



European
Commission

Health Equity Pilot Project (HEPP)

Evidence review

*Interventions in maternal and infant nutrition in
the first 1000 days with a focus on socio-
economic status*



A report on literature reviews and scientific evidence relating to the impact of interventions and policies on the socio-economic gradient in maternal and infant nutrition in the first 1000 days.

Prepared for the Health Equalities Pilot Project
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Table of Contents

Overview	4
Methods	6
1. Summary results.....	8
Interventions with women of reproductive age.....	8
Interventions for weight gain during pregnancy	8
Interventions on birth weight.....	8
Interventions on breastfeeding	8
Interventions on complementary feeding	9
Interventions on the role of fathers.....	9
2. Women of reproductive age	10
Summary	10
Conclusion	10
3. Weight gain during pregnancy	13
Summary	13
Conclusion	13
4. Birth weight	17
Summary	17
Conclusion	17
5. Breastfeeding	19
Summary	19
Conclusion	19
6. Complementary feeding	23
Summary	23
Conclusion	23
7. Note on paternal influence	27
Summary	27
References.....	29

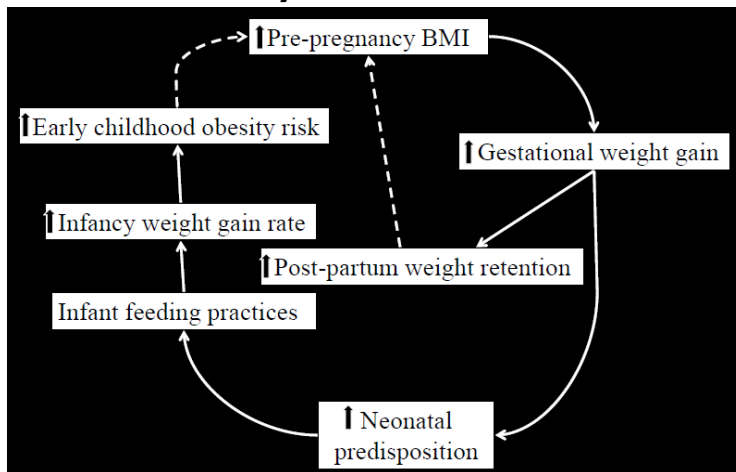
Overview

The concept of 'the first 1000 days' embraces the period from around conception through gestation, birth and infancy to age two years. In this review we identify interventions which show an impact on the socio-economic gradient in nutrition and obesity for mothers (and fathers) and infants in this period.

Conceptual model

A 'life course' approach to health promotion considers the influence on children of the nutritional status of their parents, and how the nutritional status of children as they grow to adulthood will have an influence on their children in turn. Policies which improve the pre-conceptual nutrition of parents-to-be will have follow-on benefits for the child, and for their children in turn. Such policies can help EU Member States to decrease the risk of childhood obesity, improve maternal health, and reduce health disparities in the most disadvantaged groups. This life-course approach is shown in Figure 1.

Figure 1: Life-course framework for understanding inequalities in childhood obesity



BMI = body mass index.

Source: Pérez-Escamilla¹

At each stage in the cycle, there are potential socio-economic disparities with resulting effects on the social gradient in nutritional status. Women who become pregnant when they are overweight are more likely to gain excessive weight during pregnancy and to retain more weight after delivery. Women within low SES groups tend to have more children and thus they are exposed more to the impact of repeated pregnancies. Women who are obese and/or gain excessive weight during pregnancy are more likely to deliver new-borns who are predisposed to getting

childhood obesity, especially if infant feeding practices are not optimal and such sub-optimal feeding is more likely in lower SES groups. This will set an infant on a trajectory, especially if it is a girl, to be obese before they become pregnant and so repeat the cycle, transferring the risk of obesity to the next generation.

This life-course framework is supported by two systematic reviews that examined the evidence published between 1 January 1980 and 12 December 2014². In these reviews, several risk factors were consistently associated with childhood overweight: higher maternal pre-pregnancy body mass index (BMI); excess maternal weight gain during pregnancy; prenatal tobacco exposure; high infant birth weight; and high infant weight gain.

The two reviews include interventions starting in pregnancy and continuing after birth and those starting after birth but before age 2 years. The first review³ included: prevention of childhood overweight or obesity as an outcome, identifies gaps in current research, and discusses conceptual frameworks and opportunities for future interventions. The review was based on 34 articles representing 26 completed interventions, as well as 46 ongoing trials. Nine of the interventions were effective for general population groups but not necessarily for low socio-economic groups. The majority of interventions targeted individual-level behaviour and many were confined to clinical settings; few examined the early-life systems, infrastructures, and policies that impact childhood obesity.

The second review⁴ presents the evidence on interventions that could prevent childhood obesity later in life and described modifiable childhood obesity risk factors that are present from conception to age 2. Several risk factors were consistently associated with later childhood obesity, including: higher maternal pre-pregnancy BMI; excess maternal gestational weight gain; prenatal tobacco exposure; high infant birth weight; and accelerated infant weight gain. The authors conclude that reducing maternal pre-conceptual overweight, gestational weight gain, and healthy infant weight gain by implementing nutrition recommendations shows promise for childhood obesity prevention.

