Early years interventions to tackle childhood obesity and promote life-long health

The Academy of Medical Sciences

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Executive summary

Childhood obesity has risen to alarming levels in most countries around the world, including the UK and Italy. Across Europe, the prevalence of overweight or obesity is around 30% in both boys and girls. Within countries, there is substantial variation between different settings, for example, between the most deprived and least deprived areas, with socioeconomic factors playing a key role in shaping disparities in childhood obesity rates.[1]

Severe obesity leads to a range of health problems in childhood. However, the public health consequences of childhood obesity go beyond this, as **obesity typically persists into adulthood** and **increases the risks of a wide range of later-life cardiometabolic and other health problems** that limit both healthspan and lifespan. It can also be associated with **lower educational attainment and employment opportunities** which, along with adverse health consequences, lead to reduced human potential and economic costs. Moreover, there is now evidence for passage of obesity risk across generations by several mechanisms. This emphasises the importance of viewing child obesity through a life-course lens.[2]

In October 2024, the UK Academy of Medical Sciences and the Accademia Nazionale dei Lincei (Italian National Academy of Sciences) held a joint policy workshop on childhood obesity and its implications for health later in childhood and during adulthood. Participants (see Annexe 1) took stock of the current epidemiological picture in the two countries and discussed evidence relating to policy and other interventions designed to promote healthier lifestyles and reduce childhood obesity. Discussions at the meeting highlighted key themes relating to policymaking that should be prioritised:

Intervene early: Developmental trajectories are set early in life, including during the prenatal period, and appear difficult to alter after the age of about 5 years. The first 1000 days of life are critical to development and health across the life-course. Pregnant women are therefore a key group, and participants argued that entering pregnancy with a healthy weight is vital to ensure a healthy pregnancy. **Breastfeeding** should be encouraged for a host of reasons, including its association with a reduced risk of childhood obesity. **Rapid 'catch-up' growth** in low-birth-weight babies should not be encouraged, as it may increase the risk of later-life obesity and poor cardiometabolic health. The overall goal should be to **establish and maintain a healthy body-weight trajectory that avoids excess gain early in life.**

Take a systems approach: Multiple factors affect weight gain during infancy and childhood. Much evidence suggests that targeting single factors, such as diet or physical activity, in single settings, without consideration of wider contexts, is rarely an effective way to tackle obesity. Rather than look for 'silver bullets', participants suggested that **policymakers should target wider societal drivers, to create an enabling and supportive environment for healthy lifestyles.** The evidence suggests that complex interventions targeting multiple factors affecting energy balance are more likely to be effective. As these are delivered within complex systems, they may have unintended consequences, emphasising the need to assess multiple outcomes.

1. World Health Organization (2021). High rates of childhood obesity alarming given anticipated impact of COVID-19 pandemic. Retrieved from https://www.who.int/europe/news/item/11-05-2021-high-rates-of-childhood-obesity-alarming-given-anticipated-impact-of-covid-19-pandemic.
2. Hanson M, Gluckman P, Bustreo F. (2016). Obesity and the health of future generations. The Lancet Diabetes & Endocrinology. 1;4(12):966-7.

Implement cross-sectoral solutions: Policies in multiple sectors affect the environment that shapes diet and physical activity, including food policy, education, urban planning and transport. Participants stressed the need to **avoid conflicting policies** – such as public health policies that encourage people to be more active, and urban planning policy that makes this more difficult. Conversely, some policies are likely to be **mutually reinforcing and deliver co-benefits** – such as both health and climate benefits. Participants also highlighted the need to explore potential impacts on health inequalities. A robust approach to **regulation,** such as legislation to regulate the food industry rather than voluntary agreements, were felt to be necessary to create environments that help people to adopt healthier lifestyles.

Refine messaging: Communication about obesity is often challenging, with overweight or obesity sometimes being portrayed as a character flaw, leading to **stigmatisation.** Lack of care with messaging can be counterproductive, leading to mental health impacts that may increase the risk of unhealthier diet and lifestyles. Participants supported **more positive messaging** emphasising the benefits of maintaining a healthy weight, rather than focusing on obesity per se. Healthcare workers have a critical role to play in public and patient communication but need guidance on how to communicate most effectively. There is also a need to understand better how other mediators and communication channels favoured by young people influence attitudes and behaviours, and how they can contribute to more effective and less stigmatising messaging.

Strengthen research and researcher–policymaker engagement: Continuing research is needed to close key knowledge gaps on the **interplay between physiological, psychological and social factors affecting weight,** particularly to bridge the gap between statistical associations and causative pathways. Participants suggested there was a need to **move beyond body mass index (BMI) as a core metric,** focusing more on biomarkers of harmful adiposity. **Closer ties with policymakers** are needed, with development of clear messages that acknowledge but do not overplay uncertainty, and economic analyses that include the consequences of failure to act. By focusing on the adverse economic and societal impacts of rising population obesity, efforts could be made to establish a cross-party political consensus around the need to intervene, to ensure long-term prioritisation and a stable, forward-looking policy landscape.

