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## 70th Anniversary Conference on ‘Nutrition and health: from conception to adolescence’

### Symposium III: Metabolic health, weight management, and obesity prevention in childhood and adolescence Maternal and child obesity: some policy challenges

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The recent rise in the prevalence of obesity in the UK population includes women of reproductive age and children. For both groups there are specific health concerns consequent on excess bodyweight, including obstetric complications, fetal growth abnormalities and a range of obesity co-morbidities seen in children that were rarely found in young people a generation earlier. This paper identifies some of the issues which challenge policy-makers: guidelines for gestational weight gain and for weight loss after pregnancy; inequalities and interventions in pregnancy; interventions to prevent child obesity; and the role of individuals, government and the commercial sector in implementing policies for promoting healthy weight.

#### Maternity: Pregnancy: Obesity: Commercial: Responsibility

The rapid rise in adult and child obesity in the UK population is widely recognised. The Health Survey for England shows that, among women of peak child-bearing age (here defined as ages 16–44) the proportion with a BMI over 30 kg/m<sup>2</sup> has risen from about 7% in the early 1980s<sup>(1)</sup> to 19% in 2009<sup>(2)</sup>. The 2009 survey also found that a further 27% of women in this age-group were overweight, non-obese (BMI 25.0–29.9). Figures for Scotland are similar, with 21% of women aged 16–44 obese and a further 29% overweight, in 2008<sup>(3)</sup>. Figures for Northern Ireland in 2010/2011 are expected later in 2011, but are likely to be similar to those in Scotland<sup>(4)</sup>.

Among children, the levels of overweight and obesity have also risen rapidly since the early 1980s and although there is some evidence that the rise in prevalence may have eased in recent years, the levels remain high, with between a quarter and a third of all school-age children overweight or obese, according to the definitions used<sup>(5)</sup>.

These rapid changes in the population’s nutritional status raise questions for policy makers. Is obesity purely an individual responsibility, or are there social, economic and environmental factors which put individuals at particular risk? Is child obesity simply the responsibility of

parents or should policy-makers consider intervening, and if so, what interventions should they consider?

#### Health concerns

Obesity during pregnancy is related to higher health care costs, largely due to a higher level of caesarean sections and a raised incidence of high-risk obstetric conditions including gestational diabetes and hypertension<sup>(6)</sup>. Among women (average age 29 years) of normal weight prior to pregnancy, weight gain during pregnancy of more than 20 kg is associated with more than three-fold increased risk of pregnancy complications, with a substantial increase in hypertension, forceps delivery, caesarean delivery and high neonatal birthweight<sup>(7)</sup>.

Weight gain in the decade before pregnancy is a recognised predictor of pregnancy complications and of high infant birthweight<sup>(8)</sup>. However, pre-pregnancy weight gain does not have to happen in adulthood as the effects of excess bodyweight on pregnancy risks can be found among women in their teenage years<sup>(9)</sup>. Table 1 shows the effect of excess maternal bodyweight among teenagers

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**Table 1.** Percentage of teenage women experiencing obstetric and neonatal complications, by bodyweight status (Adapted from Sukalich *et al.*<sup>(9)</sup>)

Complication	Healthy weight	Overweight mothers	Obese mothers
	BMI 18.5–24.9 <i>n</i> 3324	BMI 25–29.9 <i>n</i> 981	BMI 30–34.9 <i>n</i> 347
Gestational hypertension	4.5	6.8	11.0*
Preeclampsia	2.4	3.3	4.6**
Gestational diabetes mellitus	0.6	1.1	1.7**
Caesarean delivery	12.2	15.7	21.8*
Cephalopelvic disproportion	9.3	13.1	17.2*
Induction of labour	18.3	22.7	26.7*
Fetal macrosomia	5.9	7.9	11.5*

Chi-squared test across three weight categories \* $P < 0.001$ , \*\* $P < 0.05$ .

