weight
  - Multiple births
  - Private hospital
  - Primiparity
  - Mother of Asian ethnicity

Factors that reduced the likelihood of breastfeeding at six months were:

- Young mother
- No tertiary education
- Multiple births

- Use of formula in hospital
  - Low birth weight
  - Mother seeking postnatal professional breastfeeding advice within 14 days
- Data from a cross-sectional survey of 2669 mothers in Western Australia (Hauck et al. 2010) revealed that more multiparous than primiparous women were exclusively breastfeeding in hospital and at nine weeks. Independent predictors of early cessation of breastfeeding were:
    - Younger maternal age
    - Primiparity
    - Lower maternal education level
    - Supplementation with formula in hospital
    - Caesarean birth
  - Bandyopadhyay et al (2010) report, from a postal survey of mothers at six months postpartum in Victoria, that immigrant women were more likely than Australian-born women to be breastfeeding at six months.
  - Baxter et al. (2009) reported on data from a large, representative cohort of Australian infants and showed the following maternal characteristics were associated with early breastfeeding cessation:
    - Age < 25 years
    - Smoking in pregnancy
    - Early full-time postnatal employment
    - Less educational attainment

Infant factors associated with a transition to complementary breastfeeding in the first postnatal month were:

- Multiple births
  - Caesarean section
  - Infant admitted to intensive care
  - Primiparity
- Yeoh et al. (2007) explored the socio-economic factors and other maternal characteristics that influence breastfeeding rates among 9618 babies in south-western Sydney. They found that the factors that increased the risk of not breastfeeding were:
    - Being Australian born
    - Unmarried
    - Living in disadvantaged accommodation
    - Having lower levels of education
    - Currently smoking
  - Forster et al. (2006) examined factors associated with breastfeeding at six months postpartum among 981 primiparous women attending a public, tertiary hospital for women in Melbourne. Factors positively associated with breastfeeding at six months were:
    - A very strong desire to breastfeed
    - Having been breastfed oneself as a baby

- Being born in an Asian country
  - Older maternal age
- Scott et al. (2006) examined predictors of breastfeeding duration among a group of 587 mothers recruited from two maternity hospitals in Perth. Factors relating to increased risk of discontinuing fully breastfeeding to six months and any breastfeeding at 12 months were:
    - Breastfeeding problems at or before four weeks
    - Introduction of a pacifier before 10 weeks of age
    - Smoking during pregnancy (see below)
    - Returning to work before infant 12 months

Factors associated only with discontinuation of fully breastfeeding to six months were father preferring formula or ambivalent about type of feeding, and unplanned pregnancy (unintended or mistimed). Grandmothers' preference for formula feeding or ambivalence towards breast feeding was associated with reduced likelihood of any breastfeeding at 12 months.

### **3.3 Specific Other Factors associated with Poorer Breastfeeding Practices**

#### **3.3.1 Caesarean Delivery**

- Two recent studies in Australia have found an association between poorer breastfeeding outcomes and caesarean section (Baxter et al. 2009, Hauck et al. 2010), the former study being among a large, representative sample.
- Caesarean delivery has been associated with decreased initiation of breastfeeding in Puerto Rico (AOR 0.64, 95% CI 0.51 0.81) (Perez-Rios et al. 2008). Also in 2008, Nakao et al. showed that fully breastfeeding to four months was affected by caesarean section, and premature delivery, in Japan.
- An earlier study in Australia (Rowe-Murray and Fisher 2002) found that caesarean section was a significant barrier to the implementation of Baby Friendly Hospital Initiative Step 4 (early skin-to-skin contact) and that hospital practices were amenable to changes that enabled its implementation regardless of the mode of delivery.
- Asole et al. (2009) showed caesarean section to be a major factor in increasing supplementation during the hospital stay, which was subsequently associated with not breastfeeding at one month.

#### **3.3.2 Preterm and Low Birth Weight Infants**

- The systematic review by Renfrew et al. (2009) concluded that providing mothers of babies in neonatal units with extra help with breastfeeding and expression of breast milk is more effective and less costly than normal staff contact.

For preterm babies, the use of breast milk substitutes is associated with increased short and long-term adverse outcomes. The fragility of such infants, their changing nutritional and health needs, the increased difficulty in producing breast milk experienced by preterm mothers, the anxiety that is provoked in mothers and family members, and the fact that health-care staff may not have the skills or



the time needed, can make breastfeeding a difficult process (Renfrew 2009). To complicate the issue further, starting and continuing to breastfeed, or to express breast milk, is particularly difficult in special and intensive care settings where care is dominated by medical procedures. In such settings, parents are likely to be anxious and distressed and mothers are often separated from their babies.

*'Babies of mothers from disadvantaged groups are least likely to be breastfed, yet these babies are also most likely to be born too soon or too small. This aspect of early years care is really important in terms of health inequalities, along with disease prevention.'* (Renfrew 2009)

In summary, the review showed that, despite the limitations of the evidence base, kangaroo skin-to-skin contact, peer support, simultaneous breast milk pumping, multidisciplinary staff training and the Baby Friendly accreditation of the associated maternity hospital have been shown to be effective, and skilled support from trained staff in hospital has been shown to be potentially cost-effective. All these factors point to future research priorities. Many of these interventions inter-relate: it is unlikely that specific clinical interventions will be effective if used alone.

- A similar review of interventions to improve breastfeeding outcomes for infants admitted to neonatal units by McInnes and Chambers (2008) found large variability in studies but concluded that skin-to-skin contact and additional post-natal support seemed to offer greater advantage for the infant in terms of breastfeeding outcomes.
- Ahmed and Sands (2010) also concluded that kangaroo care, peer counselling, in-home breast milk measurement and post-discharge lactation support improved breastfeeding outcomes among preterm infants, and that maternal satisfaction improved with post-discharge interventions.
- A Cochrane systematic review by Collins et al. (2008) showed that supplementing breast feeds by cup significantly decreased 'no breastfeeding or only partially breast feeding' on discharge home (RR 0.75, 95% CI 0.61 0.91); however, cup feeding significantly increased length of hospital stay by 10 days (95% CI 3.87 16.29). There was also a high degree of noncompliance with cup feeding in the largest study, indicating dissatisfaction with this method by staff and/or parents.

### 3.3.3 Obesity

There is now substantial evidence linking maternal obesity with poorer breastfeeding outcomes.

- A systematic review by Amir and Donath (2007) found that there is evidence that obese women plan to breastfeed for a shorter period than normal weight women and are less likely to initiate breastfeeding. Three out of four studies reported a significant relationship between obesity and delayed lactogenesis. Among 15 studies examining breastfeeding duration and obesity, the majority of studies showed a significant negative relationship with obese women breastfeeding for a shorter duration.
- Donath and Amir (2008) examined data from the longitudinal study of Australian children and showed that, among overweight/obese women who initiate breastfeeding, higher rates of cessation of breastfeeding in the immediate postpartum period (1 week) and in the first six months contribute to the shorter duration of breastfeeding compared to normal weight women. The adjusted odds ratio for overweight women ceasing breastfeeding in the first week was 1.52 (95% CI 1.02 2.28) and for obese

women the AOR ratio was 2.54 (95% CI 1.70 3.79). For women who breastfed for at least one week, overweight women had an AOR of 1.26 (95% CI 1.04 1.53) and obese women an AOR of 1.38 (95% CI 1.10 1.73) for ceasing breastfeeding in the first six months.

- Nommsen-Rivers et al. (2010) found that delayed onset of lactogenesis among first time mothers is related to maternal obesity, as well as factors associated with ineffective feeding.
- Liu et al. (2010) in the US showed that, compared to normal-weight white women, very obese white women were less likely to initiate breastfeeding (OR 0.63, 95% CI 0.42 0.94) and more likely to discontinue breastfeeding within the first six months (hazard ratio 1.89, 95% CI 1.39 2.58). Pre-pregnancy BMI was not associated with initiation or duration of breastfeeding among obese black women, although black mothers had lower rates of breastfeeding compared to white mothers overall.
- Krause et al. (2010) also found a negative association with initiation of breastfeeding and lactation score (intensity of breastfeeding) and BMI. These authors suggest that there may be unrealistic expectations regarding the effect of breastfeeding on weight loss that result in early cessation of breastfeeding. They recommend additional support and encouragement for overweight and obese women to initiate and continue breastfeeding.

### 3.3.4 Smoking

In Australia, data have shown that mothers who smoke have a lower prevalence and shorter duration of breastfeeding than non-smoking mothers (Giglia et al. 2006, Scott et al. 2006), although this appears to not be the case among Aboriginal mothers (Gilchrist et al. 2004). The lower prevalence of breastfeeding appears to be due largely to a lower motivation to breastfeed rather than a physiological effect of smoking on the milk supply (Donath and Amir 2004).

A study among Maori mothers in New Zealand (Glover et al. 2009) has shown that the relatively high rates of tobacco use by Maori create a tension for breastfeeding mothers, which is cited by some as a reason to end breastfeeding prematurely. Bogen et al. (2008) note that smoking is not contraindicated with breastfeeding (American Academy of Pediatrics), yet this is not understood by most mothers who smoke. They conclude that correction of misinformation could increase breastfeeding rates.

The encouragement to cease smoking in the antenatal setting is an area for considerable public health gain (Giglia et al. 2006); however, smoking cessation during pregnancy has been associated with weight gain above recommendations and more than that which occurs in non-smokers or smokers (Adegboye et al. 2010). Hence, care should be taken when addressing potential weight gain issues in this high risk group.

### 3.3.5 Primiparity and Multiple Births

Three studies in Australia have associated primiparity, compared to multiparity, with poorer breastfeeding practices. Forde and Miller (2010) showed that infants of primiparous mothers were more likely to be given formula in hospital; Baxter et al. (2009) showed that these infants were more likely to be given infant formula during the first month postpartum; and Hauck et al. (2010) showed that these infants were at risk of early cessation of breastfeeding and less likely to be exclusively breastfed in hospital and at nine weeks postpartum.

Also, multiple births result in infants being more likely to be given formula in hospital (Forde and Miller 2010), more likely to be given formula in the first month (Baxter et al. 2009) and less likely to be breastfed at six months (Forde and Miller 2010).

### **3.3.6 Postpartum Depression**

Dennis and McQueen (2009) performed a qualitative systematic review of the relationship between infant feeding outcomes and postpartum depression. The review found that there is a suggestion that women in the perinatal period who experience depressive symptoms may be at increased risk for poorer infant feeding outcomes, including breastfeeding initiation, duration and exclusivity. They suggest that research to determine effective interventions to support breastfeeding mothers who are depressed is warranted.

### **3.3.7 Analgesia in Labour**

Jordan (2006) indicated that, while the evidence is not conclusive that analgesics in labour are detrimental to breastfeeding, mothers and clinicians may feel that there is sufficient evidence to justify offering extra support to establish breastfeeding if the mother has received high doses of analgesics in labour.

### **3.3.8 Early Postnatal Discharge**

Policies of earlier postnatal discharge of healthy mothers and term infants do not appear to have adverse effects on breastfeeding or maternal depression, when accompanied by a policy of offering women at least one nurse-midwife home visit post discharge (Brown et al. 2002, Cochrane Review).

## **3.4 Summary of At-Risk, Vulnerable Groups**

Data from the NSW Health Survey 2007-2008 show consistently poorer breastfeeding practices among two particular subgroups. A significantly smaller percentage of younger mothers aged less than 25 years, and those less well educated, i.e. with less than tertiary qualifications, exhibited poorer breastfeeding practices.

Also, children of mothers from English-speaking backgrounds were less likely than children of mothers from non-English speaking backgrounds to be ever breastfed or to be breastfed at 12 months.

The proportion of mothers breastfeeding at 12 months was particularly high in the second quintile of least disadvantage but not in the first quintile of disadvantage (least disadvantaged) compared to NSW overall.

Research studies of breastfeeding in NSW and Australia generally confirmed the above findings, with nearly all studies showing younger women and those with no tertiary education having poorer breastfeeding outcomes. Several studies examined the effect of country of birth on breastfeeding which also confirmed the results from the NSW Health Survey, i.e. that immigrant women, including Asian women, were more likely to have better breastfeeding outcomes, including more likely to initiate breastfeeding and breastfeed at six, 12 and 26 weeks postpartum. No effect on exclusive breastfeeding was identified and one study showed a higher rate of supplementation in hospital among Asian women.

