

CENTRE FOR LONGITUDINAL STUDIES, UCL - WRITTEN EVIDENCE (FDO0103)

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1. Summary

1.1. This evidence is submitted on behalf of the Centre for Longitudinal Studies (CLS) at University College London (UCL).

The Centre for Longitudinal Studies

1.2. Along with the partnered MRC Unit for Lifelong Health and Ageing (LHA), CLS is the home of a series of longitudinal birth cohorts, known collectively as the British Birth Cohorts. These cohorts have followed over 72,000 babies born in the years 1946 (The National Survey of Health and Development – NSHD), 1958 (National Child Development Study – NCDS), 1970 (The 1970 British Cohort Study – BCS70), 1989-90 (Next Steps) and 2000-2 (The Millennium Cohort Study – MCS), following all aspects of their lives, from social circumstances to health and disease.

1.3. Physical health makes up one of the core research themes at CLS, and thus decades of research have gone in to understanding the health of these successive cohorts, including trends in diet and obesity over time. With cohort data collection occurring repeatedly over the lifetime of various generations, CLS is well positioned to submit evidence, particularly on diet and obesity, having acquired a unique insight into and understanding of how health and disease develops across the life course, and how this has changed between generations.

Focus of this submission

1.4. This submission aims to primarily address topics one to four in the terms of reference, with a particular focus on trends in obesity.

1.5. We highlight the growing prevalence of overweight and obesity at all ages and across all generations since the 1980s, a period that coincides with changing food environments and the

development of the “obesogenic environment”: an expansion of industrialised food production, and more ready introduction of ultra-processed foods into our diets.

- 1.6. We examine how various factors such as socioeconomic position, sex, and ethnicity impact changing trends. Typically, those in more disadvantaged socioeconomic position are at greater risk of developing obesity and doing so earlier in their lifetime, whilst socioeconomic inequalities in obesity are typically greater among women.
- 1.7. The picture for ethnicity is more complex, especially when also considering socioeconomic circumstances. Any policies seeking to address inequalities in obesity need to take careful consideration of the potential impacts for different ethnic groups. Further funding for longitudinal research exploring the intersection of ethnicity and socioeconomic position is also needed.
- 1.8. We also outline how younger generations are spending more of their lives overweight and obese, and the impacts this has on lifelong health, including increased likelihood of chronic health diseases and multimorbidity.
- 1.9. These trends present large challenges for the health of younger generations, as a longer period spent living with overweight and obesity increases the risk of adverse health, over and above living with overweight and obesity at a single time point in adulthood.
- 1.10. Finally, we summarise the main influencers of child and adolescent obesity and overweight identified across the British Birth Cohorts, including the influence of pre- and post-natal nutrition and parental body mass index (BMI).
- 1.11. Whilst this submission aims to summarise the contribution the British Birth Cohorts have made to our understanding of obesity and diet since 1946, there is variation, and in some instances, contradictions in the evidence. In large part, this is due to the differing models of analysis applied to the data, and the varying definitions and descriptions of terms. One example of this is differences in how the wider “food environment” is defined in the

literature when examining obese or overweight outcomes. Various authors use different combinations of food and diet behaviours, social class markers, understanding of the physical environment, and proximity or access to different food types to define this term in their analyses. Despite this, given the robust longitudinal nature of our data, the findings highlighted here remain insightful, particularly when examining trends in food consumption and obesity over time.