**Table 2.** Prevalence of comorbidities in overweight and obese children (Source: Lobstein & Jackson-Leach<sup>(16)</sup>)

Co-morbidity	Studies	Aggregate sample ( <i>n</i> )	Prevalence among obese children (%)
Hypertension	17	5690	25.8
Hypercholesterolaemia	8	2030	26.7
Hyperinsulinaemia	4	938	39.8
Impaired glucose tolerance	14	2699	11.9
Type 2 diabetes	9	1851	1.5
Metabolic syndrome (three factors)	7	1540	29.2
Fatty liver (steatosis)	7	900	33.7

on the likelihood of a number of problems during pregnancy and labour, and a raised risk of complications for the child.

Obese women are at a higher risk of maternal death<sup>(10)</sup>. Maternal obesity raises the risk of miscarriage, and the infant is more likely to suffer congenital malformations and be large in size<sup>(11)</sup> and is less likely to survive the first 12 months of infancy<sup>(12,13)</sup>.

The problems of childhood obesity have been extensively documented<sup>(14,15)</sup>. An obese child is not only at risk of chronic disease later in life but also at risk of immediate co-morbidities: a review of studies on indicators of comorbid disease found high blood pressure, early signs of type 2 diabetes and fatty liver disease to be present in a substantial proportion of obese children (see Table 2). In addition to the disease indicators listed, obese children are also more likely to suffer various orthopaedic and neurological conditions, breathing disorders and psycho-social problems<sup>(14)</sup>.

### Social inequalities

Maternal obesity and child obesity are both found more commonly among lower socio-economic groups than higher socio-economic groups. Using data from the Health Survey for England, 18% of women in the highest-income

quintile were obese compared with 28% in the lowest-income quintile<sup>(17)</sup>.

Obesity among children is also linked to household income or a measure of household deprivation<sup>(18,19)</sup>. Data from the National Child Measurement Programme for children of aged 4–5 (reception class) and 10–11 (year 6) show a strong association between obesity prevalence and household deprivation index (see Fig. 1).

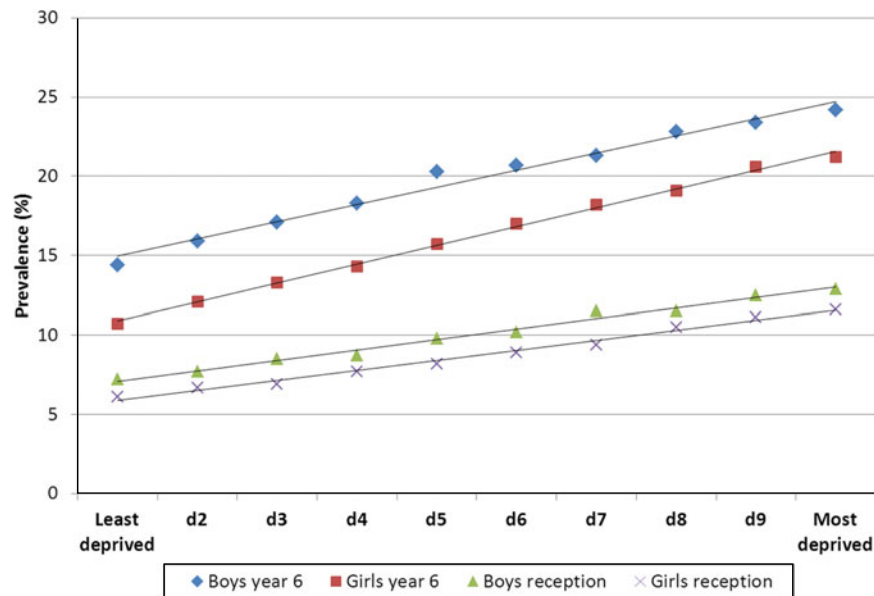
In lower socio-economic groups, the foods eaten are higher in energy and lower in micronutrients, with a lower consumption of vegetables and fruit, and with children drinking more soft drinks than those from higher socio-economic groups<sup>(20)</sup>. This may not be surprising, given the relatively cheaper price per calorie of energy-dense processed foods and soft drinks compared with less energy-dense foods such as fruits and vegetables. Among women, food insecurity and obesity are associated<sup>(21,22)</sup> indicating that the quantity of food energy consumed may be more than adequate, whereas the quality may be poor and deficient in some essential nutrients. Kramer *et al.*<sup>(23)</sup> discuss socio-economic disparities in pregnancy and suggest a clustering of problems in lower-income groups including infectious disease, smoking and obesity co-existing with deficiency disorders.