Several specific other factors were highlighted in the literature as being detrimental to breastfeeding, including primiparity and multiple births. Also, the following factors are associated with significantly poorer breastfeeding outcomes:

- Maternal obesity
- Caesarean birth
- Preterm and low birth weight infants
- Women who smoke

Obesity in pregnancy is considered to be a major health care issue (Tsoi et al. 2010). Obese mothers are less likely to breastfeed, or to breastfeed for as long, as normal weight mothers yet breastfeeding can mitigate the adverse metabolic effects of obesity, and the often associated gestational diabetes mellitus, on both mother and child (Trout et al. 2010). Additional support and encouragement for overweight and obese women to initiate and continue breastfeeding is required.

Effective interventions were identified for preterm and low birth weight infants. Early skin-to-skin contact, kangaroo care, and additional postnatal support in hospital and on discharge have been identified as effective strategies, with the latter strategy identified as cost-effective.

Smoking is not contraindicated with breastfeeding; hence, mothers who smoke should be encouraged to still breastfeed while encouraged also to cease smoking. Care should be taken to avoid excess weight gain in those who do cease smoking.

Postpartum depression and analgesia in labour may be associated with poorer breastfeeding outcomes. Early discharge has not been associated with poorer breastfeeding outcomes, provided there is at least one follow-up at-home visit.

## 4 INTERVENTIONS TO ENCOURAGE AND SUPPORT BREASTFEEDING

### 4.1 Methods

The literature was searched in September and October 2010 for articles published since 2005 that were on the following topics:

- Systematic reviews of interventions to promote, protect and support breastfeeding, including policy (conducted on studies in developed countries)
- Studies of the Baby Friendly Health Initiative and the 'Ten Steps' that comprise the Baby Friendly Hospital Initiative
- Research studies of breastfeeding interventions in Australia.

Recent systematic reviews were examined as they provide the best summaries of evidence to date. Several of them also provide recommendations for policy and practice. An overview of the literature beyond systematic reviews was performed in relation to the Baby Friendly Health Initiative, as no systematic reviews were identified on this topic and it is an area of particular interest. Studies conducted in Australia were specifically identified. Also, individual research studies of breastfeeding interventions in NSW and Australia were included, in order to provide evidence for policy and practice that may be locally applicable.

### 4.2 Evidence of Intervention Effectiveness

Eleven reviews published in peer-reviewed journals since 2005 were identified that systematically examined the literature around interventions to promote and support breastfeeding:

- A systematic review of the nature of support for breastfeeding adolescent mothers (Hall et al. 2006)
- Interventions for promoting the initiation of breastfeeding (Dyson et al. 2005)
- Support for breastfeeding mothers (Britton et al. 2007)
- Primary care interventions to promote breastfeeding: An evidence review for the US Preventive Services Task Force (Chung et al. 2008; USPSTF 2008)
- A systematic review of telephone support for women during pregnancy and the early postpartum period (Dennis and Kingston 2008)
- A systematic review of professional support for breastfeeding (Hannula et al. 2008)
- Systematic review of education and evidence-based practice interventions with health professionals and breastfeeding counsellors on duration of breastfeeding (Spiby et al. 2009)
- Breastfeeding peer counselling: From efficacy through scale-up (Chapman et al. 2010)
- Lay health workers in primary and community health care for maternal and child health and the management of infectious diseases (Lewin et al. 2010)
- Breastfeeding educational interventions for health professionals: a synthesis of intervention studies (Watkins and Dodgson 2010)
- Factors that positively influence breastfeeding duration to 6 months: a literature review (Meedya et al. 2010; self-efficacy and social support)

A Cochrane review of interventions in the workplace (Abdulwadud and Snow 2007) found that the evidence was too limited.

The evidence is summarised below according to type of intervention:

1. Hospital Practices, including the Baby Friendly Hospital Initiative
2. Health Professional Education
3. Support for Breastfeeding Mothers and Development of Personal Skills

## **4.2.1 Hospital Practices**

### **4.2.1.1 Effectiveness of the Baby Friendly Hospital Initiative (BFHI)**

Although the Baby Friendly Health Initiative has been extended from ‘Hospital’ to ‘Health’, the evidence to date is only in relation to ‘within hospitals’. There is no literature pertaining to BFHI outside of hospital facilities, i.e. in community health facilities or paediatric units. Any further mention of BFHI in this report is therefore in relation to the Hospital Initiative only. Evidence for each of the Ten Steps which comprise the Baby Friendly Hospital Initiative (Box 1) was first summarised by the World Health Organization in 1998. This mainly narrative review discussed each of the ten steps, providing evidence from experimental and quasi-experimental studies for breastfeeding outcomes. The findings of the WHO 1998 review are described in Hector et al. (2004, pp 57-60) and a summary statement is provided below.

*‘The available evidence indicates that implementation of the ‘Ten Steps’ in maternity facilities can increase breastfeeding in almost any setting. Implementing each step by itself has some effect, but implementing them all together can be expected to have a greater effect, while omitting one or two may limit the impact of those in place.’ (WHO 1998)*

The Case Study of the BFHI in NSW by Heads (2005) mentions the evidence from nine studies on the effectiveness of the BFHI (from 2000-2005); from studies in diverse countries such as Scotland, the UK, Republic of Belarus, the US, Switzerland and Brazil (Kramer et al. 2001, Philipp et al. 2001, Cattaneo and Buzzetti 2001, Braun 2003, Merewood et al. 2003, Merten and Ackermann-Liebrich 2004, Philipp et al. 2003, Broadfoot et al. 2005, Do Nascimento and Issler 2005). All of these studies showed increases in rates of initiation and/or duration of breastfeeding as a result of the BFHI; however, they have not been systematically reviewed.

## **BOX 1 THE TEN STEPS TO SUCCESSFUL BREASTFEEDING (UNICEF/WHO 1991)**

Every facility providing maternity services and care for newborn infants should:

1. (a) Have a written breastfeeding policy, that is (b) routinely communicated to all health care staff
2. Train all health care staff in skills necessary to implement this policy
3. Inform all pregnant women about the benefits and management of breastfeeding
4. Place babies in skin-to-skin contact with their mothers immediately following birth for at least an hour and encourage mothers to recognise when their babies are ready to breastfeed, offering help if needed.
5. Show mothers how to breastfeed and how to maintain lactation even if they should be separated from their infants
6. Give newborn infants no food or drink other than breast milk, unless medically indicated
7. Practice rooming-in, allow mothers and infants to remain together 24 hours a day
8. Encourage breastfeeding on demand
9. Give no artificial teats or dummies to breastfeeding infants
10. Foster the establishment of breastfeeding support and refer mothers on discharge from the facility.

The findings of some more recent studies are listed below.

- Murray et al. (2007) found that five hospital practices, together, were associated with breastfeeding duration in a large population-based study in the US. The five practices were: breastfeeding within the first hour (now considered to be skin-to-skin contact within the first hour); breast milk only; infant rooming-in, no pacifier use; receipt of a telephone number for use after discharge. Sixty eight per cent (95% CI 61 75) of mothers who experienced all five steps were breastfeeding at 16 weeks, compared with one-half (53%, 95% CI 49 56) of those who did not. Only 19% of mothers experienced all five supportive practices.
- Declercq et al. (2009) examined the effect of hospital practices on exclusive breastfeeding at one week, among those who intended to breastfeed at birth, in the US. Primiparas who delivered in hospitals and practised six or seven of the steps (seven hospital practices were examined) were six times more likely to achieve their intention to exclusively breastfeed than were those in hospitals who practised one or none of the steps.
- Hannula et al. (2008) summarised, from a systematic review of professional support and education in breastfeeding during pregnancy, in maternity hospitals and postnatally, that the BFHI – particularly restriction to supplementary fluids – as well as practical, hands-off teaching, when combined with support and encouragement, were effective approaches in maternity hospitals.
- Rosenberg et al. (2008) examined the effect of the Ten Steps on breastfeeding at two days and two weeks in 57 hospitals in Oregon, US. Increases in overall 'Breastfeeding Support Scores' (added up

number of steps followed) were associated with increases in breastfeeding percentage at two days and at two weeks. Of the specific components, only Step 1a, the presence of a written hospital policy, was independently associated with breastfeeding percent. They found lowest compliance with staff training (Step 2) and highest for Step 4 (help with initiation) and Step 8 (encouraging feeding on demand).

When they controlled for all the other noted demographic and intrapartum variables, among primiparas, four hospital practices were statistically significantly associated with the likelihood of achieving breastfeeding intention: helping mothers get started – Step 5 (adjusted odds ratio 6.3; 95% CI 1.8, 21.6), hospital staff not supplementing with formula or water – Step 6 (AOR 4.4; 95% CI 2.1,9.3), telling mothers about community resources for breastfeeding support – Step 10 (AOR 2.3; 95% CI 1.1, 4.9), and staff not giving the baby a pacifier – Step 9 (AOR 2.3; 95% CI 1.2, 4.4). Among multiparas, two hospital practices significantly impacted fulfillment of intention to breastfeed: hospital staff not supplementing – Step 6 (AOR 8.8; 95% CI 4.4, 17.6) and hospital staff encouraging feeding on demand – Step 8 (AOR 3.4; 95% CI 1.7, 6.8).

- Abrahams and Labbok (2009) examined the effect of BFHI on rates of exclusive breastfeeding, pre- and post- BFHI, in 14 developing countries. They found that at the country level there were significant trends from baseline over time, with an average annual increase of 1.54 percentage points in the rate of exclusive breastfeeding in infants less than two months and 1.11% points in exclusive breastfeeding among infants less than six months. However, the trends upwards were not significantly different from pre-BFHI trends.

#### 4.2.1.2 Effectiveness of the Individual Steps of the BFHI

This non-systematic review of the literature found no evidence to support the individual effectiveness of Steps 1b, 2, 3 and 7 on breastfeeding outcomes. However, few studies examined these individual steps in terms of effectiveness on breastfeeding outcomes.

##### *Step 1a – Presence of a written breastfeeding policy*

Only one study was identified that dealt specifically with Step 1 of the Ten Steps. Rosenberg et al. (2008) showed Step 1a, the presence of a written policy, to be independently associated with breastfeeding percent.

##### *Step 4 – Early skin-to-skin contact (SSC)*

- Results from a population-based cohort study in California (Bramson et al 2010) demonstrated a dose-response relationship between the duration of early skin-to-skin contact (SSC) and the likelihood of breastfeeding exclusively during the hospital stay. Compared to mothers who received no early SSC, mothers who experienced early SSC were more likely to exclusively breastfeed their infants in hospital, and this likelihood increased as the duration of SSC increased: 1 to 15 minutes of early SSC (OR 1.4; 95% CI 1.19, 1.59), 16 to 30 minutes (OR 1.67; 95% CI 1.47, 1.89), 31 to 59 minutes (OR 2.36; 95% CI 2.06, 2.7), and more than 1 hour (OR 3.15, 95% CI 2.91, 3.41).
- The Cochrane Review by Moore et al. (2007) '*Early skin-to-skin contact for mothers and their healthy newborn infants*' showed that babies with early SSC were more likely to be breastfed, and to breastfeed for longer. Specifically, the authors found statistically significant and positive effects of early SSC on



breastfeeding at one to four months post birth (10 trials; 552 participants) (OR 1.82; 95% CI 1.08, 3.07), and breastfeeding duration (seven trials; 324 participants) (weighted mean difference 42.55 days; 95% CI -1.69, 86.79). No adverse effects were found.

- In a study in Japan, Nakao et al. (2008) found that the 'time to first breast feed' up to 120 minutes was significantly associated with the proportion of mothers fully breastfeeding during their hospital stay, at one month and at four months after the birth. However, they did not find a dose-response relationship; there was no significant difference between mothers who first breastfed within the first 30 minutes, compared to those who first breastfed later than 30 minutes but up to 120 minutes postpartum.
- The Cochrane review by Anderson et al. (2003) found statistically significant and positive effects of early SSC, for breastfeeding at one to three months (8 trials) and duration (6 trials).

#### *Step 5 – Helping mothers get started*

- Rosenberg et al. (2008) showed that 'helping mothers get started' was independently associated with the likelihood of achieving breastfeeding intention (AOR 6.3; CI 1.8, 21.6).

