

# Inequality and childhood overweight and obesity: a commentary

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## Summary

Statements on childhood overweight and obesity (COO) have focused on different avenues for prevention and treatment, critical stages of the life cycle, including pregnancy and lactation, individual, family, school and community-based interventions, multidisciplinary family programmes and multicomponent interventions. This commentary is concerned with the less-addressed relationship between COO and inequality. It describes current global patterns of inequality and COO and the ways in which those inequalities are linked to COO at micro-level, meso-level and macro-level. It then describes current programmatic approaches for COO inequality, preventive and medical, and considers important pitfalls in the framing of the problem of COO and inequality. It ends with describing how childhood and adolescent overweight and obesity prevention and treatment programmes might be formulated within broader socio-political frameworks to influence outcomes.

**Keywords:** Childhood, inequality, obesity, treatment.

## Introduction

Approaches to childhood overweight and obesity (COO) interventions have focused on critical stages of the life cycle, including pregnancy and lactation (1), individual, family, school and community-based interventions (2), multidisciplinary family programmes (3) and multicomponent interventions (4–6). This commentary is concerned with the less-addressed relationship between COO and inequality. The first half of the paper reviews current framings of COO prevalence and COO inequality, popular models of how COO and inequality interact such that those inequalities are perpetuated and the current programmatic approaches that attempt to address COO inequality. The second half of the paper turns to a discussion of the possible failings of this framework and offers a potential alternative.

## Global patterns of childhood overweight and obesity and inequalities in childhood overweight and obesity

Global patterns of COO are commonly described using the high-income (HIC), middle-income and

low-income (LMIC) classification of countries employed by the World Bank. Obesity prevalence in HICs is higher than in LMICs, but in absolute numbers, there are more overweight and obese children living in LMICs: of an estimated 42 million overweight children worldwide, 31 million live in developing country settings (7). In 2013, 23.8% of boys and 22.6% of girls in HICs were overweight or obese, and 12.9% of boys and 13.4% of girls in LMICs were overweight or obese, indicating a significant increase in COO prevalence since 1980 (8). Data from the 2013 Global Burden of Disease Study indicates a similar prevalence across HICs, with figures of 25.3% (boys) and 24% (girls) in Australasia, 24.2% (boys) and 22% (girls) in Western Europe and 28.5% (boys) and 29.1% (girls) in Canada and the USA (8). Studies reporting plateauing of rates of COO in HICs (9–13) should be interpreted with caution given that plateauing is mostly reported by studies of short duration and is seldom seen in longer-term studies, or those that measure waist circumference rather than body mass index (BMI) (14,15). In HIC, there is an inverse relationship between rates of overweight and obesity and socioeconomic status (SES), whereas in LMICs, COO rates are higher among those of high SES. There is variation in LMICs in the

pattern and rate at which changes in nutritional profiles manifest, but the profile is most often a dual burden of undernutrition and overnutrition, where childhood overnutrition appears to be increasing without an accompanying decrease in rates of undernutrition. Some regional patterns are evident: high rates of COO cluster in the Middle East and North Africa (22.2% and 27.9% for boys and girls, respectively), Southern Latin America (31.3% and 26.4% for boys and girls, respectively) and Oceania (17.8% and 22.9% for boys and girls, respectively) (8).

Between-country inequality in COO rates is generally characterized by rates that continue to increase faster in LMICs than in HICs (16). Obesity in HICs clusters among low-income groups (17), but economic factors alone cannot explain variation in rates of obesity within communities (18) or across nations (19). In an analysis of inequality in COO within and between 33 countries, Due and colleagues found that the gross national income of a country was significantly positively associated with absolute socioeconomic inequality in overweight and obesity for both sexes, while economic inequality within country explained much of the inequality in overweight and obesity, especially for women (20). Even where rates of COO appear to have stabilized, as in Stockholm, SES differences persist (21). In the USA, the prevalence of obesity among those aged 2 to 19 years remained stable at between 15.4% and 17.2% between 2003/2004 and 2013/2014 (22), but inequalities in obesity and overweight prevalence increased between 2003 and 2007. This increase is attributed to rapid increases in prevalence among children in lower SES groups (23).

## Potential links between inequality and childhood overweight and obesity

The mechanisms that associate inequality with increased rates of COO are not fully understood, and a full review of the literature on this topic is beyond the scope of this article. Furthermore, it is important to be cautious because links between inequality and obesity that are demonstrated for adults may not apply to children. However, it is important to be aware of the potentially important links between inequality and COO that currently inform policy and intervention, or are overlooked in these interventions, and these are summarized here. Existing work in this area considers links between inequality and COO across multiple levels ranging from the individual, family and community to broader historical and socio-political

settings. Theories of the association between inequality and COO can be categorized as follows.