Other relevant risk factors for obesity are linked to socio-economic status: women in lower socio-economic groups show the lowest levels of breastfeeding in all parts of the UK<sup>(24)</sup>. Women from lower-income households are less active and more sedentary than those from higher-income households, according to surveys conducted in 2008 in England<sup>(25)</sup> and Scotland<sup>(3)</sup>. Among children in England, the National Child Measurement Programme has shown obesity prevalence to be higher among older girls than younger girls, and, although younger girls show inequalities in obesity prevalence, the difference in obesity prevalence comparing girls from the least and the most deprived households is greater among the older girls (see Fig. 1)<sup>(19)</sup>.

In summary, women in lower socio-economic groups appear to be leading the obesity epidemic and the implications for women of childbearing age are a particular concern. Inequalities in obesity are affecting children even at a young age, implying that the causes of these inequalities are not merely historic but are exerting their influence in very recent years.

### Policy responses for maternal obesity

While the policy response to child obesity has been extensive, including Public Service Agreement targets, a range of local and national actions<sup>(26)</sup> and guidance from The National Institute for Health and Clinical Excellence (NICE) on interventions to prevent child obesity<sup>(27)</sup> the policy response in maternity services has been noticeably weaker. For example, there are no officially accepted guidelines for weight gain during pregnancy in the UK. Indeed, far from monitoring women's weight as their pregnancy develops, the NICE guidance on weight management in pregnancy<sup>(28)</sup> states that women should be weighed once at the first antenatal appointment and after that 'Do not weigh women repeatedly during pregnancy as a matter of



**Fig. 1.** (Colour online) Prevalence of obesity (%) by decile of household deprivation index for school-age children, England 2008–2009. Obesity <95th UK National BMI percentile. Linear trend lines shown. All linear regression coefficients significant at  $P > 0.005$ . Source: Adapted from National Obesity Observatory<sup>(19)</sup>.

routine' and suggests that, for women who have a BMI over  $30 \text{ kg/m}^2$  at the first weighing, health workers should 'Explain to women (how their weight) ... poses a risk, both to their health and the health of their unborn child. Explain that they should not try to reduce this risk by dieting while pregnant and that the risk will be managed by the health professionals caring for them during their pregnancy'.

Similar advice is given in the Royal College of Obstetrics and Gynaecology guidelines on the management of overweight women in pregnancy<sup>(29)</sup>. Again, there is no recommendation to monitor weight change during pregnancy, only to monitor the development of possible complications among those who present as obese at the outset of pregnancy. No guidance is given on what amount of weight gain should be expected for women of different weight status. The US Institute of Medicine made recommendations in 1990<sup>(30)</sup> which were modified in 2009<sup>(31)</sup> and these are shown in Table 3, but it should be noted that these are not adopted in the UK as official guidance.

A lack of clear policy to prevent obesity or its effects in pregnancy, either through better services to women prior to pregnancy or better management of weight and gestational weight gain during pregnancy (and weight loss after pregnancy), needs attention. Publicly funded health services are bearing the economic costs of maternal obesity but if services move towards private sector provision and insurance-based care then further issues might arise: in the USA there are media reports indicating that some obstetric-gynaecology practices are refusing to take new patients who are over 200 lbs (14st 4 lbs or 91 kg) because of the higher risk of complications<sup>(32)</sup>.