Policy interventions on marketing of breast-milk substitutes appear to influence socio-economic differences in breast feeding. On average, mothers with high levels of education appear to breastfeed significantly more compared with those with low levels – with those with lower levels of education relying more on professional advice than more highly educated women who rely on written material.⁵ When breast-milk substitutes are provided for free in maternity facilities and when they are promoted by health workers and in the media, there is evidence that this undermines breastfeeding.⁶ Conversely, when breastfeeding support is offered to women, the duration and exclusivity of breastfeeding is increased.⁷ Given the correct policy infrastructure, breastfeeding rates can improve dramatically in a very short time.

This report summarises the evidence base for interventions and policies that affect certain aspects of diet and obesity and which show differential effects on different socio-economic groups, focussing on maternal and infant nutrition with regard to the EU Member States.

Methods

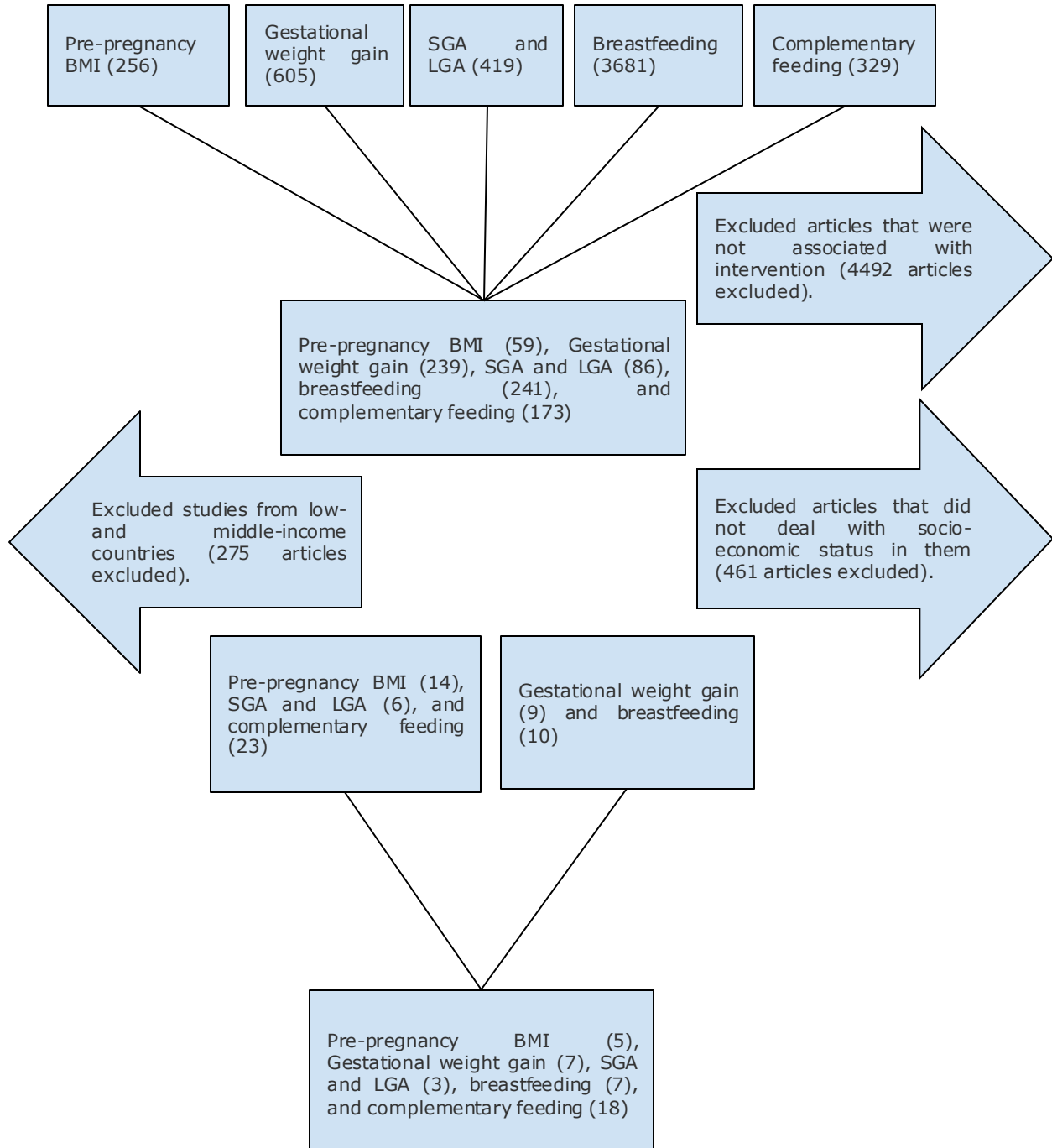
A rapid review was undertaken using standard scientific journal databases, grey literature searches, and snowballing from the papers' references. Papers were included if they were systematic reviews, literature or narrative reviews, or were studies published in the last 15 years describing interventions conducted in the European region or other OECD country.

