Protocol for “Systematic Review of the association between maternal smoking during pregnancy and obesity in infancy and childhood”

Background

Childhood obesity is an ever increasing public health concern. It has been predicted that by 2015 the prevalence of obesity amongst boys and girls in England, will have risen to 10.1% and 8.9% respectively, with an increase in obese adolescents to 8% of males and 9.7% of females. Between 2010 and 2011 there were 11,574 hospital admissions with a primary diagnosis of obesity among people of all ages, which is more than ten times as high as the number in 2000-01. There is a significant need for public health interventions in order to reverse these trends.

Obese children face serious physical health complications, including hypertension, hyperlipidaemia and type two diabetes, all of which are known major risk factors for cardiovascular disease. In addition to these, they also face mental health and psychological morbidities. Evidence suggests that once obesity is established it is not only difficult to reverse through interventions, but also continues on through to adulthood. It is becoming increasingly recognised that the path to obesity starts early in infancy. An American longitudinal study found children who were overweight (above 85th BMI percentile) more than once between 24 and 54 months of age, were five times as likely to be overweight at 12 years of age as their normal weight counterparts.

The widely accepted Barker hypothesis describes adverse environmental factors in early life causing disruption of normal growth and development leading to a more susceptible adult phenotype prone to cardiovascular disease. In particular, childhood and adult obesity are among the cardiovascular risk factors now felt to be programmed by early life. One review published in 2007 highlighted evidence that nutritional and environmental inbalances in utero and early postnatal life are making a significant contribution to the obesity epidemic. It is therefore of critical importance to identify possible factors present in early infancy and childhood which may lead to the development of obesity, in order to tackle these through primary prevention methods. It would appear that maternal smoking in pregnancy may be one of these possible factors.

The association between maternal smoking and low birthweight is well documented; however there also appears to be evidence that maternal smoking in pregnancy may have a positive association with the subsequent development of obesity. In particular, one longitudinal study identified different patterns of weight gain in infancy among children born to smokers when compared to children born to non-smokers. Children born to smoking mothers who were found to be overweight at 4.5 years, started life with a birthweight approximate to that of the population mean, however, they gained more weight than their counterparts born to non-smoking mothers in the first five months of life. It appears that the more rapid and earlier an infant gains excess weight, the greater the likelihood for undesirable weight in subsequent months and years. A further prospective cohort
study demonstrated that children who showed this “catch up growth” between birth and two years of age were heavier, taller and with a higher percentage of body fat at five years compared to other children. These children had lower birth weights and were more likely to have had mothers who smoked during their pregnancy. In addition to this, infants born with a lower birthweight who later develop obesity, appear to be at the highest risk for cardiovascular morbidities in the long term. There is evidence as above to suggest that this growth pattern may be typical of those children born to mothers who smoked prenatally.

**Rationale**

Tackling childhood obesity is a public health priority. A systematic review of published data up until June 2006, showed evidence that maternal smoking was indeed positively associated with childhood overweight. Since then, there has been a marked increase in the number of studies performed into the aetiology of childhood obesity, in view of the ever increasing interest in this area. In addition to this, smoking rates are declining less rapidly among women than men and the highest rates of smoking are amongst the 16-24 year age group. Therefore smoking rates amongst women of child bearing age continues to be a significant problem. In fact, the latest Infant Feeding Survey published in 2010 found that one in eight mothers (12%) in the UK continue to smoke throughout their pregnancy. Reducing the rates of smoking has to remain a public health concern and if there is ongoing evidence that smoking is contributing to the childhood obesity epidemic, it further strengthens the need for continued public health measures.

**Objectives of Study**

The objective of this systematic review is to evaluate the current evidence since 2006 of the association between maternal smoking during pregnancy and the subsequent development of obesity during infancy or childhood.

**Search Strategy**

Search strategies will be undertaken through online databases: Pubmed, EMBASE, Global health, Cinahl and Web of science. The search terms to be used are as follows and terms will be combined using Boolean operators OR (within the columns) and AND (between columns).

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<th>Population</th>
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<td>Pregnancy</td>
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<td>Maternal</td>
<td>Cigarette</td>
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<td>Mother</td>
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The reference lists of relevant studies and review articles will be chased in addition to reviewing the related citations for relevant articles. The PRISMA guidelines for the presentation of systematic reviews will be followed.

**Study Selection**

All studies identified using the above search strategy will be considered initially. Following the removal of duplications, the titles and abstracts will be scanned for relevance i.e. any study which includes maternal smoking during pregnancy as a possible exposure with a measurement of obesity as an outcome. The full text article will be obtained for those deemed to be potentially relevant and these will be graded against specific inclusion and exclusion criteria.

**Data Collection**

Data will be extracted from each study and collected using a proforma for data collection.

**Risk of bias analysis**

During the data collection process, each study will undergo a Risk of Bias assessment categorising each component of the study into high, low or unknown risk of bias categories.

**Synthesis of Results**

Results from each study will be analysed by meta-analysis in order to produce a summary of evidence. Where possible, subgroup analysis will be performed to explore notable differences in gender, geographical area and age (maternal and child). Statistics to be undertaken with RevMan 5.1 software.

II Statistics on Obesity, Physical Activity and Diet: England 2012. NHS Information Centre. Published February 2012

III Interventions for preventing obesity in children. Waters, E et al. Cochrane Database Systematic Review 2011 Dec 7; (12)


V Identifying risk for obesity in early childhood. Paediatrics 2006 (need to complete with authors etc)

VI Developmental programming of obesity in mammals. Taylor P.D, Poston L. Experimental physiology 92.2 pp 287-298


VIII Association between postnatal catch-up growth and obesity in childhood: prospective cohort study. Ong, K et al. BMJ 200; 320:967-71


XII The Infant Feeding Survey 2010. The NHS Information Centre. Published June 2011 (www.ic.nhs.uk)