The lack of comprehensive policies to address the issue of maternal obesity may worsen health inequalities. Health education messages directed to women of reproductive age

**Table 3.** Recommended weight gain in pregnancy published by the US Institute of Medicine (IOM)

Weight category at start of pregnancy	IOM 1990 <sup>(30)</sup> kg	IOM 2009 <sup>(31)</sup> kg	Actual median weight gain reported in USA in 2002–2003 <sup>(31)</sup> kg
Normal weight*	11.5–16.0	11.5–16.0	15.0
Overweight*	7.0–11.5	7.0–11.5	13.9
Obese*	≥ 6.0	5.0–9.0	11.2

\*In 1990, the IOM defined these categories as BMI 19.8–26.0, 26.0–29.0 and  $> 29.0 \text{ kg/m}^2$  for normal weight, overweight and obese, respectively. The 2002–2003 survey and the 2009 IOM definitions follow the WHO classifications of BMI 18.5–24.9, 25.0–29.9 and  $\geq 30 \text{ kg/m}^2$ , respectively.

are likely to be less effective among women in lower socio-economic groups for several reasons: besides the differences that may exist in intention of pregnancy and early awareness of pregnancy, lower socio-economic status women are less likely to attend regular antenatal clinics, may be less motivated to make changes to their lifestyles and will have fewer resources (time, money, facilities, etc.) to adopt health-promoting behaviour<sup>(20)</sup>. As stated earlier, women in lower socio-economic groups are less likely to breast feed, an important strategy to support weight loss after pregnancy. Reliance on health education approaches alone as a policy response may serve to increase the existing high levels inequalities in health outcomes<sup>(33)</sup>.

Few intervention studies aimed at weight management during pregnancy have been performed<sup>(34)</sup>. One study<sup>(35)</sup> examined the efficacy of providing education and behavioural strategies for low-income pregnant women to promote healthy eating, moderate exercise and appropriate weight gain. The intervention decreased significantly

the proportion of women exceeding the Institute of Medicine's recommendations for weight gain among the normal weight women but not among the overweight women. A study in Denmark<sup>(36)</sup> monitored obese women in pregnancy under two conditions: the intervention group (twenty-three women) received ten dietary consultations of 1 h each with a dietitian aimed at limiting their weight gain during pregnancy to 6 kg. The control group (twenty-seven women) were instructed to eat a healthy diet according to the official Danish dietary recommendations. There was a remarkable difference between the groups: weight gain in the intervention group averaged 6.6 kg (SD 5.5) compared with 13.3 kg (SD 7.5) in the control group. In addition the intervention group retained almost 7 kg less than the control group 4 weeks after childbirth.

Such interventions may also be beneficial for the women in the longer term. Overweight and obese women who gain excessive weight in pregnancy are more likely to retain their pregnancy weight gain into the postpartum period than normal weight women, and excess weight gain and failure to lose weight after pregnancy are important predictors of persistent higher BMI in later life<sup>(20)</sup>. Factors that influence the retention of weight gain in pregnancy include the initial pre-pregnancy weight, the degree of gestational weight gain, race/ethnicity, parity, lactation and lifestyle alterations associated with the new infant<sup>(37)</sup>.

The conclusion is that pregnancy could be an opportunity for successful lifestyle interventions because women are highly motivated to provide the best care for their infant. How such approaches would need to be adapted in order to be effective among all sections of the population needs further research.

### Policy responses for child obesity

Several policy issues arise as a result of the high prevalence of obesity among children. The first, highlighted by the figures in Table 2, is the need for guidance on screening for comorbid indicators of chronic disease. The comorbidities commonly found are largely symptom-free and may not be spontaneously reported by children or parents. Should children be screened for these comorbidities? Should all children be screened or just those at high risk, and if the latter then what criteria should be used? More urgently, perhaps, is the question of service provision. Are clinical services ready for the potentially large numbers of children presenting with high blood pressure, early stages of diabetes or fatty livers?

Countries worldwide have generally avoided the problem by not conducting mass screening although a few have screened higher-risk groups<sup>(14)</sup>. Most countries have focussed their policies on reducing the prevalence of obesity *per se*. In the UK and most developed economies, the development of interventions to prevent obesity in childhood has been more extensive than it has for any other age group. However, systematic reviews have shown most interventions to have only weak effects in reducing obesity risk, although some modest improvements in dietary habits and physical activity levels are detectable in the short term<sup>(38,39)</sup>. The reviews note particular problems with the

child obesity interventions reported in the literature, such as a lack of sustainability (often linked to inadequate funding), lack of reach across population groups, lack of adequate evaluation (including a lack of reports of process evaluation to identify why projects might not have succeeded) and insufficient financial information to judge the cost-effectiveness of an intervention.