PRISMA data

Search	Papers reviewed after duplicates removed	Papers after exclusion for no intervention	Papers after exclusion for LMI country or no SES analysis	Papers after exclusion for context and topic	Papers added from citation and snowballing	Papers reported
Women of reproductive age	256	59	14	0	5	5
Gestational weight gain	605	239	9	0	7	7
Birth weight*	419	86	6	0	3	3
Breastfeeding	3681	241	10	1	6	7
Complementary feeding	329	173	23	2	4	6

* Classified as small-for-gestational-age (SGA) and large-for-gestational-age (LGA)
LMI, low- or middle-income; SES, socio-economic status

Figure 2: Flow chart of the literature search for pre-pregnancy obesity, gestational weight gain, SGA and LGA, breastfeeding and complementary feeding.



BMI, body mass index; LGA, large-for-gestational-age; SGA, small-for-gestational-age

1. Summary results

The results indicated a remarkable lack of detailed evidence. Despite the fact that many studies of interventions collect data about the participants' economic, educational or occupational status, many such studies report their data after controlling or adjusting for SES, thus preventing assessment of differential effects.

It should also be noted that targeted interventions which are undertaken only with lower SES groups may have an impact which the authors interpret as reducing the SES gap or the SES gradient. On their own this may be true, but if the same intervention was available to higher SES groups their response may have been equal or greater than the response found in the lower SES groups, which would widen the gap or increase the gradient. Thus, targeted interventions may indicate effectiveness among low SES participants but cannot claim to reduce or increase the SES differentials on a population-wide basis.

In brief, the following results were found:

Interventions with women of reproductive age

A very weak evidence base suggests that improvements in self-assessed motivation and reported behaviour leading to improved diet and more physical activity are achievable through counselling and educational sessions in targeted lower-income groups. The only evidence of improved adiposity measures is reported in a small-scale study involving personalised counselling over a one-year period.

Interventions for weight gain during pregnancy

A weak evidence base suggests that interventions targeted at lower-income women during pregnancy are effective for improving health behaviours, reducing the level of weight gained during pregnancy and reducing the likelihood that weight gain exceeds national recommendations.

Interventions on birth weight

A very weak evidence base suggests that counselling and personalised nurse advice given to lower-income (ethnic minority) women during pregnancy can improve birth outcomes. This is the case for low birth weights or small-for-gestational-age babies. No studies were found of interventions to reduce the risk of high birth weight or large-for-gestational-age babies.

Interventions on breastfeeding

A weak evidence base suggests that a variety of interventions can be effective in producing better breastfeeding initiation and duration outcomes, including peer-support and specialist counselling in group and one-to-one sessions, among lower-

income mothers. Conversely, breastfeeding is undermined, particularly for those with less education, when breast-milk substitutes are provided for free in maternity facilities and when they are promoted by health workers and in the media

Interventions on complementary feeding

A weak evidence base suggests that the provision of various forms of intervention through professional, peer-group and other forms of counselling, health education, and skills training were generally successful at improving infant feeding practices, and in some cases showed evidence of reduced adiposity in the offspring.

Interventions among fathers / fathers-to-be

Of two papers identified, one stated that the benefits of intervention (pre-conception dietary and lifestyle advice given during counselling) were greatest for men with intermediate or higher educational level, and the second found benefits of an intervention (moderate dietary restrictions and cognitive behavioural change techniques used with a physical activity programme) for low education adolescents with obesity but did not differentiate the results between the male and female adolescents.

2. Women of reproductive age

Summary

No systematic reviews were found. Five intervention studies were found (four in Europe), all of them targeting* low-income or at-risk groups. Of the five, one is an ongoing assessment of targeted multi-disciplinary care pathways, and the results of this study have not been reported as of February 2017. The remaining four were also targeted interventions using various approaches: (i) counselling young couples; (ii) behaviour change techniques for dietary change and physical activity among adolescent girls; (iii) counselling and educational sessions for lower income women in rural areas; and (iv) counselling and educational sessions among young women at risk of obesity (e.g. obese parents).

All studies reported an increase in motivation and intention to change dietary behaviour and increase physical activity. The first study did not measure body weight but reported improved dietary behaviour. The second study did not measure body weight but reported improved motivational scores among the adolescent girls with lower educational status. The third study reported improvements in diet and physical activity behaviours among the low-income women, but no significant differences in anthropometric measures. The fourth study involved regular personalised contact with women at risk of obesity (having obese parents) over a one-year period and found significant improvements in BMI, waist circumference, and waist-to-hip ratio, along with improved diet and physical activity behaviours. This appeared to be the most successful of the interventions reported, but was based on a small sample size (40, of which 10 dropped out, leaving 14 interventions and 16 controls after 1 year) and did not differentiate lower SES from other women with obese parents.