2. Topic 1: Key trends in food, diet and obesity, and the evidential base for identifying these trends.

- 2.1 Repeated longitudinal data provides a strong evidence base for identifying and tracking trends in obesity and diet. The CLS cohorts allow us to distinguish between secular changes in obesity trends that reflect broad and substantial changes to our environment, and those occurring naturally at particular life stages.
- 2.2 Increases in BMI are typically observed as individuals age, with declines in BMI observed in older age [1]. BMI declines in older age often reflect more rapid declines in muscle rather than in fat tissue. Using longitudinal data in older adults in the UK, BMI was found to peak at age 71 and waist circumference at age 80, with declines observed thereafter [1].
- 2.3 However, the prevalence of overweight and obesity in the UK has been increasing since the 1980s across all ages, and this is seen simultaneously across all the British Birth Cohorts [2]. Among more recently born cohorts, particularly those born since the 1980s, the likelihood of being overweight or obese occurs at increasingly younger ages [2].
- 2.4 More recent born generations are therefore spending a greater proportion of their lifetime overweight and obese. By the age of 10, the likelihood of being overweight or obese, measured by BMI, was two to three-fold higher in cohorts born post-1980 than those born prior [2].
- 2.5 Additionally, the ways in which BMI develops over the lifetime has changed across generations. In younger cohorts, not only are there a higher proportion of individuals exhibiting high BMI across

their lives, but there has also been an increase in the number of people who experience rapid increases in BMI across adolescence and adulthood.

2.6 A comparison of the 1958 and 2000-2002 cohorts found that the number of children who move from overweight at age 7, to obese at age 17, tripled in the more recent born cohort compared to those children born before the onset of the obesity epidemic [3]

2.7 Similarly, a comparison of individuals born in 1946, 1958 and 1970 find those born in 1970 demonstrate rapid increases in weight between ages 11 and 42, not observed to the same degree in the older cohorts. For these individuals, they move from the low end of normal weight BMI categories in childhood, to the high end of overweight and almost obese weight categories in adulthood, representing rapid weight gain and crossing of several BMI categories [4].

2.8 This comparison of BMI data from participants in the 1946, 1958 and 1970 cohorts documents that those with greater prolonged exposure to the obesogenic environment were more likely to experience rapid increases in BMI over the life course, supporting the notion that a change in the environment is driving increases in obesity.

2.9 Given the uptick in obesity prevalence is observed across all generations simultaneously, and the time frame in which it has emerged is short, these trends do not reflect genetic changes or mutations, and instead reflect environmental changes.

2.10 The environmental changes that drive trends in obesity are in turn likely related to our food environment and food systems; over the 1980's there was mass expansion of industrialised food production, and more ready introduction of ultra-processed foods into our diets [5]. As younger people experience additional exposure to obesogenic environments, it is likely that these trends in BMI development will increase.

2.11 In the 2000/2 Millenium Cohort Study, children who lived in closer proximity to fast-food outlets, or who had a higher density of fast-food outlets near their schools, were more likely to have higher

BMI, be overweight or obese, or to have higher body fat from ages 7-14. However, this was only the case among children whose mothers were not educated to degree level, indicating a protective effect from maternal education [6].

3. Topic 2: The primary drivers of obesity both amongst the general population and amongst distinct population and demographic groups.

- 3.1 There are multiple and related factors which drive obesity across the general population and in particular groups. The British Birth Cohorts have contributed to the expansive existing literature examining the relationship between various inequalities in overweight and obesity, including socioeconomic position, sex, and ethnicity, as well as providing evidence for more discreet drivers, particularly in young people.
- 3.2 Socioeconomic, Ethnic and Sex Inequalities
Obesity, as measured by BMI, follows a social gradient. Those living in the most disadvantaged socioeconomic circumstances are more likely to be overweight than their more advantaged counterparts. In the UK this is true of both adults [7] and children [8].
- 3.3 In the UK, a comparison of inequalities in BMI across the British Birth Cohorts demonstrated there were no inequalities in BMI in childhood before the 1980s [9], and that inequalities in adult cohorts emerged around the same time [10]. As above, this corresponds to the emergence of obesogenic environments, specifically changes to food environments such as the increased prevalence of ready meals, takeaway restaurants, ultra processed food, and artificially sweetened beverages.
- 3.4 Evidence from the Millenium Cohort Study showed that children who consumed artificially sweetened beverages more than once a day had a 39% greater risk of being overweight compared to those who did not [11]. The availability and accessibility of these changing food environments is also important; fast food density is higher in areas with higher neighbourhood deprivation, and higher density of fast-food outlets is related to greater fast-food

consumption in cities [12].