One of the problems with systematic reviews is the requirement to consider only those studies which have a high level of quality of evidence such as randomised control studies or prospective cohort studies. Intervention studies are nearly always conducted in school settings where children can be gathered into groups, where it is fairly easy to expose them to different interventions, and where there is a reasonable chance of detecting a change in the dependent variable, be it a measure of adiposity or a change in dietary behaviour or physical activity levels. This focus on school interventions has been described as a 'settings bias' in terms of how it shapes the evidence base for policy-makers<sup>(40)</sup>.

In recognition of the limitations of the evidence base, and with the publication of the UK Office of Science's Foresight report on Obesity in 2006<sup>(41)</sup> which emphasised the multiple influences which determine an individual's risk of overweight, the UK government's cross-departmental obesity strategy was widened to include a number of measures for which the evidence base was less well developed but for which there were *a priori* reasons for expecting some beneficial results for child health. In the period 2006–2010, these included promoting breastfeeding, limiting the marketing of foods high in fats and sugars on children's television programming, targeting support to at-risk families, encouraging health education to families through children's centres and Sure Start schemes, improving the dietary quality of school food and promoting more physical activity in schools and in the community, introducing free school fruit schemes, and developing a mass media social marketing campaign with child obesity among the issues it highlighted<sup>(42)</sup>.

Recent surveillance of children in England has shown a downturn in obesity and overweight prevalence<sup>(5)</sup>, which might be taken to indicate policy success. However, the downturn appears to have begun in 2005 or 2006, and so may not be attributed exclusively to policy measures introduced at a later date. Furthermore, the downturn may be due, at least in part, to self-exclusion from the surveys by those children who are overweight (just 50% of children in the core sample of target households cooperated sufficiently for their BMI to be established in the 2009 Health Survey for England<sup>(43)</sup>, down from 64% in 2001). It is also interesting to note that a levelling-off or downturn in child obesity prevalence has been reported in several other countries in the last few years<sup>(44)</sup>, including the USA, Germany, France, Greece and Australia, and this appears to have occurred despite each country having a different range of policy measures in place.

### Changing behaviour

It is a common assumption that people are in control of their own behaviour and are responsible for the



**Table 4.** Potential cost to the food sector of reducing obesity in 3 years assuming no contribution from increased energy expenditure

Average adult weight gain since 1980 <sup>(1,2)</sup>	8.14 kg
Maintenance energy gap per kg*	100 kJ/d
Maintenance energy gap for 8.14 kg excess weight	814 kJ/d
Reduced energy intake per person in a year	297 MJ
Reduced energy intake for 52 million adults in a year	15449 trillion kJ
Food energy purchased per person <sup>(56)</sup>	9639 kJ/d
Price paid for food (incl. alcohol) per person <sup>(56)</sup>	£38.08 per week
Average price paid for food energy	0.06 pence/kJ
Value of food energy for the maintenance energy gap	£0.46 per 814 kJ
Value of average food purchase reduction per adult	£167 per year for 3 years
Value of food purchase reduction for 52 m adults	£8.7 billion per year for 3 years

\*Maintenance energy gap: estimated negative energy balance required to lose 50% of 1 kg bodyweight over 1 year and 95% over 3 years. See Hall *et al.*<sup>(55)</sup>.

consequences of their choices and actions. It follows that interventions to improve health behaviour can focus on ensuring that people are fully aware of the effects of their lifestyle choices, and are given the information needed to assess their choices. However, the literature indicates that health promotion approaches which rely on education, information and advice as a means of changing behaviour have only limited effects<sup>(45–47)</sup> and the effects are likely to be weakest among those population groups most in need of health behaviour improvement<sup>(33,48)</sup> indicating that educational approaches may lead to a widening of health inequalities.