Conclusion

A very weak evidence base suggests that improvements in self-assessed motivation and reported behaviour leading to improved diet and more physical activity are achievable through counselling and educational sessions in targeted lower-income groups. The only evidence of improved adiposity measures is reported in a small-scale study involving personalised counselling over a one-year period.

** Although targeted interventions may indicate the responsiveness among low SES participants, they cannot claim to reduce or increase the SES differentials across all social groups (the social gradient) on a population-wide basis.*

Table 1: Interventions in women of reproductive age, with SES assessment.

Reference	Study design	Population	Intervention	Comparator	SES	Outcome	Results
Denktas et al, 2014 ⁸	Cluster-randomized controlled trial (The Netherlands)	14 municipalities with adverse perinatal outcomes above national and municipal averages.	Healthy Pregnancy 4 All (HP4ALL). A score card focuses on both medical and nonmedical risk factors, including psychological, social, lifestyle, and follow-up lasts till 6 weeks after delivery.	Outcomes across areas after standardisation	Municipalities selected on basis of high risk, including maternal age, ethnicity, and low socio-economic status.	Prevalence of SGA and prevalence of congenital anomalies	The Healthy Pregnancy 4 All study was launched in 2011 & 1 st study participant delivered in March 2013. The trial is ongoing.
Hammiche et al, 2011 ⁹	Factorial (The Netherlands)	Couples planning a pregnancy are given information and requested to complete questionnaire before counselling session. 419 couples participated in 1 st counselling session.	A subgroup (110 couples) was counselled twice. During the counselling, appropriate pre-conception dietary and lifestyle advice was given.	Couple visiting either one or two counselling sessions were compared.	Levels of education.	Reproductive risk score and dietary risk score	Significant changes in diet and lifestyle factors in couples visiting the clinic for 2 nd session. Majority of those coming for 2 nd counselling were obese. Women with low levels of education showed a larger reduction in their risk scores.
Verloigne et al, 2011 ¹⁰	Residential obesity treatment programme (Belgium)	177 obese adolescents >12yrs; a random sub sample of 65 selected.	Moderate dietary restrictions and cognitive behavioural change techniques were used. Physical activity programme included 4 hrs/week with physio-therapist, 2 hrs/week of physical education at	Final outcomes were compared with baseline results.	Adolescents with low levels of education	Intrinsic motivation and self-regulation	Adolescents in a residential obesity treatment program with lower level of education increased their introjected regulations

			school & 2 hrs supervised exercise before & after school each day along with additional psychological & medical support.				(associated with increase in physical activity motivation over short term).
Hillemeier et al, et al, 2008 ¹¹	Randomised controlled trial (USA)	695 non-pregnant low-income women from rural communities (18-35yr).	Subjects invited to 6 biweekly sessions. A financial incentive (\$20) was offered for each session.	Control group women did not receive the same services.	Low income women as they are more vulnerable to adverse pregnancy outcomes	Self-efficacy measures, anthropometry and bio-markers	Subjects had: higher self-efficacy in healthy eating; higher intent to eat healthily and be physically active; higher rates of physical activity and reading food labels compared with control. No significant differences found in anthropometric measurements
Eiben and Lissner, 2006 ¹²	Randomised controlled "Health Hunters" trial (Sweden)	Women aged 18-22y who had obese parents Intervention group: 14 Control group: 16	Intervention subjects counselled and given information on diets, physical activity and weight control. Regular personalised contacts with clients were maintained throughout.	Control group did not receive any of the services that intervention group received.	Sample of young women pre-disposed to obesity.	Changes in BMI, waist circumference and waist to hip ratio, at 1 year after start.	Significant change in BMI, waist circumference and waist-hip ratio; improved dietary practices and physical activity levels but difference not significant. Women who lost weight reduced their fat intake and increased fibre intake.

3. Weight gain during pregnancy

Summary

No systematic reviews were found. Seven intervention studies were found (two in Europe) and all of these were targeted interventions among low-income populations or geographical areas. Interventions used a range of approaches including counselling, vouchers, leaflets, motivational lectures, self-monitoring reports, and exercise training.

The results were mixed. Two of the studies did not report gestational weight gain but reported improvements in dietary behaviour, exercise, and subsequent breastfeeding. In both of these cases a voucher system was used which gave financial incentives for purchasing fruit and for accessing counselling services for nutrition, cooking, and lactation advice. Among the five interventions measuring gestational weight gain, all but one showed significantly reduced weight gain for the intervention group compared with controls, and / or significantly reduced risk of exceeding the recommended weight gain specified in national obstetric guidance.

Conclusion

A weak evidence base suggests that interventions targeted at lower-income women during pregnancy are effective for improving health behaviours, reducing the level of weight gained during pregnancy and reducing the likelihood that weight gain exceeds national recommendations.

Table 2: Interventions to reduce excess weight gain during pregnancy, with SES assessment.