- 3.5 In the Millennium Cohort Study, the youngest of the British Birth Cohorts, inequalities in diet related behaviours (including skipping breakfast) are observed at age 5 and increase across adolescence [13], with poor children being more likely to experience upwards movement across weight categories than richer ones. A range of other family health behaviours and environmental risk factors were observed within this cohort as relevant when considering income inequalities in overweight and obesity in children, such as time spent doing sports, watching TV, engaging in active playing with a parent, living in an area with a playground, and tending to have later or irregular bedtimes [14, 15]. These help to explain some of the inequalities in obesity between socioeconomic groups.
- 3.6 Ethnic differences in the risk of overweight and obesity also exist, and socioeconomic inequalities follow different patterns across ethnic groups. Evidence from the Millenium Cohort Study has contributed to the understanding that lower socioeconomic position among white children is associated with both a higher BMI [16] and waist circumference [17] than children of other ethnic groups.
- 3.7 In contrast, Black African and Caribbean children typically have higher mean BMI than the White population [18], and among this group higher income is instead related to higher BMI; the opposite pattern seen among White children [16, 18].
- 3.8 A study utilising the same cohort data found that diet and maternal dietary behaviours are important for explaining social inequalities in BMI for White children, but this is not the case for children of other ethnic backgrounds. In some non-white ethnic groups, specifically Pakistani/Bangladeshi and Black African/Caribbean children, disparities for health behaviours are less clear, and for some maternal health and dietary behaviours, those in the most disadvantaged positions typically practice better health behaviours than more advantaged groups [19]. This in part explains the differing and complex patterning of social gradients in BMI observed across ethnic groups.

- 3.9 Various studies using the British Birth Cohorts have found less consistent relationships between socioeconomic position and obesity/overweight amongst children from South Asian groups, and more specifically from Indian, Pakistani, or Bangladeshi heritage [16, 19, 20].
- 3.10 The ways in which ethnicity, socioeconomic position and obesity relate to each other also likely differs across generations and across stages of life. However, at current our evidence on ethnic differences in overweight and obesity in the British Birth Cohorts comes primarily from the Millenium Cohort Study, the youngest of our cohorts born in 2000/2, and therefore only captures childhood and adolescence.
- 3.11 A key takeaway is that associations between ethnicity and obesity and overweight are not straightforward, and complex patterns emerge when socioeconomic circumstances are also considered. Funding for future data collection, and specially ethnically boosted data collection in the older cohorts, is needed to fully understand how these associations play out across generations and over the life course. Further research that examines the drivers of overweight and obesity across different ethnic backgrounds may well be beneficial for developing and implementing policies aimed at tackling obesity in young people.
- 3.12 Importantly, any policies that aim to tackle social inequalities in overweight and obesity, should consider the likely consequences of such policies across ethnic groups. It may be that targeted policies are required, such as those that will help improve the socioeconomic circumstances among individuals from minority ethnic groups, whilst promoting continued adoption of healthy dietary behaviours.
- 3.13 Looking across the 1946, 1958 and 1970 cohorts, there is typically a greater proportion of males who are overweight or obese than females across adulthood [2], and evidence from the 1970 cohort shows that men typically have higher mean BMI than women [21].
- 3.14 Similarly, comparisons of the 1946, 1958 and 1970 cohort find the age at which median BMI is in the overweight category

(BMI 25-30 kg/m²) occurs at younger ages in males, compared to females, as well as occurring at a younger age in the more recently born cohorts [2]. However, evidence from the 2000/2 Millenium Cohort Study finds, prevalence of overweight and obesity to be similar among boys and girls across childhood and adolescence [22].

3.15 Whilst men typically have higher mean BMI in adulthood, there is much more variation in women's risk of overweight or obesity according to socioeconomic position. Typically, inequalities by socioeconomic position are wider in women across adulthood. When comparing the 1946, 1958 and 1970 cohorts, inequalities in BMI are widest among women born in 1970 [10].

3.16 In the Millenium Cohort, inequalities in fat mass index (FMI) are wider in girls in early childhood. However, the inequality in FMI increases rapidly across adolescence in boys, so that by the age of 17 socioeconomic inequalities in FMI are similar between boys and girls [23].