### Micro-level

New research in the Developmental Origins of Health and Disease places childhood obesity within a framework of intergenerational cycles, where altered parental nutrition, including both undernutrition and overnutrition, leads to the transgenerational transmission of metabolic disorders (24–26). Maternal malnutrition before and during pregnancy is associated with an increased susceptibility to obesity and related metabolic disorders in later life, and parental factors prior to and at conception can exert an impact on the health of offspring for more than one generation (27). Transgenerational phenotype transmission is considered a form of epigenetic inheritance where both germline and somatic inheritance of modifications lead to phenotype changes across generations. This transmission of programming effects to subsequent generations can occur even in the absence of continued environmental stressors, potentially perpetuating a cycle of obesity and metabolic disease. The mechanisms of these epigenetic effects are poorly understood but are thought to be mediated by diet, chemical exposure and high levels of environmental stress, including the effects of chronic poverty and racism (28).

### Meso-level

At the family and interpersonal level, the role of family structure (29), interpersonal (30) and family (31) dynamics in COO is well studied in HICs. In these settings, inequality in childhood and adolescent overweight and obesity is potentially perpetuated through SES differences and stigma (32–34) and by the negative bias of healthcare practitioners (35). Individual and area level socioeconomic factors are important predictors of childhood obesity (36), and SES differences in body fatness are already manifesting in early childhood (37). Stigma surrounding childhood obesity produces further social disadvantages in employment, education, health care and interpersonal relationships for obese children (38,39).

### Macro-level

The concept of an 'obesogenic' environment has been used to characterize HICs for some time (40) as a means to describe the larger structural factors that predispose to higher rates of COO in lower SES groups. LMICs now frequently mimic the obesogenic environments of HICs. Globalization

facilitates the increased foreign direct investment in the production and distribution of food products, the supermarketisation of food retail and the expansion of fast food chains in settings that remain largely unregulated (41). These processes occur in tandem with rapid urbanization in many LMICs, which changes diets and levels of physical activity.

It is clear that an understanding of the mechanisms by which inequality predisposes to COO is still lacking. However, the current models presented here form the basis for the programmatic approaches to reducing COO inequality.

### **Current programmatic approaches to reducing childhood overweight and obesity inequality**

Programmatic approaches to reducing inequalities in COO fall into two main types: preventive and clinical. Interventions are carried out at various levels, including individual-levels, community-levels and environmental-levels. Evidence of efficacy is stronger and less contradictory for clinical than preventive intervention, and it is difficult to know if results might apply beyond the countries in which the studies were performed (most frequently the USA). In some LMICs, for example, nutrition programmes need to be cognisant of the dual problem of undernutrition and overnutrition in their populations to provide appropriate supplementation to decrease risk of undernutrition and stunting without inadvertently promoting child overnutrition. In settings where excess weight is associated with affluence, there may also be less motivation to undertake programmes to reduce inequalities in COO.

#### **Preventive interventions**

Current programmatic approaches in HICs for reducing COO inequality centre on individual and local interventions delivered via multicomponent family and school-based programmes (2,6). A recent systematic review and meta-analysis of intervention studies for the prevention of overweight and obesity in children and youth shows such interventions to have only small effects in terms of lowered BMI, BMI z-score and reduced prevalence of overweight and obesity, which are not clinically meaningful for overweight or obese children and youth (42). While this study did not examine the impacts of preventive intervention on inequalities in COO, the authors point out the difficulties of evaluating primary prevention programmes more generally and the unlikelihood of any

randomized trial ever being carried out as 'it would be hard to separate out normal-weight children in a school population, to motivate them to attend an out-of-classroom intervention or to motivate most parents of these children to take them to a community intervention for weight maintenance' (42). This contrasts with another recent systematic review that shows that multifaceted school-based interventions have some effect at reducing or preventing increases in obesity-related outcomes in children of low SES aged 6–12 years, but may not be effective in those of preschool age (43). This review also concludes that school-based nutrition and physical activity education combined with exercise sessions are considered effective in children of low SES when delivered universally to all SES groups for at least 6 months, and that school-based screen time-reduction interventions longer than 6 months may be equally effective across the SES gradient. This adds to previous evidence from a multicomponent school-based intervention where all sweets were banned from school and after school care. This resulted in a reduction of unhealthy eating at home, with a greater effect in families with low education (44).