Reference	Study design	Population	Intervention	Comparator	SES	Outcome	Results
Watt TT et al, 2015 ¹³	Prospective study (USA)	Primary care-based nutrition intervention targeting low-income Hispanic women	Pregnant women enrolled at 1st trimester and received services at 6m well-child check. Vouchers were given for fruits & vegetables from local markets, nutrition counselling, cooking classes, and lactation counselling.	Women for whom the program was not available (n=29)	Low-income Hispanic women	Gestational weight gain, infant weight at 6m and 12m, and infant development at 9 months.	Intervention women more likely to have improvements in diet, exercise, and depression, and were more likely to breastfeed. Infants were more likely to pass developmental stages
Quinlivan et al, 2011 ¹⁴	Randomised controlled trial (Australia)	132 overweight/obese pregnant women	Intervention group visited study-specific clinics. Intervention group's weight, diet and stress were assessed at each antenatal visit. They also received maternity services from a single maternity care provider.	Control group received routine antenatal care services	Study undertaken among disadvantaged populations	Gestational weight gain	Intervention group had significantly lower gestational weight gain than the standard care group and increased consumption of fruits and vegetables, water, and home-prepared meals.

Burr et al, 2007 ¹⁵	Randomised controlled trial (UK)	190 pregnant women aged >17 yr	Advice and leaflets promoting fruit, and vouchers exchangeable for fruit juice.	Control group received usual care.	Antenatal clinic in deprived area in Wales, UK	Increasing fruit and juice intake – self reported and beta-carotene biomarkers.	Subjects drank more fruit juice if they received vouchers; midwives' advice to eat more fruit had no significant effect.
Claesson et al, 2008 ¹⁶	Prospective case-control study (Sweden)	350 obese pregnant women	Weekly motivational talk and regular exercise. Talks were on weight management and consequences during pregnancy. Women also invited for aqua aerobics class: 1/2wk	Regular care.	Recruited from low income area	Weight during pregnancy and during postnatal period.	Intervention group had significantly lower weight gain; a smaller proportion of intervention women gained > 7 kg.
Hui et al, 2006 ¹⁷	Randomised controlled trial (Canada)	43 pregnant women	A group based exercise by trainer and home-based exercises conducted for intervention group. The Food Choice Map tool used to assess dietary intakes	Physical activities were recommended but without instruction in group and home-based exercise.	Majority of participants were from low-income or low-middle income group	Gestational weight gain. The number with excessive weight gain.	Weight gain during pregnancy did not differ significantly between groups. Excessive weight gain was moderately lower in intervention vs control.
Olson et al, 2004 ¹⁸	Prospective cohort design (USA)	560 pregnant women	Nutritional education provided depending on weight gained. 'Health Check book'	Women in this group did not receive any services like	Primarily white and rural women.	Behavioural factors, weight measured during the	Low-income women who received the intervention had a significantly

			with info on diet self-monitoring tools and weight gain grids, plus information on dietary pyramids and exercise during pregnancy. Newsletter along with a returnable postcard to report diet, weight and activity.	the intervention group.		women's antenatal visits, proportion of normal weight and overweight women exceeding the recommended gain in weight	reduced risk of excessive gestational weight gain.
Polley et al, 2002 ¹⁹	Randomized controlled trial (USA)	110 women with less than 20 weeks of gestation from a clinic for low income women	Oral and written information from trained health professional about weight gain, healthy eating and exercise during clinics visit. Newsletters mailed biweekly. Women gaining more weight than recommended were given additional support.	Received standard nutritional counselling and no additional services.	Participants were recruited from a clinic for low income population.	Gestational weight gain. Proportion of women complying with IOM weight gain guideline	Among women of normal weight, the intervention led to a significant reduction in the number of women exceeding the recommended gain in weight during pregnancy. There was no significant improvement for women who were already overweight.

4. Birth weight

Summary

One systematic review and two other studies were found. The systematic review focused on the situation of Australian aboriginals and interventions to reduce the risk of adverse birth outcomes. It concluded that a wide range of different approaches offering antenatal care were likely to be beneficial.

Two intervention studies were found, both of them targeting low-income African-American pregnant women. The interventions included extra personal counselling and specialist nurse advice. The outcomes measured were the proportion of low or very low birth weight babies (weight for gestational age). In both studies the intervention groups showed better outcome measures than the control group. In both studies the outcome measures concerned small for gestational age or very low birth weight: these measures have a weak association with a raised risk of excess adiposity in the offspring in adolescence and adulthood, but a greater risk is found among offspring that are born large for gestational age or with high, or very high, birth weights.

Conclusion

A very weak evidence base suggests that counselling and personalised nurse advice given to lower-income (ethnic minority) women during pregnancy can improve birth outcomes. This is the case for low birth weights or small-for-gestational-age babies. No studies were found of interventions to reduce the risk of high birth weight or large-for-gestational-age babies.

Table 3: Interventions to improve birth weight outcomes, with SES assessment.