#### *Step 6 – No supplementation in hospital, unless medically indicated*

- Two recently published studies in WA, one among 3828 mothers in Perth (Forde and Miller 2010) and one among 2699 mothers in WA (Hauck et al. 2010), showed an association between the use of formula in hospital and early cessation of breastfeeding and increased risk of not breastfeeding at six months, respectively.
- Declercq et al. (2009) showed that mothers who reported supplemental feeding to their infants were less likely to achieve their intention to exclusively breastfeed (AOR 4.4; CI 2.1,9.3 among primiparas; AOR 8.8; CI 4.4, 17.6 among multiparas).
- In a study of 266 mothers in a private hospital in Perth (McAllister et al. 2009), only two variables were significantly associated with duration of breastfeeding – whether or not artificial baby milk was administered in hospital and whether a mother could independently attach their baby on discharge from hospital. Contrary to other evidence (see above), time to first breastfeed, early skin-to-skin contact and antenatal breastfeeding classes were not associated with differences in breastfeeding duration in this study.
- In a study of 201 mothers in the US who had returned to work or study, Dabritz et al. (2009) showed that infants who were breast milk fed exclusively in hospital were about twice as likely as those who were fed formula supplements to be almost exclusively breastfeeding (no or occasional other foods and drinks), rather than partially or not breastfeeding.
- In a small survey in Italy, Asole et al. (2009) showed that caesarean section (AOR 3.69), a lack of information about the advantages of breastfeeding (AOR 4.78) and the absence or partial absence of rooming-in (AOR 14.64; 95% CI 2.24, 95.75) increased the risk of complementary breastfeeding during hospital stay. In turn, complementary breastfeeding during hospital stay was the major factor associated with not breastfeeding at 1 month of age (AOR 6.35; 95% CI 2.52, 16.01).

#### *Step 8 – Encourage breastfeeding on demand*

- Declercq et al. (2009) found that hospital staff who encouraged feeding on demand was independently associated with an increased likelihood of achieving breastfeeding intention (AOR 3.4; 95% CI 1.7, 6.8) among multiparas but not primiparas.

*Step 9 – No Pacifier Use*

A systematic review by O’Connor et al. (2009) summarised results from four randomised controlled trials and revealed no differences in breastfeeding outcomes with different pacifier interventions. They also showed that, although most observational studies reported an association between pacifier use and shortened duration of breastfeeding, the findings are likely to be attributable to other complex factors, such as breastfeeding difficulties or intention to wean.

Declercq et al. (2009) showed that hospital staff not giving the baby a pacifier significantly increased the likelihood of achieving breastfeeding intention among primiparous mothers, but not among multiparous mothers (AOR 2.3; 95% CI 1.2, 4.4).

Scott et al. (2006) had earlier indicated that additional studies are needed to determine whether breastfeeding problems that are associated with pacifiers precede or follow their introduction.

*Step 10 – Telling mothers about breastfeeding support on discharge*

Telling mothers about community resources for breastfeeding support has been associated with a significantly increased likelihood of achieving breastfeeding intention among primiparous mothers but not among multiparous mothers (AOR 2.3; 95% CI 1.1, 4.9; Declercq et al. 2009).

*Commercial Hospital Discharge Packs (CHDP) (not BFHI)*

The provision of commercial hospital discharge packs is not one of the hospital practices contained within the BFHI. Nevertheless, its impact on breastfeeding success is of considerable interest. The Cochrane review of 2000 (Donnelly et al.: *Commercial Hospital Discharge Packs for Breastfeeding Women*) has not been updated. They summarised the findings from nine studies from North America only. The provision of commercial hospital discharge packs (with or without formula) appears to reduce the number of women exclusively breastfeeding at all times, but has no effect upon the duration of any breastfeeding. They found that women with uncertain goals for breastfeeding were significantly less likely to breastfeed or breastfeed exclusively, if given commercial discharge packs.

The meta-analysis showed the following results (summarised in Hector et al. 2004):

	Exclusive breastfeeding	Peto Odds Ratio
no pack versus CHDP with promotional material but no formula	0-2 weeks	1.99 (1.04, 3.79)
	3-6 weeks	1.23 (1.05, 1.43)
	8-10 weeks	1.73 (1.13, 2.64)
no pack or non-commercial pack versus pack with formula + leaflets	0-2 weeks	1.99 (1.04, 3.79)
	3-6 weeks	1.25 (1.06, 1.47)
No pack versus packs with formula promotional material but no formula sample	3-6 weeks	1.27 (1.01, 1.62)

Two additional papers were identified since the systematic review.

Dabritz et al. (2009) found that, among 201 mothers of infants in California who had returned to work or school, the receipt of discharge gift packs containing formula was inversely associated with the degree of intensity of breastfeeding at six months. Mothers who received the packs were less likely to be almost exclusively breastfeeding (no or occasional substances other than breast milk) than partially breastfeeding or not breastfeeding (OR=0.5; 0.3-1.0). These authors summarised the literature from other studies, including studies which would have likely been included in the Cochrane review (all prior to 2000) plus the study by Rosenberg et al (2008, below), and concluded that the evidence is mixed. The effect of the packs probably depends on the vulnerability of the population, with those more likely to be affected being primiparous, Hispanic (all of the studies have been in the US), less highly educated, have lower household income and who return to work or study.

Rosenburg et al. (2008) examined the relationship between duration of exclusive breastfeeding and the receipt of commercial hospital discharge packs in a population-based sample of nearly 4000 women in Oregon, US. Among women who had initiated breastfeeding, 66.8% reported receiving the packs. Women who received the packs were significantly more likely to exclusively breastfeed for fewer than 10 weeks than were women who had not received the packs (AOR 1.39; 95% CI 1.05, 1.84).

In a Cochrane Review of interventions to promote the initiation of breastfeeding, Dyson et al. (2005) included a study by Howard (2000). In this study of 547 women, the provision of a non-commercial breastfeeding promotion pack, compared to a formula-company-produced pack, did not have any statistically significant effect on breastfeeding initiation (RR 0.93; 95% CI 0.80, 1.08, P = 0.34), although there was a non-significant effect on rates of stopping breastfeeding up to two weeks (RR 1.58; 95% CI 0.97, 2.56).

#### 4.2.1.3 Evidence from Supporting Studies

- Naylor (2010) makes seven recommendations for the implementation of the Ten Steps across the US, including the development of:
  - a program of 1-day regional courses specifically designed for hospital administrative leadership
  - linking residency approval to accreditation status
  - government approval of the International Code of Marketing of Infant Formula (the WHO Code).
- Heinig (2010) discussed the issue of supplementation and how it is often carried out by hospital staff as a means to increase maternal rest during the hospital stay. Heinig cautioned that fatigue is experienced by all new parents, not only breastfeeding families, and that fatigue will continue long after discharge from hospital; therefore, supplementation is a poor response to maternal fatigue. Instead the author offers recommendations for strategies that are associated with increased maternal rest, thereby helping to reduce conflict caused by simply withholding supplementation without offering alternative strategies for rest. The suggested strategies include prenatal education to prepare for postpartum fatigue, teaching mothers how to breastfeed in the side-lying position, addressing mothers' concerns about infant crying and organisation of nursing activities to allow mothers additional rest time.
- Dyson et al. (2009) provided policy and public health recommendations to promote the initiation and duration of breastfeeding in developed country settings. These policy recommendations came from a review of the evidence, as well as consultation with service users in the UK. Routine implementation of

the BFHI across hospital and community services was recommended as core to any breastfeeding strategy. They recommended that clinical care practices should include:

- support for effective positioning and attachment using a predominantly ‘hands off’ approach
- encouragement of baby-led breastfeeding
- supportive advice and sound reassurance and information for breastfeeding women with ‘insufficient milk’
- no restriction to mother-baby contact
- no supplemental feeds given routinely or without medical indication
- no hospital discharge packs which contain promotional information for artificial feeding.

Several studies in Australia and New Zealand have examined the extent of implementation and factors affecting implementation of the BFHI.

- Walsh et al. (2010) conducted six focus groups in hospitals in South Australia. Difficulties in implementation were identified as: the accreditation process, hospital dynamics, implementation of all Ten Steps, a bottle feeding culture, and maternal employment leading to discontinuation of breastfeeding. They considered that upper management support, specific funding, dedicated coordinator with “area leaders”, development of a specific breastfeeding policy incorporating various disciplines and staff and containing detailed protocols that comply with the Code, are required; as well as sponsorship of training for lactation consultants.
- Thompson et al. (2010) considered significant events influencing Australian breastfeeding practices over the last 40 years and encourage midwives to reflect on their role as ‘experts’ in the breastfeeding process, and to give confidence to women so that they utilise their instinctive ability to breastfeed by self-determined techniques that encourage mammalian skills for newborn sustenance and survival.
- Moore et al. (2007) examined barriers to implementation of the BFHI in hospitals in New Zealand, concentrating on steps 1 and 2: developing BFHI policy and communicating it to staff, and providing necessary staff training. The authors found that there was limited time for staff to learn about the policy; and getting all relevant staff aware of the policy was also difficult. In New Zealand there is a central government policy directive for BFHI but a limited number of hospitals which attain accreditation. The implication is that, if hospitals are not themselves leading the drive to become baby-friendly, then it is not likely to happen; there is the need for some kind of external motivation or incentive.

They also considered that, if the area was of low socio-economic status, it was harder to bolster breastfeeding rates, and that additional special education and language translation services, increased lactation consultant numbers, and close attention to the needs of mothers and maternity staff throughout the birthing process, would be needed.

The existence of interdisciplinary and advocacy groups that span hospitals and communities may also assist with policy dissemination and compliance.

- Reddin et al. (2007) examined the early experiences of graduate midwifery students in hospitals in Western Australia and South Australia. This qualitative longitudinal study found that participants

highlighted experiences such as time pressure and the established clinical practices of experienced midwives that undermined their commitment to the Ten Steps. They reported that outdated practices by senior midwives and passive resistance to the BFHI Ten Steps were commonplace, even in BFHI accredited hospitals.

- Walsh et al. (2006) examined the extent of implementation of the Ten Steps in Australian hospitals. The findings should be treated with caution however as, although there was a good response rate (n = 387/432), there are a large number of limitations to the study, including likely significant social desirability response bias. Overall, they found that improvements in Steps 1b (communication of policy to staff), 2 (staff training), 7 (rooming-in), and 10 (information on discharge) are needed.

#### 4.2.2 Education of Health Professionals

- Watkins and Dodgson (2010), in their paper titled *Breastfeeding Educational Interventions for Health Professionals: A synthesis of Intervention Studies*, reviewed intervention studies between 2002-2008 in developed countries that focused on increasing the breastfeeding knowledge, self-confidence and supportive behaviours of healthcare professionals. Fourteen articles included in the review showed that breastfeeding education can be successful in increasing the knowledge and confidence of nurses, and also showed that breastfeeding outcomes *may* also be improved; the effect was shown in two of four studies that measured these outcomes.

Primary care teams were incorporated into the intervention in less than one-third of those studies included in the review, yet most breastfeeding issues arise after women return to the community. The need for education of staff providing community paediatric support services is stressed.

- Spiby et al. (2009) conducted a systematic review of studies, published between 1980 and 2003, relating to interventions with health professionals and breastfeeding counsellors and undertaken in a developed country. The search identified nine studies. All were before-after studies involving the education of health professionals; no studies were identified that related to breastfeeding counsellors. Six of the studies involved mothers and babies in hospital (3 UK, 2 Italy, 1 France), three studies were in community settings (Canada, Spain, US), and four studies involved mothers living in disadvantaged areas (2 UK, 1 Spain, 1 US). Most interventions aimed to increase knowledge and change professional practice in support of breastfeeding.

The authors concluded that there were many methodological limitations to the studies, as well as differences in study contexts and settings. Hence, they concluded the evidence was insufficient to draw conclusions. From the studies identified, there seems to be no single method that consistently achieves changes in breastfeeding duration, although evidence from the more robust studies indicated that the UNICEF/WHO BFHI training might have the potential to influence breastfeeding duration.

- The Cochrane review by Britton et al. (2007) reported that exclusive breastfeeding was significantly prolonged with use of WHO/UNICEF training (RR 0.69; 95% CI 0.52, 0.91).
- Whalen and Crampton (2010) reviewed studies relating to overcoming barriers to breastfeeding continuation and exclusivity and summarised that paediatricians should educate themselves regarding

predictors of and barriers to successful breastfeeding. Once these have been identified, targeted anticipatory guidance can be provided to lead to breastfeeding success.

- Brodribb et al. (2008) indicated that further targeted training is needed to improve Australian General Practice (GP) registrars' breastfeeding knowledge, attitudes, confidence and effectiveness. A more recently published study of attitudes to infant feeding decision-making among Australian medical students and GP registrars (Brodribb et al. 2010) found that there were three choices to infant feeding decisions: the moral choice ('women were expected to breastfeed'), the free choice ('doctors should not influence a woman's decision'), and the equal choice ('the outcome of the decision was unimportant'). Participants were uncertain about differences in health outcomes from artificial versus natural breastfeeding, and there was concern that advising a mother to breastfeed may lead to maternal feelings of guilt and failure. These findings provide a foundation on which to base further educational interventions for medical practitioners.
- A national postal survey of 3,500 Australian midwives showed that the Newborn Feeding Ability Questionnaire and the Breastfeeding Initiation Practices Scale can contribute to practice development by assessing lactation and infant feeding knowledge and practice deficits (Creedy et al. 2008). Individual learning needs can be identified, and effectiveness of education interventions evaluated using these tools. Further testing is required.
- A descriptive account of New Zealand mothers' responses to questions on their breastfeeding experiences (Manhire et al. 2007) helped iterate the importance of consistency of advice and skills of health professionals, of listening and understanding women's responses to early breastfeeding assistance, and giving continuous encouragement and support throughout their breastfeeding experience.