For adults, greater success has been found with interventions that include multiple components, including elements such as skills development, group support and financial incentives<sup>(47)</sup>. However, for both adults and children there has been an increasing recognition that behaviour needs to be seen in the context of the prevailing environment (including the social and financial environments as well as the physical environment)<sup>(41,42)</sup> and that behaviour change needs to be supported by changes in these environments. For children this indicates a greater need to support parents, schools and communities, and to consider means of changing the social and media environments which children experience. For both adults and children, successful policies will require a complex mix of approaches involving education and skills development, information and social marketing, measures to influence perceived cultural norms, financial incentives, the provision of access to health-promoting foods and attractive settings for physical activity, and other local and national policy interventions to ensure that healthy choices are easy to achieve<sup>(49)</sup>. To this end, a House of Lords select committee has recently urged the UK government to broaden the range of measures it is willing to consider, including regulatory measures<sup>(50)</sup>.

#### Extended responsibility

Besides individual responsibility and government policies, there is a third sector – the commercial sector, involved in shaping the ‘obesogenic environment’. As of 2010, food and beverage manufacturers, retailers and caterers have been encouraged to take new initiatives to promote

healthier diets as part of the UK government’s Responsibility Deal for public health<sup>(51)</sup>. Although food companies have argued that they will not consider changes to food prices, they have indicated a willingness to consider other approaches to improve population dietary health.

However, food companies are being pulled in apparently contradictory directions: they are urged to respond to the public health call for consumers to reduce food energy intake, especially from energy-dense foods and beverages (as well as to increase their physical activity levels)<sup>(52)</sup>, while company shareholders and investors require their companies to maintain and increase their sales of food and beverage products. This tension is recognised by professional investment banks who have produced assessments of companies most exposed to potential revenue losses if dietary trends became healthier<sup>(53,54)</sup>.

It follows that a successful public health programme which reverses the rise in obesity in recent decades might undermine the profitability of some parts of the sector if they do not change the nature and quantity of their products. As heavier people consume more food, it can be argued that the industry as a whole has, albeit inadvertently, increased demand for their products through the creation and maintenance of obesity. To return to the bodyweight distribution seen among adults in the UK in 1980 would require the average adult to lose 8.14 kg<sup>(1,2)</sup>, and if there is no change in energy expenditure levels, then it would require the removal of some 15.45 trillion kJ/year (3.69 trillion kcal/year; about 8% of current purchases) from the food supply for at least 3 years (see Table 4 for calculations and references). This would be equivalent to a reduction of some £8.7 billion in food sales every year over the period, based on 2009 purchasing patterns and food energy density patterns.

This will be a challenge to the food industry, one which has been recognised in the USA, with an industry-wide commitment to reduce food energy sales by 6.3 trillion kJ (1.5 trillion kcal) by 2015<sup>(57)</sup>. Similar pledges may be forthcoming from the UK government Responsibility Deal. To achieve the level of change needed, companies will have to consider the options available, including changing their processed food recipes, reducing the portion and serving sizes and adjusting their marketing strategies in order to play their part in ensuring that the population in general,

and women and children in particular, will find it easier to follow health advice and eat healthier diets.

A good example already exists in the case of the marketing of breastmilk substitutes. This has been limited by a mixture of policy initiatives including education of consumers and health professionals, company action and national legislation, resulting in an improvement in breast-feeding rates<sup>(24)</sup>. Similar policies may need to be established to encourage the necessary action to improve food marketing, with clearly stated targets, independent monitoring and regular review.

### Conclusion

Obesity during pregnancy is widely recognised as a health concern, but there have been few attempts to find ways of reducing the problem at the stage when mothers-to-be first present at clinic. Indeed, the current policy from NICE is to monitor the obese mother for potential comorbidities but not to monitor weight gain or specifically to encourage the mother to manage her weight during the pregnancy.

Excess bodyweight among children and among women of child-bearing age needs to be considered as an issue of individual, professional and social concern, especially as parent's weight status is a strong predictor of child weight status. Responsibility for addressing obesity prevention involves health services, educational services, local planning services and other sectors of society including mass communication providers and food suppliers. The need for such inter-sectoral action to promote health is increasingly recognised in the UK<sup>(26,51)</sup> and internationally for health generally<sup>(58,59)</sup>, for maternal health promotion<sup>(60)</sup> and for obesity<sup>(61,62)</sup> including child obesity prevention<sup>(14)</sup>.

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