Reference	Study design	Population	Intervention	Comparator	SES	Outcome	Results
Rumbold and Cunningham, 2008 ²⁰	Systematic review (Australia)	To evaluate the effectiveness of interventions for aboriginal Australians at high risk of adverse birth outcomes	Intervention women received range of antenatal services.	Studies varied in their use of control groups	Australian aboriginals are considered socially disadvantaged	Low birth weight and pre-term birth, and access to health care services	Increased use of services offered, some interventions lowered the incidence of small-for-dates babies.
Roman et al, 2014 ²¹	Quasi-experimental cohort study (USA)	All women who had a Medicaid-insured singleton birth between January-December 2010 recruited (N=60653)	Intervention group were screened for risks and received 3 face-to-face antenatal contacts and counselled on healthy pregnancies and positive outcomes.		Black women low social status at high risk of adverse pregnancy outcomes.	Low and very low birth weights, pre-term births.	Lower rates of all measures in intervention vs controls
Brooten et al, 2001 ²²	Randomised controlled trial (USA)	173 pre-gestational or gestational diabetic women diagnosed with hypertension and at risk of SGA	Home visits by specialist nurses advising on diet, physical activity and coping skills along with 1 postnatal and weekly phone during 8 wks postpartum.	Standard care for high risk women at the hospital clinic	Participants were African American and poor, where most had low levels of education.	Low birth weight, infant mortality and preterm birth, maternal hospitalization and cost of care	Intervention group had lower incidence of SGA infants vs. controls. The intervention was cost saving.

5. Breastfeeding

Summary

Two systematic reviews and five intervention studies were found. All studies were conducted in the USA except two studies conducted in the UK. All studies including all studies summarised in the systematic reviews were targeted interventions among lower-income groups or in disadvantaged or low SES areas.

The systematic reviews reported that educational and counselling programmes, including peer counselling (alone or with professional), along with breastfeeding-specific clinics, and group antenatal education, were all found to improve breastfeeding initiation, duration, or exclusivity. One of the reviews concluded that postpartum support delivered by professionals was the least effective intervention type.

Five intervention reports were found: all of them reported significantly improved indicators of breastfeeding initiation and duration. Nearly all interventions were based on counselling and forms of professional and peer support. One intervention (in the UK) provided a peer support scheme to all mothers (titled 'Star Buddies') and, for the intervention group, supplemented this with small gifts and vouchers and additional home visits to the mother. The results showed that the addition of these gifts and vouchers did not enhance breastfeeding rates above the Star Buddies scheme alone.

Conclusion

A weak evidence base suggests that a variety of interventions can be effective in producing better breastfeeding initiation and duration outcomes, including peer-support and specialist counselling in group and one-to-one sessions, among lower-income mothers.

Table 4: Interventions to improve breastfeeding, with SES assessment.

Reference	Study design	Population	Intervention	Comparator	SES	Outcomes	Results
Ibanez et al, 2012 ²³	Systematic review and meta-analysis	Studies conducted at primary care of pregnant or already breastfeeding women. 9 studies from USA & 1 UK, 1985-2009	Various interventions including counselling, education, leaflets	Control group received usual care and in some studies also received specific materials.	Women with low SES	Breastfeeding initiation and duration	Educational programmes were effective in increasing initiation, and breastfeeding rates after 3-months improved Educational programmes via personal contact with health professional increased rates of breast-feeding among low income women.
Chapman DJ & Pérez-Escamilla R. 2012 ²⁴	Systematic review	18 studies from USA targeting minorities	4 peer counselling; 4 professional support; 3 team [peer + professional support]; 2 breastfeeding-specific clinics; 3 group prenatal education; 2 enhanced breastfeeding programs	Randomised trials with control groups	All 18 studies targeted minority groups	Improved breastfeeding practices	Peer counselling interventions (alone or with professional), breastfeeding-specific clinics, group antenatal education, and were all found to greatly improve breastfeeding initiation, duration, or exclusivity. Postpartum professional support delivered by professionals was least effective intervention type.

Kao et al, 2015 ²⁵	Randomised controlled trial (USA)	96 pregnant women on welfare & between 20-35 weeks gestation. Women with score of ≥ 27 for risk of postpartum depression were enrolled	The intervention group received 4*60-mins group sessions over 4 weeks, plus individual 50 mins booster session after delivery. Women taught the importance of self-care and assertive help to improve breast-feeding practices and support each other.	Women in the control group received standard antenatal care only.	The study was especially designed for low-income women	Breastfeeding initiation; median duration of breastfeeding	Both intervention and control groups had similar breastfeeding initiation rates, but intervention women had better duration and greater likelihood of breastfeeding at 3 months.
Chapman DJ et al, 2012 ²⁶	Randomised prospective study (USA)	Over-weight/ obese, low-income women.	3 prenatal visits, daily in-hospital support, and up to 11 postpartum home visits addressing obesity-related breast-feeding barriers	Controls got standard care at a Baby-Friendly hospital	Over-weight/ obese, low-income women.	Breastfeeding practices	The additional support was associated with increased rates of any breastfeeding and breastfeeding intensity at 2 weeks postpartum and decreased rates of infant hospitalization in the first 6 months after birth.
Thomson et al, 2012 ²⁷	Prospective study (UK)	136 mothers joining 'Star Buddies' (ante- & post-natal peer support) before & after getting financial incentive	Intervention group got gifts and vouchers incentives for 8 wks along with participation in 'Star Buddies' intervention	Mothers who joined 'Star Buddies' before financial incentive scheme were controls.	Disadvantaged area of NW England	Breastfeeding at 6 to 8 weeks after birth	No difference between groups in exclusive and any breastfeeding rates at 6 to 8 wks