To meet these recommendations, breastfeeding education for health professionals needs to include technical expertise and communication skills.

### 4.2.3 Breastfeeding Support and Maternal Self-Efficacy

Support provided for infant breastfeeding may be from various sources including professionals, peer supporters (paid and volunteer) and informal social networks; although defining the term 'support' can be problematic (Schmied et al. 2009). Different definitions have been used by different researchers.

*Professional Support* is defined by the Cochrane Review as breastfeeding support that is 'provided by a variety of medical, nursing and allied professionals (for example nutritionists)'. *Peer Support* is defined by Dennis (2008) as: 'the provision of emotional, appraisal, and informational assistance by a created social network member who possesses experiential knowledge of a specific behaviour or stressor and similar characteristics as the target population'. Schmied et al. (2009) apply Dennis' use of the term 'created social network' to indicate that peer supporters are not part of the woman's own informal social network but are linked with her for the specific purpose of providing this support, although the supporter may or may not be paid. The Cochrane review also identifies that *lay support*, a term which has been used interchangeably with peer support, may be either paid or voluntary.

#### 4.2.3.1 Professional Support

- The systematic review *Primary care interventions to promote breastfeeding: An evidence review for the US Preventive Services Task Force* (Chung et al. 2008 and USPSTF 2008), updates the USPSTF's 2003 evidence report (cf. Hector et al. 2004) and includes literature published between January 2001 and January 2007. The final report focused on randomised controlled trials. The review *did not* address community-based interventions, such as media campaigns, worksite lactation programs and peer-to-peer support programs that do not interact with the health system. Thirty-six studies in the US and the developed world were included.
  - Random-effects meta-analyses (all interventions together) showed that breastfeeding promotion interventions in primary care in developed countries resulted in significantly increased rates of short-term (1-3 months) and longer-term (6-8 months) exclusive breastfeeding; rate ratios were 1.28 (95% CI 1.11, 1.48) and 1.44 (95% CI 1.13, 1.84) respectively.
  - Interventions with formal breastfeeding education or individual-level professional support were not effective in improving breastfeeding outcomes – although no studies directly compared it to lay support within the same sample. Therefore, to further understand the role of lay versus professional support in breastfeeding promotion, further studies should directly compare them in the same population.
  - In subgroup analyses, combining pre- and post-natal breastfeeding interventions had a larger effect on increasing breastfeeding duration than either pre- or post-natal alone. Furthermore, breastfeeding interventions with a component of lay support (peer support, peer counselling, social support, e.g. home visits or telephone support) were more effective than usual care in increasing the short-term breastfeeding rate.
  - Further research is required to examine the role of postnatal home support for breastfeeding from trained professionals or peer counsellors.
- A systematic review of professional support interventions for breastfeeding by Hannula et al. (2008) examined the outcomes of studies that provide professional support and education in breastfeeding during pregnancy, in maternity hospitals and postnatally. Studies published between 2000 and March 2006 were included if they were in Swedish, Finnish or English. Thirty-six articles were included in the final analysis.
  - Interventions spanning from pregnancy to the intra-partum period and throughout the postnatal period were more effective than interventions conducted in just one period. In addition, intervention packages using various methods of education and support from well-trained professionals, and peers, are more effective than interventions concentrating on a single method. The effectiveness of the various methods or components of the interventions is difficult to calculate because most interventions were a combination of many methods. A combination of interventions resulted in better success.
  - During pregnancy, the effective interventions were interactive, involving mothers in conversation.
  - Practical hands-off teaching in hospital was effective if it included professional support and encouragement and empowered women with knowledge and skills. Technical education, e.g. lecturing, without supportive elements was not effective.

- Vulnerable groups like women giving birth by caesarean section, who were discharged early, or who did not have breastfeeding supporters, benefited from extra support tailored to their needs.
  - Effective postnatal interventions were home visits, telephone support and breastfeeding centres (professional support) combined with peer support.
  - Professionals’ role in breastfeeding promotion and encouragement was crucial – women were more likely to breastfeed if their trained health care provider encouraged them and gave them support. However to promote breastfeeding effectively the health care provider needs evidence-based breastfeeding education.
- One systematic review of interventions to promote the initiation of breastfeeding (Dyson et al. 2007) included data from 11 randomised controlled trials among low-income women in the US, and therefore acknowledged that the generalisability to other settings may be low. The findings showed that health education and peer support interventions can result in some improvements in the number of women beginning to breastfeed. The findings suggest that larger improvements are more likely to result from needs-based, one-to-one, informal repeat education or support sessions than more generic, formal antenatal sessions. Ideally, these sessions should be delivered by a trained professional or peer counsellor.
  - The Cochrane review by Britton et al. (2007) concluded that additional professional support was effective in prolonging any breastfeeding, but its effects on exclusive breastfeeding were less clear. They also concluded that effective support offered by professionals was specific to breastfeeding and given to women who had decided to breastfeed.
  - McDonald et al. (2010) evaluated the effect of an extended midwifery postnatal support program on the duration of breastfeeding among 849 women who gave birth in Western Australia. The program did *not* succeed in improving breastfeeding rates at six months postpartum in this setting, where there was high initiation of breastfeeding.
  - Hauck et al. (2010) examined Western Australian women’s perceptions of conflicting advice concerning breastfeeding. Advice that was viewed as conflicting extended beyond the provision of information that was inconsistent or directly contradictory, and included issues about information overload and disparities between the mother’s and health professional’s expectations. An empathetic approach focusing on the woman as an individual can help allay these perceptions.

#### 4.2.3.2 Peer and Social Support

- In a review of 26 studies conducted in September 2008. *Breastfeeding peer counselling: From efficacy through scale-up*, Chapman et al. (2010) found that the overwhelming majority of evidence from randomised controlled trials indicates that peer counsellors effectively improve rates of breastfeeding initiation, duration and exclusivity. These types of intervention were also shown to significantly decrease the incidence of infant diarrhoea and the duration of lactational amenorrhoea.
- Chapman et al. (2010) found that breastfeeding peer counselling initiatives can be scaled up as part of well-coordinated national breastfeeding promotion or maternal-child health programs. The cost-effectiveness of such scaled-up programs was recently estimated in South Africa. An intervention which



involved a small number of home visits plus more clinic-based support was more cost-effective than either numerous home visits only or a basic intervention that was clinic-based. Countries that have scaled-up breastfeeding peer support have not offered it as a stand-alone service, an existing health program or initiative has been used as the vehicle of delivery of the peer counselling services.

- A Cochrane review by Lewin et al. (2010), *Lay health workers in primary and community health care for maternal and child health and the management of infectious diseases*, defined a lay health worker as ‘any health worker carrying out functions related to healthcare delivery, trained in some way in the context of the intervention, and having no formal professional or paraprofessional certificate or associated tertiary education degree’. Their review and meta-analysis found evidence of moderate quality of the effectiveness of lay health workers in promoting initiation of breastfeeding (RR 1.36; 95% CI 1.14, 1.61;  $p < 0.00001$ ); any breastfeeding (RR 1.24; 95% CI 1.10, 1.39;  $p = 0.0004$ ); and exclusive breastfeeding (RR 2.78; 95% CI 1.74, 4.44;  $p < 0.0001$ ).
- The Cochrane review by Britton et al. (2007) searched databases from 1974 to January 2006 for interventions to support breastfeeding mothers. The review included studies from randomised or quasi-randomised controlled trials which compared extra support for breastfeeding mothers with usual maternity care. 34 trials from 14 countries were included in the analysis.
  - All forms of extra support analysed together showed an increase in the duration of any breastfeeding, with a relative risk of 0.91 (95% CI 0.86, 0.96) for stopping any breastfeeding before 6 months. All forms of extra support together had a larger effect on duration of exclusive breastfeeding than on any breastfeeding (RR 0.81; 95% CI 0.74, 0.89).
  - Lay and extra support together extended duration of any breastfeeding significantly ((RR before 4-6 weeks 0.65 (95% CI 0.51, 0.82); RR before 2 months 0.74 (95% CI 0.66, 0.83)).
  - Additional lay support, compared with standard care, was effective in prolonging exclusive breastfeeding, while its effect on duration of any breastfeeding was uncertain.
- Meedya et al. (2010) reviewed intervention studies examining social support and found only one intervention study which examined a specific strategy to increase breastfeeding intention. This intervention provided some evidence that such an intervention should involve women, their partner and their broader social networks. The authors found scarce evidence of interventions involving fathers, grandmothers and/or women’s social networks; and overall concluded that there are inconsistent results regarding the role of social support – probably due both to inconsistencies of the definitions across studies and lack of understanding about how social support operates.
- Cameron et al. (2010) investigated the influence of peers on breastfeeding discontinuation among new parents in the Melbourne InFANT program. Membership in a group in which a large proportion of mothers had ceased breastfeeding by six weeks was strongly related to cessation of breastfeeding before six months (among those who continued breastfeeding beyond six weeks), OR 2.1 (95% CI 1.3, 3.3). The authors concluded that attendance at parent groups where peers are breastfeeding infants of a similar age may have an important influence on the continuation of breastfeeding to six months. First-time parent groups may be an important setting to promote the continuation of breastfeeding.
- A systematic review of the nature of support for breastfeeding adolescent mothers (Hall Moran et al. 2006) examined the research question: ‘What is the nature of support offered in or emerging from

research studies undertaken in the context of breastfeeding adolescent mothers?’ Studies published between 1980 and 2006 were included. Of the 209 studies identified, only seven met the inclusion criteria – three in the US, two in Australia and two in the UK. The two in Australia were: Benson et al. (1996) ‘Adolescent mothers’ experience of parenting and breastfeeding’ and Quinlivan et al. (2003) ‘Examination of the effect of a postnatal home visiting service on maternal and neonatal outcomes’.

- Five types of support were identified from the seven studies: emotional, esteem, instrumental, informational and network. Emotional, esteem and network support were most beneficial. Support from the participants’ mothers seemed to be particularly powerful.
  - The provision of continuity of support from an expert individual, who is skilled in both lactation support and working with adolescents, was also highly valued by breastfeeding adolescents.
  - There was also evidence to suggest that targeted breastfeeding educational programs, specifically designed for the adolescent learner, may be successful in improving breastfeeding initiation and continuation rates in this population. However, it is not known which elements of the complex package on offer were most effective.
- Brown et al. (2009) examined factors associated with breastfeeding initiation and duration in young mothers aged  $\leq 24$  years in the UK, and found that helping young mothers to view breastfeeding as the norm, creating an environment where breastfeeding is accepted, providing professional and peer support, and encouraging the mother to continue breastfeeding are important.

#### **4.2.3.3 Maternal Self-Efficacy**

- Meedya et al. (2010) reviewed the literature on interventions to increase breastfeeding intention, self-efficacy and social support, including studies from 2000-2009. They found no firm evidence base on which to design an intervention strategy to increase the three modifiable risk factors of self-efficacy, intention and social support simultaneously.
- There is increasing evidence that a woman’s sense of her own breastfeeding self-efficacy (or confidence) is crucial to her continuing to breastfeed (Meedya et al. 2010). Meedya et al. considered that, in order to enhance self-efficacy, parents need to be taught about challenges that may arise during early breastfeeding and about how to overcome them. They suggested that problem solving and role playing in educational sessions may be useful strategies in this instance. Meedya et al. also advocate for adherence to suggestions by Dennis (2003), who made a number of recommendations to increase self-efficacy including the encouragement to recall positive aspects of breastfeeding performances purposefully; the provision of anticipatory guidance to acknowledge and normalise maternal anxiety, stress and fatigue; and proactive attention to making the unobservable breastfeeding skills apparent to the mother, including envisioning successful performances, thinking analytically to solve problems, managing self-defeating thoughts and persevering through difficulties.
- The systematic review by Hannula et al. (2008) concluded that mothers benefit from breastfeeding encouragement and support for their self-efficacy and feelings of being capable, empowered and good mothers. Therefore, peer support as part of the intervention package was particularly effective for at-risk groups such as youth, immigrants and low-income mothers.

- Baghurst et al. (2007) studied 317 women in Adelaide and showed that the Breastfeeding Self-Efficacy Scale (BSES), including a new shortened version, is an important instrument for identifying women at risk of early cessation of breastfeeding. They recommend that, together with demographic variables, it should be useful for targeting limited resources to those mothers in need.