#### **Clinical interventions**

##### *Behavioural*

Cochrane evidence from treatment studies shows that behavioural methods are an essential part of effective interventions (45). Bambra and colleagues identify a number of clinical interventions that are effective in reducing socioeconomic inequalities in childhood obesity (43). At the individual level, they conclude that (1) tailored weight loss programmes work equally well across SES gradients and may have more beneficial effects in lower SES groups; (2) screen time-reduction interventions may have effects on obesity reduction in children of low SES but not of high SES and (3) mentor-based health promotion interventions can have beneficial long-term effects among low SES children who are already overweight or obese. At community level, they conclude that family-based group weight loss programmes are identified as working equally across the SES gradient to benefit short-term weight loss and long-term weight maintenance. At societal level, the review found no macro-level interventions aimed at reducing COO. In sum, Bambra and colleagues identify some effective interventions for overweight and obesity among those of low SES in HICs, but concede that they are unlikely to reduce inequalities in rates of overweight and obesity according to socioeconomic position (43).

### *Surgical*

The possible role of surgical interventions to reduce COO inequality is unknown, but is likely to differ according to health policy and affordability in different countries: socialized medicine, as practiced in Sweden, may be more effective in reducing inequalities than private insurance-based medicine in the USA. While there is no data on disparities in bariatric surgery uptake according to socioeconomic position, data for adults in the USA might be suggestive. In 2006, 35% of bariatric eligible patients were either uninsured or underinsured, and 15% had incomes less than the poverty level; of 87 749 in-patient bariatric surgical procedures undertaken, 80% were performed on people with greater median incomes and 82% were carried out on people with private insurance (46). In private hands, bariatric surgery might be a procedure that increases socioeconomic inequality in obesity rates. Further, bariatric surgery requires structured aftercare and long-term support. Bariatric surgical and other successful obesity interventions in the absence of the necessary aftercare may not mitigate the psychosocial effects of obesity that interact with inequality. As such, it is not clear whether or not surgical interventions would impact on COO inequality and buffer against social disadvantage in adulthood.

## **Potential pitfalls in current framings of childhood overweight and obesity and inequality**

### Measurement, methods and data interpretation

There are a number of challenges in interpreting the data on COO prevalence and inequalities in COO in and between countries. Although COO is usually measured by scaled down cut-offs of BMI of 25 and 30 kg m<sup>-2</sup> (47), caution is needed when comparing groups of differing nationalities, sex and age groups, because BMI is not an equivalent measure of percentage body fat across such categories (48). In addition, the measurement and classification of inequality for the purposes of epidemiological study is a topic of ongoing debate (49,50), and use of different measures may give differing patterns of variation in obesity rates. For example, there are hierarchy effects that influence health, including rates of overweight and obesity, which are independent of absolute income or education level, both of which are commonly used as proxies for SES (51).

Another issue is that intervention studies and systematic reviews assume a level policy playing field. Standard epidemiological reporting is unable to capture the historical and socio-political contexts of COO, but childhood obesity inequalities, like other health inequalities, are neither historically nor politically neutral. Currently, obesity science and public health utilize a global picture that shows how HIC and LMIC settings differ with respect to economic status and prevalence of large body size and a regional picture that is useful for organizations such as the World Health Organization, whose activities are organized by regions – Africa, the Americas, South East Asia, Europe, Eastern Mediterranean and Western Pacific. This representation is less useful for understanding how economic inequalities foster inequalities in rates of COO. For example, a useful picture might emerge if nations are grouped according to trade relations rather than geographic region. Reporting COO according to membership of the North American Free Trade Agreement – USA, Canada and Mexico – would suggest how inequalities in trading relationships might influence the factors that predispose to COO rates in these countries. Reporting rates of COO within the European Union might indicate how European policy influences rates of COO across member states. Direct comparison of two nations – Sweden and the USA for example – allows reflection on how their respective political systems and the policies they generate contribute to different rates of COO. Within-nation inequalities in COO rates may be better described by reporting at district and local level, which could identify the local levels of political organization that might be mobilized to the cause of childhood obesity reduction. Such responses are likely to differ according to local circumstances and politics. Most epidemiological reporting of COO gives little attention to how the reporting unit relates to how policy and intervention might address the issues they identify as being important. The absence of any absolute measure of inequality within and across nations and the incomplete interchangeability of different measures of inequality makes the interpretation of data on inequalities in COO more tentative than is often presented. Such inequalities exist and persist, however, regardless of method of measurement.