Pugh, 2010 ²⁸	Randomised control trial (USA)	328 breastfeeding mothers of full-term infants	24-weeks of hospital visits and home visits by a breastfeeding support team, plus telephone support and 24-hour pager support	Control group receiving normal care	All mothers were eligible for the WIC Special Supplemental Nutrition Program	Percentage breast-feeding at 6, 12 and 24 weeks.	Significantly higher breastfeeding rates at 6 and 12 weeks for the intervention group.
Ingram et al, 2002 ²⁹	Non-randomised prospective cohort phased intervention study (UK)	Midwives trained on 8 different breastfeeding techniques and encouraged to practice them. 1173 mothers observed by midwives before and after discharge.	Women got breastfeeding support in maternity ward and at home. Also given leaflets to reinforce breastfeeding techniques.	Normal care	Subjects were from lower socio-economic urban areas in UK	Exclusive and any breastfeeding at 2 and 6 wks	Significant increase in % mothers exclusively breastfeeding at 2 and 6 weeks and any breastfeeding at 2 weeks. There was a significant decrease in number of mothers feeling that they did not have enough milk.

6. Complementary feeding

Summary

One systematic review and five other studies were included. The systematic review and all five individual studies concerned targeted interventions based on selecting low-income families, areas of deprivation or minority ethnic groups.

The systematic review covered young children up to 5 years old, but of the 32 studies reviewed 14 were of children under age two years in developed economies (11 USA, 2 UK, 1 Australia). A range of interventions were reported, including counselling, health education, diet or physical activity promotion using trained volunteers, trained field workers, trained mentors, and peer educators. In all 16 studies, positive effects were found in prolonging breastfeeding, delaying the introduction of solid foods, greater physical activity, and in some cases reduced prevalence of excess bodyweight.

In addition to the studies reviewed in the systematic review, five further studies were found, 3 in the UK and 2 in the USA. A UK controlled intervention among women in a minority group (ethnic Pakistani) found a high level of non-attendance at supplementary antenatal and postnatal counselling classes, but of those that did attend a significant reduction in infant adiposity was reported. A US study of an intervention providing one-on-one child care services for infants under 2 months old found better breastfeeding practices and an improvement in adiposity at 2 years old. The three other studies reported improvements in knowledge and feeding behaviour. The three other studies reported improvements in knowledge and feeding behaviour among those exposed to interventions consisting of workshops, counselling, and home visits.

Conclusion

A weak evidence base suggests that the provision of various forms of intervention through professional, peer-group and other forms of counselling, health education, and skills training were generally successful at improving infant feeding practices, and in some cases showed evidence of reduced adiposity in the offspring.

Table 5: Interventions to improve complementary feeding, with SES assessment

Reference	Study design	Population	Intervention	Comparator	SES	Outcome	Results
Laws, 2014 ³⁰	Systematic review	Infants and children from low socio-economic status were recruited as sample population in the studies. 32 papers were reviewed of which 14 concerned infants <2yr in higher income countries.	Counselling, health education, health promotion, primary prevention early intervention, diet or physical activity interventions, provided by trained volunteers, field workers, mentors, indigenous educators, professional and peer educators.	Control groups	Children described as low socio-economic status, low income and low education	Child BMI, the prevalence of overweight/obesity, time of introduction of solid foods, breastfeeding duration, diet, physical activity	The mean difference of BMI between the intervention and the control groups varied from -0.27kgm^{-2} to 0.54kgm^{-2} and a reduction in overweight/obesity by 2.9% to 25.6%. Interventions initiated during infancy had a positive impact on diet related behaviours-diet quality. Less than 10% of the studies reviewed were of high quality.
McEachan RR et al, 2016 ³¹	Feasibility RCT (UK)	120 pregnant overweight or obese women in mid-gestation	The intervention (Healthy and Active Parenting Programme for early Years - HAPPY) provided six antenatal and six postnatal sessions on physical activity and healthy.	Control groups received standard usual care	Nearly half (49%) of women that attended were of South-Asian origin	Child's weight and length; infant diet; maternal diet	Almost 2/3 of the recruited women failed to attend intervention sessions. At 12 months, infants in the intervention group had average weight 0.33 SD above the WHO standard while infants in the control group were 0.53 SD above the standard. 23% and 45%