#### 4.2.3.4 Mode of Support

- A systematic review of telephone support for women during pregnancy and the early postpartum period by Dennis and Kingston (2008) concluded that proactive telephone support may increase breastfeeding duration and exclusivity (data from three studies).
  - For any breastfeeding, an overall beneficial effect on the continuation of any breastfeeding was found in the meta-analysis of all types of telephone interventions at final assessment (three trials, n = 618; RR = 1.18, 95% CI 1.05-1.33). Excluding studies based on trial quality did not alter the results significantly. When specific time periods were examined for the continuation of any breastfeeding, a beneficial effect was found for shorter-term breastfeeding: at 0 to 4 weeks (1 trial; n = 256; RR 1.10; 95% CI 1.01-1.21), 5 to 8 weeks (1 trial; n = 256; RR= 1.13, 1.00-1.28), and 9 to 12 weeks (2 trials; n = 295; RR = 1.25, 1.07-1.45), but not at 13 to 16 weeks (1 trial; n = 323; RR =1.12, 0.94-1.34) or 17 to 24 weeks (1 trial; n = 39; RR = 2.11, 0.61-7.24).
  - An overall beneficial effect on the continuation of exclusive breastfeeding was found at final assessment (2 trials, n = 295; RR = 1.45, 1.12-1.87). When specific time periods were examined for the continuation of exclusive breastfeeding, a beneficial effect was found at 0 to 4 weeks (1 trial; n = 256; RR = 1.18, 1.00-1.40) and 9 to 12 weeks (2 trials; n = 295; RR = 1.45, 1.13-1.86), but not at 5 to 8 weeks (1 trial; n = 256; RR = 1.15, 0.93-1.41) or 17 to 24 weeks (1 trial; n = 39; RR = 2.11, 0.61-7.24).
- Fallon et al. (2005) evaluated a telephone-based postnatal support intervention in a regional Australian city. For women from a private hospital, the support improved exclusive breastfeeding duration to 4.5 weeks postpartum, but these improvements did not extend to three months. No effects were observed from mothers from the public hospital.
- Emerging evidence indicates that internet-based delivery of support may be particularly appealing to the current generation of time-poor breastfeeding mothers (Heinig 2009), and has appeal in terms of requiring few resources (Pate 2009). A study in Finland has shown that online support has the potential to reach parents from diverse backgrounds (Salonen et al. 2010).

#### 4.2.4 Gaps in the Interventions Evidence

The systematic evidence is focused on two main areas of health promotion action: developing personal skills, e.g. education and support of the individual; and reorientation of health services, e.g. health service policies and practices such as the Baby Friendly Hospital Initiative and health professional training.

Significant gaps remain in the evidence base. As identified previously (Hector et al. 2004, 2005), none of the systematic evidence base, and very little of the evidence base overall, provides evidence of effective strategies related to public policy, supportive environments or community action. For example, despite

breastfeeding facilities in workplaces and public settings being consistently perceived as barriers to breastfeeding, there is no systematic evidence of the effectiveness of workplace interventions to support, encourage and promote breastfeeding among working mothers (Abdulwadud and Snow 2007).

Most published reports on interventions addressing social and environmental factors comprise descriptive studies, or are often not evaluated (King et al. 2005). Among those that are evaluated, effectiveness in terms of breastfeeding rates is often not seen. However, it is important to emphasise that no single intervention alone is likely to increase breastfeeding rates at the population level. Therefore, single intervention studies might be better assessed also in terms of their effect on any of the specific enablers or barriers to breastfeeding, rather than on rates of breastfeeding alone.

The 'Case Studies' report (King et al. 2005) provided examples of a range of initiatives relating to strategies and intervention points not covered in the systematic reviews, including workplace policies and strategies, as well as providing more detailed descriptions of strategies known to be effective. Many of these case studies remain as illustrations of practice within the evidence-based and evidence-poor areas of action. Additional intervention research studies can be identified in more recent literature for some of these evidence-poor action areas. For example, a recent study showed that various components of a workplace lactation program were effective (Balkam et al. 2010).

### **4.3 Summary of Evidence – Breastfeeding Interventions**

The current review of the evidence found sufficient and in some cases strong evidence of interventions successful in supporting breastfeeding, and that should therefore be included in policy and practice. These are focused in three areas: hospital practices, education of health professionals, and maternal support. The findings are summarised below.

#### **4.3.1 Hospital Practices**

There is strong evidence for the effectiveness of the Baby Friendly Hospital Initiative (BFHI) as a whole and for most of the individual components that have been studied. It is important to note that several of the Ten Steps which comprise the BFHI have not been well-implemented, hence their effectiveness is less able to be determined.

The strongest evidence for effectiveness in terms of improving breastfeeding outcomes is in relation to the following practices:

- Having a written breastfeeding policy and communication of the policy to staff
- Early skin-to-skin contact
- Restricted supplementary fluids while in hospital unless medically indicated

The evidence surrounding the latter two practices is extremely strong. Heinig (2009) suggests that supplementation is a poor response to maternal fatigue, which will persist regardless of feeding practices; rather, health professionals should identify alternative methods to reduce fatigue in new mothers and/or help mothers to cope with the fatigue.

There is some evidence suggesting the effectiveness of Step 3 ‘informing all pregnant women of the benefits and management of breastfeeding’, Step 5 ‘helping mothers get started’, and Step 8 ‘encouraging breastfeeding on demand’.

There is a lack of evidence around Step 2 ‘training staff in skills to implement the policy’ and Step 10 ‘informing mothers about breastfeeding support on discharge’, although these are identified in Australian studies as areas for improvement. Communication of written policies to staff and rooming-in are also areas that were identified as requiring improvement in Australian hospitals.

The evidence for Step 9 ‘give no artificial teats or dummies’ is mixed. No controlled trials have found a relationship between pacifier use and poorer breastfeeding outcomes, whereas most observational studies have found an association. The evidence to date does not strongly support causality.

The evidence about the provision of commercial hospital discharge packs (CHDP) is somewhat limited, although the evidence in summary supports not providing the packs. CHDP are probably most effective at limiting breastfeeding among those who are most vulnerable; hence, banning their provision has a strong equity basis.

There have been no studies of the effectiveness of the Baby Friendly Health Initiative in paediatric or community settings, likely because of the extremely limited implementation in these settings.

Expert opinion in the literature examined in this review supports the routine implementation of the BFHI across hospital and community services. Barriers to implementation identified in Australia and New Zealand include: lack of management support, the lengthy accreditation process, embedded alternative practices and attitudes by senior midwives, and time pressures to learn about the policy and its’ implementation. Enabling factors include the gaining of upper management support and training in BFHI for hospital management – a one-day course has been proposed. Specific funding or incentives are likely to be required.

### **4.3.2 Health Professional Education**

There is insufficient evidence surrounding what works best in terms of health professional education. There is some evidence that the WHO/UNICEF training is effective at improving breastfeeding rates, but it is unlikely to be sufficient.

Qualitative evidence stresses the need for education of staff providing community support services. Also, relevant health professionals, including paediatricians, would likely benefit from being trained to identify the predictors and barriers to successful breastfeeding, and subsequently to provide targeted anticipatory guidance. There is some evidence to suggest particular ‘scales’ to assess current knowledge and understanding of breastfeeding by midwives in Australia (Creedy et al. 2008).

The provision of consistent advice and empathetic communication skills should be distinctive outcomes of the training.

### 4.3.3 Support and Self-Efficacy of Mothers

Support in any form has been identified as a core component of programs to ensure good breastfeeding outcomes; the evidence is very strong.

There is strong evidence that a mixture of professional and peer support is likely to be most effective, particularly support spanning all periods, i.e. antenatal, perinatal and postnatal. Kelaher et al (2008) have shown the effectiveness of an area-based early childhood intervention 'Best Start' involving peer and professional counsellors. One study (Curtis et al 2007) has shown that having a clear structure and relationship established between peer counsellors and professional supporters is important to reduce tension at the peer-professional interface and to increase the success of any combined program.

The evidence for the provision of professional support alone is mixed, and is stronger for postnatal than antenatal support, although the role of postnatal home support from trained professionals alone is not clear. It has been recommended (Dyson et al 2009) that breastfeeding support from a professional should be targeted to women on low incomes, in order to increase their rate of exclusive breastfeeding.

Practical, hands-off teaching with professional support and encouragement has been shown to be effective. Encouragement by health professionals is identified as being crucial to breastfeeding success. Professional support must be breastfeeding specific to be successful. Empathetic, listening support by health professionals is likely to be useful (Dyson et al 2009).

There is overwhelmingly strong evidence that peer counselling is effective in improving all aspects of breastfeeding. Scaling-up experience has suggested that it must not be offered as a stand-alone intervention, rather, it would benefit from being part of an existing health professional program or initiative. Also, a single session of informal, small group and discursive breastfeeding education should be delivered in the antenatal period (including topics like the prevention of nipple pain and trauma) to improve breastfeeding outcomes in low SES women.

The Australian InFANT study, which is based on anticipatory guidance to mothers of infants aged around 3 months onwards, has shown that attendance at parent groups, where peers are breastfeeding infants of a similar age, is effective at improving breastfeeding. Several studies have shown that targeted, peer counselling and social support, combined with professional support, is particularly important for younger mothers.

Telephone support has been shown to be successful in 3 studies in a systematic review, although a single study of telephone support in regional Australia was not successful at improving breastfeeding outcomes. Dyson et al (2009) recommended that complementary telephone support be provided to all breastfeeding women. Technology (internet, SMS, mobile phones) could be a potentially important mode of providing support in the current generation of mothers.

Overall, any breastfeeding promotional efforts should aim at enhancing mothers' self-efficacy and confidence with respect to breastfeeding. There is no strong evidence for how this might be achieved, although expert opinion suggests that pregnant women and mothers should be taught the challenges of breastfeeding, and to examine their thought-processes, so that they are not defeated but, rather, will persevere through difficulties; in other words, that breastfeeding-specific, practical and problem-solving

support should be provided. Mothers need to understand ways to solve the problems, as and if they arise, which could perhaps be addressed through anticipatory guidance.

The Breastfeeding Self-Efficacy Scale has been suggested as useful for identifying women at risk of early cessation of breastfeeding and, together with the socio-demographic factors such as young age and lack of tertiary qualifications, can be used to identify those women who require pro-active, additional support.

#### **4.3.4 Gaps in the Intervention Evidence**

Several of the reviews, including that of Renfrew et al (2007), highlight the lack of good quality evidence for interventions to promote, encourage and support breastfeeding. Many studies are methodologically-flawed, few are based on relevant theory, and only a few have targeted disadvantaged sub-groups of women.

No reviews have identified systematic evidence of effectiveness of public policy or environmental initiatives or of community interventions. No media campaigns were identified. The 'case studies report' (King et al. 2005) remains relevant in terms of illustrating a range of strategies and intervention points not covered in the systematic evidence base.

In order to be successful, many interventions need to be implemented within public health policy, mainstream clinical practice and local interventions (Dyson et al. 2009). Chung et al. (2008), in an expert review for the United States Special Task Force, indicated that system-level interventions with senior support may be more likely to be sustained over time.