3.17 Other drivers

Analysis of data from the 1970 cohort found a marked and consistent association between general psychological problems in children - particularly conduct problems such as hyperactivity and difficulties with attention - and being obese in later in life [24]. Conduct problems were found to increase the risk of adult obesity by approximately 40-60%, particularly when these problems appeared early on in life and were persistent throughout childhood. Specifically, persistent attention deficit and hyperactivity problems in childhood were found to increase the risk of obesity as an adult by 30-50%.

3.18 Similarly, amongst the 1958 cohort, both affective symptoms and conduct problems in early life were found to be associated with an increased risk of abdominal obesity in women in mid-life, along with a range of other poor health biomarkers [25].

3.19 Sleep is a multidimensional construct and our understanding of how various aspects, including sleep timing and quality, influence health is still developing. However, evidence from the Millenium Cohort Study has contributed to a growing evidence base that short

sleep is related to increased overweight and obesity severity in adolescence. It was found that sleep timing, duration and sleep quality all show independent associations with adiposity levels in adolescence. For girls, poor sleep quality in particular was associated with higher adiposity [26].

4. Topic 3: The impacts of obesity on health, including on children and adolescent health outcomes.

- 4.1 More recent born generations are spending a greater proportion of their lifetime overweight and obese, and this has consequences for health over the life course. It is well-established in the literature, and observed across the British birth cohorts, that obesity in adulthood is associated with chronic health conditions such as coronary heart disease, type 2 diabetes, and hypertension [27].
- 4.2 However, individuals that were additionally overweight or obese in childhood and adolescence, and therefore had a greater accumulation of exposure to overweight and obesity across their lifetime, demonstrated an even higher risk of chronic health conditions such as coronary heart disease and type 2 diabetes, compared to individuals who were only obese in adulthood [28].
- 4.3 The finding that greater lifetime exposure to overweight and obesity is related to worse health is also seen for other outcomes in the British Birth Cohorts. Individuals that develop obesity at younger ages rather than in later adulthood or never at all are also at higher risk of developing chronic kidney diseases [29], high blood pressure [30, 31], high cholesterol and diabetes [31], long COVID and of being admitted to hospital from a COVID-19 infection [32].
- 4.4 These findings are of concern, considering recent trends in overweight and obesity, with more recently born generations spending more of their lives overweight and obese, and doing so from earlier ages. It is likely that current trends in obesity will result in an increase in the prevalence of chronic diseases, as well as earlier onset of these diseases.

- 4.5 In a comparison of mid-life multimorbidity, the more recently born 1970 cohort, who also demonstrate higher average BMI over their lifetime, have higher rates of multimorbidity than the earlier born 1958 cohort. Multimorbidity for this cohort was shown to exist in a third of the population at age 46-48 [33]. Comparatively in the older cohort of individuals born in 1958, multimorbidity in midlife was seen in less than a fifth of the population at a similar age [34]. This is of significance given the link between multimorbidity, complex health needs and lower quality of life [35].
- 4.6 Evidence from the 1958 cohort showed that obesity at any age in adulthood and BMI gains over the life course were also associated with poor physical functioning in mid-life [36]. A longer duration of obesity was associated with increased risk of poor physical functioning, with this risk being higher for obesity onset in childhood.
- 4.7 Given poor physical functioning predicts multiple adverse health outcomes, including cognitive decline, increased risk of falls and hospitalisation, interventions to maintain physical functioning will be of importance as our population ages and the prevalence of obesity increases.
- 4.8 The association between obesity and mental ill-health is bidirectional, with obesity leading to poor mental health outcomes and vice versa [37]. Analysis of data from the 1958 and 1970 birth cohorts demonstrates consistent associations between socioeconomic disadvantage and an increased risk of comorbid obesity and mental health [38]. These associations are observed in both childhood and adulthood, and get larger over time, with the most disadvantaged individuals experiencing the greatest risk of comorbidity of obesity and poor mental health.
- 4.9 Further evidence from the Millenium Cohort Study showed that childhood obesity is also associated with both emotional and behavioural problems in children at ages 3 and 5 [39], as well as worse psychosocial wellbeing at age 11 [40].
- 4.10 It is likely that the negative impacts of obesity on health are occurring at younger ages in more recently born cohorts. However, we need greater research funding for biomedical data collection at

younger ages in longitudinal datasets to fully test these associations. It is often difficult to secure funding for biomedical data collection in younger age groups, as it is assumed that these populations will be healthy. However, the trend we see of increasing obesity and overweight in younger generations challenges this view.