							of infants in the intervention and control groups respectively were classified as overweight.
H Machuca et al, 2016 ³²	Non-randomised group design (USA)	180 women with infants up to 2 months old.	One-on-one child care service offered to families.	Women in the control group received the traditional well-child care service offered at the health centre.	Conducted at a health centre that serves an area with one of the highest poverty rates in the United States	BMI-for-age greater than or equal to 85 th percentile; breastfeeding initiation; breastfeeding duration	Children in the intervention group were significantly less likely to be overweight or obese at 2 years of age than children receiving traditional care. Well Baby Group membership was a significant protective factor in a multiple regression analysis.
Andrews et al, 2015 ³³	Mixed method (qualitative and quantitative) (UK)	67 women, 16-44 yrs, participated in at least two workshops	Workshops held in local community venues held over 2 wks for 1 h and each session led by health worker on infant food preparation.	Normal care	Women from deprived areas participated	Knowledge and understanding before and after workshops	Workshops were rated positively and women reported better knowledge, understanding and confidence after workshop. Improved compliance with feeding recommendations was observed.
Brophy-Herb et al, 2009 ³⁴	Pre-post test research design (USA)	Mother-child dyads participating in the Supplemental Nutrition Program for Women, Infants & Children	Every mother attended 1 class/wk for 6 weeks.	Normal care	Low income mothers (WIC)	Knowledge about infant feeding; efficacy in transition to solid foods; self-efficacy in being able to	After training mothers had improved knowledge about feeding practices. Higher numbers delayed introduction of solid foods unless infants made signs of readiness for foods. Overall

		(WIC).				deal with conflicting information	satisfaction of mothers was high with the Infant Feeding Series.
Hoare et al, 2002 ³⁵	Non-randomized intervention study (UK)	109 mothers with infants born in 1997 were recruited from 2 towns	Intervention group were given training on complementary feeding including video and instruction leaflet showing how to prepare home-made foods/meals and their relative costs.	All mothers were invited to attend 1 training session 8 weeks after birth. Control mothers were given training on home safety along with standard care from their family health visitor.	At least half population belonged to manual occupation classification	Parental actions and knowledge on infant feeding and oral health advice	Intervention mothers showed a marked improvement in their knowledge of infant feeding, improved duration of breastfeeding. Intervention mothers used more home-made foods and knew more about oral health vs. controls.

7. Note on paternal influence

It is well-recognised that the nutritional status of the father can influence the nutritional status of the infant in the first 1000 days and beyond. Fathers' influence in the pre- and peri-conceptual period on his offspring's subsequent risk of obesity and metabolic disease has been recently reviewed by Dunford and Sangster³⁶ and Lucas and Watkins³⁷.

Besides the father's nutritional status, the father's behaviour in the family may also have an effect: encouraging and supporting feeding with breastmilk, preparing complementary foods, encouraging physical activity and contributing knowledge and skills to promote infant health.

Fathers should therefore be considered within the life-course model for potential interventions. Furthermore the father's nutritional status and role in the family can vary across the SES gradient^{38,39}, indicating that interventions which include or target fathers may be able to have an effect on reducing the SES gradient in infant and later childhood obesity.

In the review undertaken for this report we revisited the papers on interventions in the first 1000 days described above to identify any interventions that specifically described effects on the status or role of fathers, differentiated by socio-economic status.

Summary

Two papers were identified which included information on interventions on fathers and which described effects differentiated by socio-economic status. *Of two papers identified, one stated that the benefits of intervention (pre-conception dietary and lifestyle advice given during counselling) were greatest for men with intermediate or higher educational level, and the second found benefits of an intervention (moderate dietary restrictions and cognitive behavioural change techniques used with a physical activity programme) for low education adolescents with obesity but did not differentiate the results between the male and female adolescents.*

Table 6: Interventions on the nutritional status or role of fathers / fathers-to-be.

Reference	Study design	Population	Intervention	Comparator	SES	Outcome	Results
Hammiche et al, 2011 ⁹	Factorial (The Netherlands)	Couples planning a pregnancy are given information and requested to complete questionnaire before counselling session. 419 couples participated in 1 st counselling session.	A subgroup (110 couples) was counselled twice. During the counselling, appropriate pre-conception dietary and lifestyle advice was given.	Couple visiting either one or two counselling sessions were compared.	Levels of education.	Reproductive risk score and dietary risk score	Greatest benefits shown in normal weight men with intermediate/high education
Verloigne et al, 2011 ¹⁰	Residential obesity treatment programme (Belgium)	177 obese adolescents >12yrs; a random sub sample of 65 selected.	Moderate dietary restrictions and cognitive behavioural change techniques were used. Physical activity programme included 4 hrs/week with physio-therapist, 2 hrs/week of physical education at school & 2 hrs supervised exercise before & after school each day along with additional psychological & medical support.	Final outcomes were compared with baseline results.	Adolescents with low levels of education	Intrinsic motivation and self-regulation	Adolescents in a residential obesity treatment program with lower level of education increased their introjected regulations (associated with increase in physical activity motivation over short term). Male and female data not reported separately.

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