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## Appendix A: Summary Tables of Recent Evidence of Health Benefits of Breastfeeding

**Table A1: Summary of included studies: Health outcomes and breastfeeding**

Abbreviations: Aust. = Australia, BF = breastfeeding or breastfed, BM = breast milk, BMI = Body Mass Index, CI = Confidence Interval, EBF = exclusive breastfeeding, MBF = mixed breastfeeding, mo. = months, OR = Odds Ratio, SIDS = Sudden Infant Death Syndrome, T1DM = type 1 diabetes mellitus, T2DM = type 2 diabetes mellitus, UK = United Kingdom

Type of study (NHMRC level of evidence)	Reference	Intervention / comparator	Population / study information	Quality/Comments	Results
Systematic review or meta-analyses (Level I)	Dennis C, McQueen K. The relationship between infant-feeding outcomes and postpartum depression: a qualitative systematic review. <i>Pediatrics</i> . 2009.	Not specified.	Searched academic databases Medline (1966-2007), CINAHL (1982-2007), EMBASE (1980-2007). Results of 49 studies included.	No specific outcome measures for systematic review, likely due to nature of available research in this field. Evidence largely from developed countries, but included two studies from China (n=1) & Pakistan (n=1)	Bottle feeding was associated with higher levels of depressive symptoms in 7 studies. Whereas, BF associated with lower levels of depressive symptoms in a further 7 studies. Twelve studies found mothers with depressive symptoms are significantly more likely to discontinue BF early. Presence of depressive symptoms may also influence BF initiation. These associations may be due to lower self-efficacy to BF with depressive symptoms. Due to methodological limitations however, further research is warranted to establish causation paths between depressive symptoms and BF discontinuation.
	Huang L. Systematic review: infant breastfeeding and later overweight/obesity. <i>Journal of Chinese Clinical Medicine [Lin Chuang Yi Xue Za Zhi]</i> . 2009	Ever BF vs. never BF.	Searched academic databases MEDLINE, CINAHL, EMBASE, Pub Med, and Cochrane Library. Included literature was published in English between 1990 and 2008. Included 17 studies.	Article described as systematic but process of exclusion is not well defined.	Ten studies supported the association between ever BF and overweight or obesity, six of which provided a dose-response relationship between risk of overweight or obesity and duration of BF.
	Kramer MS, Kakuma R. Optimal duration of exclusive breastfeeding. <i>Cochrane Database of Systematic Reviews 2002</i> [updated, 2009], Issue 1. Art. No.: CD003517. DOI: 10.1002/14651858.CD003517	Exclusive BF to 6 mo. vs. Exclusive BF to 3-4 mo. followed by MBF	11 observational studies from developed countries.	Definition of EBF varied considerably across studies. Although studies are observational, intervention trials on breastfeeding practices are unethical.	No reduction in risk of atopic dermatitis (eczema), asthma or other atopic outcomes. No difference in weight or length gain, (although larger samples are required to rule out effects of modest differences in risk of under-nutrition).
	Yang YW, Tsai CL & Lu CY.	Exclusive BF	Searched academic	Meta-analysis of	Reduced risk of atopic dermatitis but not significant, even among

Type of study (NHMRC level of evidence)	Reference	Intervention / comparator	Population / study information	Quality/Comments	Results
	Exclusive breastfeeding and incident atopic dermatitis in childhood: a systematic review and meta-analysis of prospective cohort studies. <i>Br J Dermatol.</i> 2009.	≥3 mo. vs. BF <3 mo.	databases MEDLINE (January 1966–May 2008) and EMBASE (1980–May 2008). Included 21 studies.	prospective cohort studies	children with a positive family history. Odds Ratio: 0.89 (95% CI 0.76–1.04)
	Gunasekera H, Haysom L, Morris P and Craig J. The global burden of acute otitis media and hearing impairment: a systematic review [Abstract]. <i>Pediatrics.</i> 2008.	Ever BF vs. never BF	Searched academic database Medline, EMBASE, and CINAHL. Studies included incidence/ prevalence data for acute otitis media or hearing impairment in children <18yrs	Meta-analysis of 108 studies	Increased prevalence of acute otitis media with not BF (OR: 1.28 [95% CI:1.03–1.59])
	Owen CG, Whincup PH, Kaye SJ, Martin RM, Davey Smith G, & Cook DG et al. Does breastfeeding lead to lower blood cholesterol in adult life? A quantitative review of the evidence. <i>Am J Clin Nutr.</i> 2008.	Ever BF vs. Never BF	Systematic review of observational studies. 17 included in final review (17498 subjects, 12890 BF/ 4608 formula-fed)	Mean difference between breastfed minus formula-fed were pooled using fixed effect models	Infants ever breastfed had lower mean total blood cholesterol level in adult life (>16 years of age), compared with those fed formula This difference was greater and more consistent for infants who were EBF (-0.15, 95%CI: -0.23, -0.06) compared with non-EBF (-0.01, 95%CI -0.06, -0.03)
	Horta BL, Bahl R, Martines JC, Victora CG. Evidence on the long-term effects of breastfeeding: Systematic reviews and meta-analyses. <i>World Health Organization.</i> 2007.	Ever BF vs. never BF	Medline search (1966 to March 2006). Meta-analysis of all observational and randomised studies	Only one academic database reviewed, although reference lists were searched for additional relevant articles	Small significant reduction in systolic and diastolic blood pressure in later life Small reduction in risk of obesity in later life Influence of BF on cholesterol in later life varies by age with a reduction in adulthood of 0.18mmol/, but no significant differences in children Increased cognitive development in childhood and possibly adolescence
	Ip S, ChungM, Raman G, et al. <i>Breastfeeding and Maternal and Infant Health Outcomes in Developed Countries.</i> Evidence Report/Technology Assessment No. 153 (Prepared by Tufts-New England Medical	Breastfeeding (mixed or exclusive) vs. formula fed or different durations of	Literature searched 1966 to Nov 2005. Included in r/v were 29 systematic reviews, 86 independent studies (43 on infant and 43 on maternal health	Included non-randomised trials, prospective cohort and case-control studies. Intervention/ comparator varied for different health	Infants: reduced risk of acute otitis media (ever BF vs. exclusive bottle feeding); atopic dermatitis in infants at risk of atopy (at least 3 mo. exclusive BF vs. <3 mo.); non-specific gastrointestinal infection in first year of life (ever BF vs. never BF); obesity in later life (ever breastfed versus never, association increases with increased duration of BF); acute lymphocytic leukaemia, and acute myelogenous leukaemia (BF at least 6 mo. – no reference

Type of study (NHMRC level of evidence)	Reference	Intervention / comparator	Population / study information	Quality/Comments	Results
	Center Evidence-based Practice Center, under Contract No. 290-02-0022). AHRQ Publication No. 07-E007. Rockville, MD: Agency for Healthcare Research and Quality. 2007	breastfeeding	outcomes)	outcomes	to exclusivity); necrotising enterocolitis in pre-term infants (ever BF vs. never BF). Lower systolic blood pressure in later life ( <u>small association</u> between ever breastfed vs. no breastfeeding). Increased risk of SIDS (formula fed vs. ever BF). Maternal: No effect of ever BF on return to pre-pregnancy body weight; increased risk of post partum depression with never BF or short duration of BF (causation path unclear i.e. depression may lead to early cessation of BF); reduced risk of breast cancer and ovarian cancer (ever BF vs. never BF, although poorer quality studies - retrospective case-control - for ovarian cancer).
	Guise J-M, Austin D, Morris CD. Review of Case-Control Studies Related to Breastfeeding and Reduced Risk of Childhood Leukemia. <i>Pediatrics</i> 2005		Searched academic database Medline 1990 to March 2004. Additional articles identified from <i>HHS Blueprint for Action on Breastfeeding</i> and expert panel	Review focuses on two case-control studies in Australia/Canada and the UK. Both included >3000 participants	Both studies showed a continuous association of reduced risk of acute lymphocytic leukaemia with increased duration of BF. The Aust. and Canada study found BF >6mo. compared with no BF was most protective (OR: 0.72; 95% CI: 0.60–0.87), after adjusting for maternal race, education, and family income. The largest study conducted in the UK was not significant: duration <1 mo. (OR: 0.96; 95% CI: 0.82–1.17), duration 1-6 mo. (OR: 0.90; 95% CI: 0.77–1.04), and duration ≥7 mo. (OR: 0.89; 95% CI: 0.75–1.05).
	Thompson J. Breastfeeding in infancy and blood pressure in later life: Systematic review and meta-analysis. <i>Am J Epidemiol.</i> 2005.	Ever breastfed vs. bottle feeding	Searched academic database Medline and EMBASE inception to March 2004. Mean difference in blood pressure between groups was compared through meta-analysis of 15 studies.	Search included letters, abstracts and review articles. Meta-regression analysis to measure impact of multiple variants i.e. sample size <1000 versus ≥1000 and varied definitions of breastfeeding.	Mean difference in breastfed infants was -1.4mmHg (p=0.001) and -0.5mmHg (p=0.03) in systolic and diastolic blood pressure respectively, compared with bottle fed infants. Meta-regression analyses - Systolic blood pressure. <ul style="list-style-type: none"> <li>▪ In larger studies effect size was -0.6 (p=0.06)</li> <li>▪ BF for at least two months had a larger effect -2.0mmHg compared with BF less than two months -0.4mmHg.</li> </ul> There was little evidence of heterogeneity between studies with diastolic blood pressure as the outcome, although large heterogeneity between studies concerning systolic blood pressure. Overall there is a small effect of breast feeding on systolic and to a lesser degree diastolic blood pressure in later life. BF is protective and strength of association increased with duration of BF ≥2 mo.
Prospective cohort study with	Duijts L, Jaddoe VW, Hofman A, & Moll HA. Prolonged and exclusive breastfeeding	Never BF, partial <4 mo, partial 4-	Cohort of 4164 infants from the Netherlands. Questionnaires assessed BF		Compared with never BF infants, those EBF to 4 mo and partially thereafter had lower risks of infections in the URTI, LRTI, and GI until the age of 6 months (adjusted odds ratio [aOR]: 0.65 [95%

Type of study (NHMRC level of evidence)	Reference	Intervention / comparator	Population / study information	Quality/Comments	Results
concurrent control (Level III-2)	reduces the risk of infectious diseases in infancy. <i>Pediatrics</i> . 2010.	6 mo, EBF to 4 mo (none thereafter), EBF 4 mo (partial thereafter), EBF 6 mo.	and doctor-attended infections in the first year of life		confidence interval (CI): 0.51-0.83]; aOR: 0.50 [CI: 0.32-0.79]; and aOR: 0.41 [CI: 0.26-0.64], respectively) and of LRTI infections between the ages of 7 and 12 months (aOR: 0.46 [CI: 0.31-0.69]). Partial breastfeeding, even for 6 months, did not result in significantly lower risks of these infections.
	Ladomenou F, Moschandreas J, Kafatos A, Tselentis Y, Galanakis E. Protective effect of exclusive breastfeeding against infections during infancy: a prospective study. <i>Arch Dis Child</i> . 2010.	EBF to 6mo. versus partial BF (BM with some formula given) or <6 mo. EBF	1049 Greek mother-infants pairs recruited. EBF defined as only BM with no other fluids or solids	Results adjusted for potential confounders: ethnic origin, parental education (years), birth weight, sex, multiple births, season of birth (autumn/spring), mode of delivery, other siblings	Infants EBF to 6 mo. had significantly lower incidence of acute respiratory infections, after adjusting for potential confounders. Partial BF was not associated with number of infectious episode or hospitalisations due to infection.
	Oddy WH. Kendall GE. Li J. Jacoby P. Robinson M. de Klerk NH. Silburn SR. Zubrick SR. Landau LI. Stanley FJ. The long-term effects of breastfeeding on child and adolescent mental health: a pregnancy cohort study followed for 14 years. <i>J Pediatr</i> . 2010.	Any BF <6mo. vs. ≥6mo	2366 children from the Western Australian Pregnancy Cohort (Raine) Study. Mental health assessed at 5, 8, 10 and 14 yrs using the parent-report Child Behaviour Checklist (CBCL/4-18). Regression used to assess BF and mental health over time.	EBF was investigated but did not influence study outcomes. Findings adjusted for: maternal age, education, smoking in pregnancy, stress in pregnancy, POBW, family income, and family structure.	BF <6 mo, compared with ≥6 mo. or longer was an independent predictor of mental health problems through childhood and into adolescence. Mechanisms and causal pathways however remain unclear. For example, infants with a more difficult temperament may cause early discontinuation of BF.
	Pohlabeln, H. Muhlenbruch, K. Jacobs, S. Bohmann, H. Frequency of allergic diseases in 2-year-old children in relationship to parental history of allergy and breastfeeding. <i>J Invest Allergol Clin Immunol</i> . 2010	EBF >4 mo. vs. ≤4 mo. or no BF	1685 German child cohort from birth. Parents completed questionnaires at birth and at 6, 12, and 24 mo. Analysis stratified by family history of atopic disease.	Regression models adjusted for parent education, parental smoking, sex, place of residence. Parent asked about breastfeeding at 6 months retrospectively	EBF for >4 mo. was associated with an increased risk of asthma and atopic dermatitis in children without a parental history of allergic diseases (OR=1.62; 95%CI: 1.02-2.56). Overall EBF >4 months in children with a history of atopy was associated with a lower risk of developing atopic conditions (however this was <b>not significant</b> ). Children whose fathers only had a history of allergic disease strongly benefited from exclusive breastfeeding for >4 months