### The place of responsibility

In spite of the recognized complexity of COO inequality, the discourse of personal responsibility in public health rhetoric places parents as central to the regulation of their children's weight and height, and blame for intergenerational patterns of obesity is frequently



assigned to mothers (52). While the potential of parental action to help prevent COO should not be neglected, it does not make sense to blame parents for childhood obesity when society has changed in a way that favours obesity. Parents of overweight or obese children are confronted with media-driven social stigma around fatness and an obesogenic environment that advertises and promotes the consumption of unhealthy foods to children (53). An investigation of Corporate Social Responsibility policies of two supermarket retailers in the UK shows them to use strategies in labelling and promotion that defer their responsibilities to parents (54). In the US context, these Corporate Social Responsibility strategies are used by the food and drink industry to maintain brand value and consumer goodwill at a time when government and public calls to address rising obesity rates demand new levels of accountability (55). Industry strategy promotes a narrow epidemiological understanding of obesity, shifting blame from foods to diet, constructed by individuals from individual foods and produced by a range of companies. This dilutes any regulatory action a government might take in relation to obesogenic foods and again delegates responsibility for childhood obesity to parents. The authors of this paper follow others who have argued that the responsibility for COO cannot be shouldered by parents alone (53,56).

### An alternative framework for addressing childhood overweight and obesity inequality

Childhood obesity policy requires a framework that is both cognisant of the historical circumstances that have structured inequalities and employs a forward-looking approach that includes collective responsibility for improving those circumstances. The Marmot Review of Health Inequalities in England recognizes that disadvantage starts before birth and accumulates throughout life and offers a framework for action under two policy goals (57): to create an enabling society that maximizes individual and community potential and to ensure that policies centre on social justice, health and sustainability. This is reflected in the policy objectives, which (1) give every child the best start in life; (2) enable all children, young people and adults to maximize their capabilities and have control over their lives; (3) create fair employment and good work for all; (4) ensure a healthy standard of living for all; (5) create and develop sustainable places and communities and (6) strengthen the role and impact of ill-health prevention. All six objectives could be recruited to the goal of reducing inequalities in COO.

Within this framework, there are areas of research and intervention into inequality in COO that require further work. First, an integrated view of health disparities across the life span and generations is needed, such that 'epigenetic responsibility' is placed at the political rather than individual level (58). Epigenetic knowledge complicates the assessment of health inequalities and perceptions of justice in health, given the implication that historical and socio-political contexts shape the intergenerational nutritional change that leads to COO, and that inequalities in the past have shaped childhood rates of overweight and obesity now. Better understanding of how epigenetic and other early programming mechanisms regulate developmental plasticity and mediate the biological embedding of chronic disease risks is needed and may shed new light on the nature of the pathophysiological mechanisms linking social and health inequalities. At present, interventions should be aimed at achieving a healthy pregnancy and birth outcome within a normative birth weight range followed by breastfeeding. Future interventions aimed at improving nutrition and minimizing adverse environmental exposures may act synergistically to reverse the epigenetic impact and improve the outcome of future generations.

Second, recruitment and participation in COO interventions should be carried out across all SES groups. Enabling people to maximize their capabilities and have control of their lives requires understanding their life circumstances. Disadvantaged groups are often difficult to reach, and their participation in community-based interventions is often low (43). Research that is based on populations most likely to respond to interventions, such as motivated educated middle-class families, leads to lack of generalizability to everyday practice (59) and to the perpetuation of inequalities. Treatment interventions must be designed with the improved representation of low-income families in mind, and further research should focus on how these interventions might best address the needs of minority groups. Community-based participatory research is one approach that may be useful (60), and evidence shows that capacity building and empowerment projects in anti-obesity interventions also increase the participation of difficult-to-reach groups (43). It is important that future policy on COO prevention and treatment clearly evaluates its effects on inequality, given that some groups tend to benefit from health initiatives more than others, which may inadvertently worsen inequality (56).

Third, more work is needed to demonstrate the links between local-level interventions and actions, and regional and national prevalence rates of COO,

and to design feasible and effective societal-level interventions that can decrease COO. Continued efforts to create sustainable and supportive communities for the management of COO should be targeted at whole school approaches, for which there are statistically significant effects (43,61).

## Conclusion

At the second meeting of the high-level WHO Commission on Ending Childhood Obesity on 13 January 2015, WHO Director-General Margaret Chan remarked that 'ending childhood obesity is one of the most complex health challenges facing the international community during this century' (62). There seems to be no general intervention that will reduce inequalities in rates of COO within nations, although most existing interventions do not appear to be increasing the inequalities in rates of COO. While it does not seem possible at present to close the SES gap in COO without reducing social inequalities, it is important to continue working on the problem with available intervention methods. To address inequalities in COO, it is necessary to document trends and whether socioeconomic inequalities are growing, stabilizing or diminishing. Such surveillance would seem to be a prerequisite for targeting any future actions. Childhood obesity policy would further benefit from additional attention to the historical circumstances that have structured inequalities and to the need for a genuinely collective responsibility, including political responsibility, for improving those circumstances.

## Conflicts of Interest Statement

None.

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