- 4.11 Understanding the characteristics of those, particularly in younger generations, who maintain a normal BMI throughout their lives will also be important for designing policy interventions and clinical guidance on maintaining a healthy weight, and more research should be funded in this area.

5. Topic 4: The influence of pre- and post-natal nutrition on the risk of subsequent obesity, and the specific influences on the diet of children and adolescents that contribute to the risk of becoming obese.

- 5.1 Early life infant growth and birthweight are linked to pre- and post-natal nutrition, in that mothers with a higher BMI typically have babies with a higher birthweight [41], and this can act as a proxy for early life food environments and diet. Among individuals born in the 1958 cohort, higher birthweight is typically associated with higher mean BMI in adulthood.

- 5.2 Individuals born in the 1958 cohort who grow rapidly in childhood are also at higher risk of obesity in adulthood. This is particularly the case for boys, and those born at a low birth weight [41]. The associations of rapid growth in childhood highlights the importance of early childhood nutrition environments and later life obesity risk.

- 5.3 Similarly, parental BMI may act as a proxy for early-life home (including food) environments, with certain factors, including diet, being found to, in part, explain the links between a parent's and child's BMI [42]. In this study environmental factors were defined as a combination of parental and grandparental social class, along with specific health behaviours such as smoking during pregnancy or early life of the child.

- 5.4 Children whose mothers and fathers are overweight or obese have a much higher likelihood of progressing from overweight to obesity across childhood and adolescence [3]. One study found that among the 2000-2002 cohort, the odds of a girl being overweight and subsequently becoming obese between the ages of 7 and 17 was over 13 times higher if both parents had overweight or obesity, compared to both parents having normal weight. For boys, this was over 9 times [3].
- 5.5 Evidence from the 1958 cohort further underlined that maternal weight in particular is important for explaining associations between birthweight and adult BMI, which is well-established in the literature. This study noted that maternal weight may be a more important risk factor for obesity in the child than their own birthweight [41].
- 5.6 Evidence from the Millenium Cohort Study found that maternal behaviours, many of which are potentially modifiable, in both pregnancy early childhood are relevant when attempting to explain income inequalities in overweight and obesity amongst children [40].
- 5.7 Amongst this cohort, by age 11, children in lower family income brackets were more likely than their more well-off counterparts to have mothers who smoked during pregnancy, were not breastfed or breastfed for a shorter duration, were introduced to solid food earlier in life, were less likely to do sports, engage in active playing with a parent, and to be living in an area with a playground, were more likely to spend more time watching TV and using a PC, tended to have later or irregular bedtimes, and were less likely to be eating fruit and having breakfast each day [14].
- 5.8 Further analysis showed that these patterns held within white families, however, patterns for other ethnic groups were less clear [14]. Within Pakistani and Bangladeshi and Black African and Caribbean families, children of poorer mothers were found to be much less likely to drink sugary drinks in between meals and each irregular breakfasts, again highlighting the importance of the relationship between ethnic inequalities in obesity and overweight.

5.9 There is mounting evidence that breastfeeding in the first six months of life can help reduce the risk of childhood overweight and obesity [43]. Analysis of data from the Millenium Cohort Study found that there was a robust relationship between pre-pregnancy maternal obesity and overweight and early breastfeeding cessation (within the first week of life), though more research is needed to understand the causal mechanisms underlying this [44]. This is particularly important given frequent confounding factors identified in the literature (such as socioeconomic position) when observing associations between breastfeeding and later childhood development and health.

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