Type of study (NHMRC level of evidence)	Reference	Intervention / comparator	Population / study information	Quality/Comments	Results
					(OR=0.39; 95%-CI: 0.18-0.83). Those whose mothers only had a history of allergic disease had an increased risk of asthma and atopic dermatitis with exclusive breastfeeding for >4 months (OR: 2.31; 95%-CI: 1.16-4.60).
	Liu B, Beral V, Balkwill A. Childbearing, breastfeeding, other reproductive factors and the subsequent risk of hospitalisation for gallbladder disease. <i>Int J Epidemiol.</i> 2009.	Duration of any breastfeeding per child (continuous)	1 289 029 English and Scottish women from the million Women Study. Duration of BF per child breastfed was calculated using a woman's total months of BF divided by number of BF children	Results adjusted for SES, region, BMI, smoking, hysterectomy, alcohol intake and past parity	Among women of a given parity, breastfeeding reduced the risk of gallbladder disease, the relative risk decreasing by 7% (95% CI 5–10%, $P < 0.0001$ ) per year of breastfeeding.
	Nagel G. Buchele G. Weinmayr G. Bjorksten B. Chen YZ. Wang H et al. Effect of breastfeeding on asthma, lung function and bronchial hyper reactivity in ISAAC Phase II. ISAAC Phase II Study Group. <i>Eur Respir J.</i> 2009.	Never BF, vs. any BF <6mo. vs. BF ≥6mo.	54,943 children aged 8–12 yrs, from 27 centres in 20 countries were included. Parents retrospectively reported BF. Country affluence based on gross national income	BF reported retrospectively. Results adjusted for maternal atopic disease, age and sex of child, exposure to tobacco smoke	In affluent countries... Any breastfeeding was associated with less non-atopic wheeze (OR: 0.87, 95%CI: 0.78–0.97). BF was not associated with atopic wheeze and objective measures of allergy. BF was associated with higher predicted forced expiratory volume in one second in affluent countries only (mean ratio 1.11, 95%CI: 1.02–1.20).
	Rebhan B. Kohlhuber M. Schwegler U. Fromme H. Abou-Dakn M. Koletzko BV. Breastfeeding duration and exclusivity associated with infants' health and growth: data from a prospective cohort study in Bavaria, Germany. <i>Acta Paediatrica.</i> 2009.	EBF to ≥6mo., vs. EBF ≥4 mo. vs. EBF <4mo.	1901 German infants measured from birth. Questionnaires administered by physician collected BF data, health/growth data on day 2–6, and in months 2, 4, 6 and 9.	Multivariate analyses for weight and length gain did not adjust for birth weight or maternal pre-pregnancy weight.	≥6 mo. of EBF reduced risk for ≥1 episode of gastrointestinal infection(s) during months 1–9 compared to no/<4 months EBF (OR: 0.60; 95%CI: 0.44–0.82). Highest weight-for-length z-scores at 6-7 mo. in infants EBF for <4mo.
	Kramer MS, Aboud F, Mironova E, Vanilovich I, Platt RW, Matush L, et al. Breastfeeding and child cognitive development" new evidence from a large randomised trial. <i>Arch Gen Psychiatry.</i> 2008.	EBF 3 to <6mo. or ≥6 mo. vs. <3mo.	13,889 healthy breastfed infants from the PROBIT study in Belarus (highly developed country). Follow-up at age 6.5yrs included assessment with the Wechsler Abbreviated Scales of Intelligence.	PROBIT intervention is randomised to clinics receiving breastfeeding support and those who did not. Thus EBF duration is not randomised but rather an outcome	Higher WASI scores were observed for any duration of BF and increased duration of exclusive BF. Higher verbal IQ associated with EBF for 3 to <6 mo. by 4.7 (95% CI, 4.0 to 5.3) points, and for ≥6 mo. 5.2 (95% CI, 3.7 to 6.7) points, compared with exclusive breastfeeding <3 mo. The effects on performance IQ with EBF for 3 to <6 mo. were 1.2 (95% CI, 0.6 to 1.8) points and for ≥6 mo. 2.1 (95% CI, 0.8 to 3.5). Similarly, effects on full-scale IQ were 3.3 (95% CI, 2.7 to 4.0) and



Type of study (NHMRC level of evidence)	Reference	Intervention / comparator	Population / study information	Quality/Comments	Results
				measure, hence reported findings are level III-3 evidence.	4.2 (95% CI, 2.8 to 5.6) points, respectively.
	Scholtens S, Brunekreef1B, Smit HA, Gerrie-Cor M. Gast G-CM, Hoekstra MO, de Jongste JC. Do Differences in Childhood Diet Explain the Reduced Overweight Risk in Breastfed Children? <i>Obesity</i> . 2008.	Ever BF or BF >4mo, vs. never BF	Prospective cohort of 2,043 Dutch children from the Prevention and Incidence of Asthma and Mite Allergy birth cohort study. Questionnaires used to collect data of BF, Diet (24-hr recall) and lifestyle factors.	Parent reported children's dietary intake, lifestyle measures (i.e. sedentary behaviour) and BF.	BF children had a healthier diet at seven years (adjusted prevalence ratio: 0.77, 95% confidence interval: 0.61–0.98). BF for >16 wks associated with lower overweight risk at 8 yrs (adjusted odds ratio: 0.67, 95%CI: 0.47–0.97). Little change observed after adjustment for diet (adjusted odds ratio: 0.71, 95%CI: 0.49–1.03).
	Kramer MS, Matush L, Vanilovich I, Platt RW, Bogdsovich N, Sevkovskaya Z, et al. Effect of prolonged and exclusive breastfeeding on risk of allergy and asthma: cluster randomised trial. <i>BMJ</i> . 2007.	EBF 3 to <6mo. or ≥6 mo. vs. <3mo.	13,889 healthy breastfed infants from the PROBIT study in Belarus (highly developed country). Follow-up at age 6.5yrs included assessment international study of asthma and allergy in childhood (ISAAC) questionnaire and skin prick testing to 5 antigens.	No adjustment for children with family history of atopy in results. Reliability measured between rates on the ISAAC assessment.	Borderline significant reductions in history of eczema both with more prolonged any breast feeding and with more prolonged exclusive breast feeding (p=0.08 for both associations). Positive skin prick test significantly more frequent in EBF infants for 3 to <6 months and ≥6 months, compared with <3 months for house dust mite, cat, birth pollen, mixed northern grasses, and alternaria (p<0.001 for all five antigens).
	Vohr BR, Poindexter BB, Dusick AM, McKinley LT, et al. Persistent beneficial effects of breast milk ingested in the neonatal intensive care unit on outcomes of extremely low birth weight infants at 30 months of age. <i>Pediatrics</i> . 2007.	Any BM vs. no BM.	773 infants (593 intervention; 180 comparator). Morbidities, neurodevelopment outcomes, growth parameters and nutrition data collected. Follow-up at 30 mo. Intervention infants divided into quintiles of BM ingestion in millilitres per kg per day for multivariate analysis.	Multivariate analysis adjusted for maternal age, education, marital status, race, infant gestation, gender, sepsis, intra-ventricular hemorrhage 3-4, peri-ventricular leukomalacia, O <sub>2</sub> at 36 weeks, necrotizing enterocolitis, and weight <10 <sup>th</sup> percentile at 18 mo.	Increased ingestion of BM associated with higher neurodevelopment scores (Bayley Mental Development index, psychomotor development index and behaviour score percentiles for emotional regulation), and fewer hospitalisations (discharge to 30 months) No effect on growth or incidence of cerebral palsy.

**Table A2: Summary of included studies: Breastfeeding and diabetes**

Reference	Exposure	Outcome variable	Population / study information	Quality	Results
<b>Breastfeeding and risk of type 2 diabetes (T2DM)</b>					
Horta BL, Bahl R, Martines JC, Victora CG. (2007) Evidence on the long-term effects of breastfeeding: Systematic reviews and meta-analyses. World Health Organization.	Ever BF vs. never BF	T2DM in Offspring	Medline search (1966 to March 2006). Meta-analysis of all observational and randomised studies.	One academic database reviewed, and reference lists were searched for additional relevant articles.	Insufficient evidence on programming effect of breastfeeding on glucose metabolism. Inconsistency of findings around breastfeeding and T2DM. Pooled OR 0.63 (95% CI: 0.45-0.89) for protective effect of breastfeeding on T 2DM. Nil association found between HOMA (measure of insulin resistance) and breastfeeding duration. Not possible draw conclusions on long term effect of breastfeeding on risk of T2DM in offspring
Ip S, ChungM, Raman G, et al. (2007) Breastfeeding and Maternal and Infant Health Outcomes in Developed Countries. Evidence Report/Technology Assessment No. 153 (Prepared by Tufts-New England Medical Center Evidence-based Practice Center, under Contract No. 290-02-0022). AHRQ Publication No. 07-E007. Rockville, MD: Agency for Healthcare Research and Quality.	Breastfeeding (mixed or exclusive) vs. formula fed or different durations of breastfeeding.	T2DM in Offspring T1DM in Offspring Maternal T2DM	Literature searched 1966 to Nov 2005. Included in review were 29 systematic reviews, 86 independent studies (43 on infant and 43 on maternal health outcomes).	Included non-randomised trials, prospective cohort and case-control studies. Intervention/comparator varied for different health outcomes.	History of breastfeeding associated with reduced risk of offspring type 1 and type 2 diabetes  History of lactation was associated with a reduced risk of maternal type 2 diabetes
Owen Christopher, Martin richard, Whincup Peter, Davey Smith George and Cook Derek. (2006) Does breastfeeding influence risk of type 2 diabetes in later life? A	Ever BF vs never BF	T2DM in Offspring	Searched EMBASE (1980- 2004) MEDLINE (1966 -2004) Web of Science (1980 -2004) plus additional studies identified by OVID alerts (n=1010) final	Included retrospective and prospective cohort studies, case control and 1 RCT	Pooled estimate from 6 adult studies and 1 adolescent study showed early breastfeeding was consistently associated with lower risk of T2DM in offspring  Possibility of publication bias raised although no evidence for this. Studies underpowered Confounding social class, birth

quantitative analysis of published evidence. <i>Am J Clin Nutr</i> 84: 1043-54			sample n =39		weight, maternal weight could lead to an overestimation of the association between BF and diabetes in later life  Fasting insulin levels may be a more useful marker. Association did not reach significance
Scott Taylor J., Kacmar J., Nothangle M. And Lawrence R. (2005) A systematic review of the literature associating breastfeeding with type2 diabetes and gestational diabetes <i>J Am Coll Nutr</i> 24(5): 1239-1241	Ever BF vs never BF	T2DM in Offspring	Medline (1996-2003), Cochrane and NIH Clinical Trials. Search terms breastfeeding, infant nutrition, diabetes. 12 studies(prospective cohort, case control) were included as the research pertained to relationship between T2DM(NIDDM) or GDM and BF	Systematic review with well defined exclusion criteria	There may be a lower risk of T2DM in children who were BF.  Limitations include – BF as a dichotomous variable, absence of power calculations, diagnostic criteria for T2DM (FBGL vs. OGTT). Large studies mostly in high risk groups, eg. Latino or Pima  Paediatric studies include long term follow-up but most maternal studies only short-term (less than 3 months)
<b>Breastfeeding and type 1 diabetes in offspring</b>					
Hui P, Hagopian W (2006) Environmental factors in the development of type 1 diabetes. <i>Rev Endocr Metab Disord</i> 7:149-162			Non systematic review of literature		Possible increased risk of T1DM with early introduction of cows milk/and or short duration of breastfeeding. Studies underpowered and confounders such as increased energy intake and duration of breastfeeding exist.
McNeil ME, Labbok M, Abrahams SW (2010) What are the risks associated with formula feeding? A re-analysis and review. <i>Birth issues in Perinatal Care</i> 37:1 50-58	Formula use (studies reconstructed with exclusive breastfeeding as standard)  Any formula use vs exclusive breastfeeding of varying	Type 1 diabetes in offspring	PubMed searched for exclusive breastfeeding and otitis media, asthma, type 1 diabetes, atopic dermatitis, infant hospitalisations secondary to lower respiratory tract infections and 2 diabetes and odds ratios. Also studies included in the US	Selection criteria well defined	Some evidence for an association between early formula use and T1DM (p=0.01 in one case-control study but no statistical significance in second case-control study)  Retrospective cohort(n=720) P=0.03 for T2DM exposure is exclusive BF ≥ 2 months

	duration		Agency for Healthcare Research and Quality sponsored review of maternal and infant health outcomes in the developed world		
McNeil Melinda E, Labbok Miriam, Abrahams Sheryl W. (2010)  What are the risks associated with formula feeding? A re-analysis and review.  <i>Birth issues in Perinatal Care</i> 37:1 50-58	Breastfed >3 months or <3 months vs. never breastfed	Maternal T2DM	N = 52731 women		Stratified by BMI Risk of diabetes was significantly greater for women who did not breastfeed (OR 1.48: 1.26-1.73) The benefit of breastfeeding increases with longer duration. Consistent association regardless of BMI Limitation – self reported data
Gunderson EP (2007) Breastfeeding after gestational diabetes pregnancy: subsequent obesity and type 2 diabetes in women and their offspring <i>Diabetes Care</i> 30 (Supp 2): S161-168	Ever BF vs never BF	T2DM in Offspring Maternal T2DM	Search terms not included. Includes meta-analyses, systematic reviews and quantitative reviews, case control and cohort studies	Descriptive review – exclusion criteria not defined	Inconclusive evidence on the effect of breastfeeding in reducing risk of T2DM in offspring (but systematic reviews and meta-analyses have detected an association) Maternal effects of BF include immediate effect on glucose tolerance and lasting post-weaning effect on maternal metabolic profiles. Little data on risk of T2DM specifically and on effect of exclusive breastfeeding. Prospective studies needed

**Table A3: Summary of included studies: Health outcomes and formula use**

Type of study (NHMRC level of evidence)	Reference	Intervention / comparator	Population / study information	Quality/Comments	Results
Systematic review or meta-analyses (Level I)	Alexander DD, Schmitt DF, Tran NL, Barraji LM, & Cushing CA. Partially hydrolyzed 100% whey protein infant formula and atopic dermatitis risk reduction: a systematic review of the literature. <i>Nutr Rev</i> 2010	Partially hydrolysed formula (pH) vs. cow's milk formula (CMF).	Searched Medline during March 2009. Studies included assessed risk of developing AD between conditions (n=18).	Research partially funded by Nestle although no contribution was made to writing, analysis or interpretation of findings.	In all studies of infants with family history of atopic conditions, a reduced risk of atopic dermatitis was observed over at least 3 years follow-up in pH group compared with CMP.  Review does not discern between whether any BM was also provided. Most studies included studied infants that were not BF with one including children EBF for first 1-2 months.
	McNiell ME, Labbok MH, & Abrahams SW. What are the Risks Associated with Formula Feeding? A Re-Analysis and Review. <i>Birth</i> 2010	Formula use vs. BF	Re-analysis of paper by Ip et al 2007 for the WHO (see Table 1), to convert odds ratios to illustrate health effects of formula use. PubMed search conducted to obtain additional articles.	Bottle feeding with expressed human milk considered the same as BF.	Pooled odds ratio for otitis media if any formula is introduced in the first 3 to 6 months is 2.00 (95% CI: 1.40, 2.78).  While all studies showing an increased risk of otitis media, atopic dermatitis, and lower respiratory tract infections with formula use...only two of the seven studies concerning asthma risk showed a significantly increased risk if any formula is introduced at or after 3-5 mo. Only two of the 18 studies concerning atopic dermatitis and formula use showed a significantly increased risk at or after 3-4 mo.  Two of the six studies concerning lower respiratory tract infections showed a significantly increased risk if any formula is introduced at or after 2-4 mo.
	Szajewska H & Horvath A. Meta-analysis of the evidence for a partially hydrolyzed 100% whey formula for the prevention of allergic diseases. <i>Curr Med Res Opin</i> 2010	Type of formula: Partially hydrolysed (pHF), standard (SF) or extensively hydrolysed (eHF).	Searched academic databases Cochrane Library, MEDLINE, EMBASE, and CINAHL databases from inception to 2009. 15 RCT's included. Results primarily come from one well-designed RCT, due to methodological limitations of other RCTs.	Large variations in methodological quality of included studies. Definitions of allergic conditions varied across studies.	For all allergic diseases and atopic eczema/dermatitis, use of pHF compared with SF was associated with a reduced risk (statistically significant for most, but not all, time points) in high-risk children.  Comparison of groups who received the pHF versus eHF whey formula revealed no significant differences in outcomes except for reductions in the cumulative incidences of all allergic diseases at 0-36 mo in high-risk children.  Comparison of groups who received the pHF versus eHF casein formula revealed no significant difference in outcomes between

					groups.
	Hays T, & Wood RA. A Systematic Review of the Role of Hydrolyzed Infant Formulas in Allergy Prevention. <i>Arch Pediatr Adolesc Med.</i> 2005	Extensively hydrolysed formula (eH), partially hydrolysed formula (pH) vs. cow's milk formula (CMF).	Searched MEDLINE 1985 to 'present' 2004?  Prospective controlled trials n=22 included.	Lead author a nutrition consultant to Nestle USA. This company manufactures the infant formula types reviewed.	Consistent reduction in the cumulative incidence of atopic disease from 12 to 60 months observed across studies, among <b>high-risk infants</b> fed eH casein formulas or pH whey formulas compared with CMF.  No studies showed an increase in allergy risk with any hydrolyzed formulas.
Prospective, randomized, double-blind trial  (Level II)	Rzehak P. Sausenthaler S. Koletzko S. Reinhardt D. von Berg A. Kramer U. Berdel D et al. Short- and long-term effects of feeding hydrolyzed protein infant formulas on growth at < or = 6 y of age: results from the German Infant Nutritional Intervention Study. German Infant Nutritional Intervention Study Group. <i>Am J Clin Nutr</i> 2009	Type of feed: Partially hydrolyzed whey (pHF-W), extensively hydrolyzed whey (eHF-W), extensively hydrolyzed casein (eHF-C), or cow milk formula (CMF) and infants exclusively breastfed for the first 16 weeks of life.	German birth cohort of 1840 infants with family history of atopy. Weight and length collected by pediatricians from each child at birth, days 3–10, weeks 4–6, and months 3–4, 6–7, 10–12, 21–24, 43–48, and 60–64 of life. Linear regression used to measure association between type of feed and BMI.	Adjusted for sex, juice or solids intake, maternal smoking during pregnancy and parental education.	No significant effect of either type of feed on BMI gain at 6 year follow-up.  eHF-C group showed a slower BMI gain through the 8th to 48th week of life. This difference is due to a slightly diminished weight gain (not length) in the first year of life.

**Table A4: Summary of included studies: Health outcomes and introduction of solid foods**

Type of study (NHMRC level of evidence)	Reference	Intervention / comparator	Population / study information	Quality/Comments	Results
Systematic review or meta-analyses (Level I)	Tarini BA, Carroll AE, Sox CM, Christakis DA. Systematic Review of the Relationship Between Early Introduction of Solid Foods to Infants and the Development of Allergic Disease. <i>Arch Pediatr Adolesc Med.</i> 2006	Introduction of solids before 4 mo. vs. at or after 4 mo.	Searched academic databases MEDLINE (from January 1, 1966, through March 1, 2005), Cochrane Library (March 1, 2005), and EMBASE (1991 to March 1, 2005). Included 13 studies.	Studies all observational apart from one controlled trial. Many studies did not adjust outcome measures for family history of atopy or type of milk/formula used.	Introduction of solid before 4 months of age may increase the risk of eczema, but not of other allergic conditions.
Prospective cohort study with concurrent control (Level III-2)	Sariachvili M, Droste J, Dom S, Wieringa M, Hagendorens M, Stevens W et al. Early exposure to solid foods and the development of eczema in children up to 4 years of age. <i>Pediatr Allergy Immunol.</i> 2010	Introduction of solids ≤4mo. vs. >4 mo.	Case-control study nested within the Prospective Cohort on the Influence of Perinatal Factors on the Occurrence of Asthma and Allergies. Timing of introduction of solids collected at one year of age. Occurrence of eczema recorded prospectively up to 4 yoa.	Small samples n=225 case n=305 control.  Asked about introduction of specific foods rather than time when any food was introduced.	Exposure to solids within the first 4 months was associated with a reduced risk of eczema up to four years of age (adj OR: 0.49; 95% CI: 0.32–0.74).  When analysed by sub-group (parental history of atopy versus no history) this finding was only significant for those infants with parental history of atopy, (adjOR: 0.35, 95%CI: 0.20-0.63).
	Seach KA, Dharmage SC, Lowe AJ, Dixon JB. Delayed introduction of solid feeding reduces child overweight and obesity at 10 years. <i>Int J Obes.</i> 2010	Continuous measure of association between age at introduction of solids and healthy body mass index at age 10yrs.	Recruitment: Melbourne Atopy Cohort study.  Participants: 305 children with first degree relative with an atopic condition, asthma or hay fever. Multiple logistic regression modelling of feeding practices (continuous) by risk of above healthy BMI.	Prospective data reduces bias associated with respondent recall.  Confounders assessed were maternal education, type of residence, father’s occupational status, parental smoking, regular childcare attendance, and BMI at birth. Parental BMI not collected.	Duration of exclusive breastfeeding or any breastfeeding was not associated with an above healthy BMI OR [95% CI], 0.972 [0.946-0.999] and 0.992 [0.982-1.001], respectively. Significant association with age at introduction of solids 0.905 [0.852-0.962].  Delaying introduction of solids from 20 to 24 weeks represented a crude absolute risk reduction of 15.3%.
	Neutzling MB, Hallal PR, Araújo CL, Horta BL, Vieira	Conditions were ever BF,	Prospective birth cohort study of 1 204 Brazilian adolescents	Results adjusted for infant’s sex, infant’s skin color, infant’s birth	Lowest prevalence of overweight was found among subjects who were breastfed (any

<p>Mde F, Menezes AM, Victora CG. Infant feeding and obesity at 11 years: prospective birth cohort study. <i>Int J Pediatr Obes.</i> 2009</p>	<p>predominantly BF (inclusion of water, teas and juices), introduction of solids before 4mo, and feeding pattern at 4 mo.</p>	<p>aged 11 years. Interviewed at birth 6 and 12 months of age.</p>	<p>weight, family income (first quintile), maternal schooling, smoking during pregnancy and maternal pre-gestational body mass index.</p>	<p>BM) for 1-3mo. (17.3%) and those receiving non-human milk at the age of four months: BF + solid or semi-solid food + milk (19.1% overweight), and Milk + solid or semi-solid food (21.3% overweight).</p>
<p>Snijders BE, Thijs C, van Ree R, van den Brandt PA. Age at first introduction of cow milk products and other food products in relation to infant atopic manifestations in the first 2 years of life: the KOALA Birth Cohort Study. <i>Pediatrics</i> 2008.</p>	<p>Age at introduction categorised as: 0 to 3 mo, 4 to 6 mo, 7 to 9 mo, &gt; 9 mo.</p>	<p>Prospective birth cohort of 2558 infants from the Netherlands. Questionnaires completed by parents at 3, 7, 12, and 24 mo collected information on introduction of cow's milk products and other foods (hen egg, peanut) and incidence of eczema.</p>	<p>Multiple logistic regression analysis used for analysis. Adjusted for duration of BF, sex, infant exposure to smoke, maternal smoking, age at delivery and education, parental and siblings history of atopy.</p>	<p>The longer the introduction of infants to cow's milk products the higher the risk of eczema.  Delaying the introduction of other food products (cow's milk, egg and peanut) to after 3 months or longer was positively associated with increased atopic sensitization at 2 years.</p>
<p>Zutavern A, Brockow I, Schaaf B, von Berg A, Diez U, Borte M et al. Timing of solid food introduction in relation to eczema, asthma, allergic rhinitis, and food and inhalant sensitization at the age of 6 years: results from the prospective birth cohort study LISA. <i>Pediatrics</i> 2008</p>	<p>Introduction of solids at 4 vs. 6 mo.</p>	<p>Prospective birth cohort of 2073 German children. Questionnaires completed by parents at 0.5, 1, 1.5, 2, 4, and 6 years of age. Specific immunoglobulin E (IgE) against food and inhalant allergens determined at 2 and 6 years. Introduction of solids and BF practices assessed at 6 mo.</p>	<p>Considers multiple allergens: inhalants: timothy, rye, birch, mugwort, house-dust mite, cat, dog, moulds and food allergens: egg white, soya protein, cow milk, wheat, peanut, and fish.</p>	<p>No evidence for a protective effect of a delayed introduction of solids (past 4 or 6 months) on asthma, allergic rhinitis, or food or inhalant sensitization against food or inhalant allergens at 6 years of age.  Conversely, avoidance of solid feeding for the first 4 or 6 months and less diverse diet within the first 4 months were statistically significantly positively associated with food sensitization. Effect estimates further increased when only children without early skin or allergic symptoms or children with parental allergy were examined.</p>



## Appendix B: Protocols for Cochrane Reviews of Relevant Hospital and Clinical Practices

- Separate care for new mother and infant versus rooming-in for increasing the duration of breastfeeding (2007)
- Early additional food and fluids for healthy breastfed full-term infants (2007)
- Interventions for treating painful nipples among breastfeeding women (2008)
- Pacifiers versus no pacifier use in breastfeeding term infants for increasing duration of breastfeeding (2008)
- Medications for increasing milk supply in mothers expressing breast milk for their hospitalised infants (2010)

## Appendix C: List of Abbreviations used in this Report

AOR	Adjusted odds ratio
BFHI	Baby Friendly Hospital Initiative
BMI	Body mass index
BSES	Breastfeeding Self-Efficacy Scale
CHDP	Commercial hospital discharge packs
CI	Confidence interval
NSW	New South Wales
OR	Odds ratio
RR	Relative risk
SSC	Skin-to-skin contact
USPSTF	United States Preventive Services Task Force
WHO	World Health Organization