Childhood obesity has become an **urgent public health challenge** that is both affecting lives today and storing up problems for the future. As well as shortening individual lives, it will increase demands on the health system. It has proved to be stubbornly hard to address through simple behavioural interventions, emphasising the importance of **policy initiatives that create the environment in which healthier lifestyle choices are the default option or easier to adopt.** Success is likely to be the cumulative result of multiple actions taken across a wide range of domains, within and outside health, which consistently promote and facilitate the adoption of healthy lifestyles among children and their caregivers.

Introduction

According to the WHO, adult obesity globally has more than doubled since 1990 and adolescent obesity has quadrupled.[3] In 2022, 43% of adults aged 18 years and over were overweight and 16% were living with obesity. Over 390 million children and adolescents aged 5–19 years were overweight in 2022, 41% of whom were living with obesity. Globally, the prevalence of obesity in girls aged 5–19 years increased from 1.7% in 1990 to 6.9% in 2022, and from 2.1% to 9.3% in similar-aged boys.[4]

The World Obesity Federation's World Obesity Atlas 2023 suggests that, by 2035, 51% of the global population will be overweight and 25% obese.[5] Childhood obesity is projected to increase from 2020 levels – by 100% in boys, to 208 million, and by 125% in girls, to 175 million.

This matters for many reasons. Overweight or obesity can significantly reduce quality of life, be a trigger for stigmatisation and bullying, and undermine mental health and wellbeing. Severe obesity creates physical health issues in childhood. For example, increasing numbers of children are being treated for type 2 diabetes, typically seen as a metabolic disease of later life. In England, the number of children and young people (0–25 years) with type 2 diabetes increased by 54% between 2016/17 and 2022/23.[6]

Childhood obesity also has long-term consequences. It is a key risk factor for obesity in adulthood, which has multiple consequences for health. As well as cardiometabolic diseases, excess weight is associated with a litany of other health issues, including an increased risk of various cancers, chronic respiratory diseases and digestive disorders. Higher-than-optimal BMI is estimated to be responsible for 5 million deaths a year.[7] Depending on its severity, obesity can reduce life expectancy by a decade or more.

This **life-course perspective** reinforces the need to address excess weight gain early in life, not just for the sake of children during childhood but also to keep them in good health in adulthood, including when they become parents.

Another striking aspect of childhood obesity is its association with **social disadvantage.** In high-income countries, a social gradient is typically seen, with rates of overweight or obesity being highest in the poorest communities. These patterns make significant contributions to health inequities in adulthood.

There has been no lack of awareness of child obesity, and many efforts have been made to halt its rise. However, multiple scientific studies have shown that weight gain is extremely hard to address, in children as well as adults. In a large part this reflects the fact that we now live in a highly 'obesogenic' environment, in which calorie-rich food is generally plentiful and there are fewer opportunities for physical activity. Only minor imbalances in energy intake and use lead to storage of excess calories as fat.

Moreover, the body's homeostatic mechanisms respond much more strongly to weight loss, triggering increased food consumption, than to weight gain.

3. World Health Organization (May 2025). Obesity and overweight. https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight
4. NCD Risk Factor Collaboration (NCDRisC) (2024). *Worldwide trends in underweight and obesity from 1990 to 2022: a pooled analysis of 3663 population-representative studies with 222 million children, adolescents, and adults.* Lancet **403(10431),**1027–50. doi: 10.1016/S0140-6736(23)02750-2
5. World Obesity (2023). World Obesity Atlas 2023. https://www.worldobesity.org/resources/resource-library/world-obesity-atlas-2023
6. NHS England (2024). Children and young people diabetes toolkit. https://www.england.nhs.uk/long-read/children-and-young-people-diabetes-toolkit/
7. GBD 2019 Risk Factor Collaborators (2020). *Global burden of 87 risk factors in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease study 2019.* Lancet **396,**1223–49.

In October 2024, the UK Academy of Medical Sciences and the Accademia Nazionale dei Lincei (Italian National Academy of Sciences) held a joint workshop on childhood obesity and its implications for healthy ageing. Participants from the UK and Italy discussed the current state of childhood obesity, particularly in Europe, and the policy initiatives being taken to address it, including comparisons between the UK and Italy. The workshop discussions also covered the role of science in informing policy and public engagement on childhood obesity and its connections to other key issues, including sustainability.

Spotlight on Italy and the UK

Meeting co-chairs, Professor Susan Ozanne FMedSci, Professor of Developmental Endocrinology, Head of the Department of Clinical Biochemistry, Director of the Institute of Metabolic Science-Metabolic Research Laboratories and Co-Director of the Institute of Metabolic Science, all at the University of Cambridge, UK, and Professor Paolo Vineis, Chair of Environmental Epidemiology, Imperial College London, UK, provided a brief introduction to current patterns of obesity in the UK and Italy, setting the scene for the challenge faced.

In the UK, 25% of adults are living with obesity and a further 40% are overweight. By the age of 10, around one in five children in England, Scotland and Wales are living with obesity. Obesity levels in schoolchildren have been steadily increasing over the past two decades and spiked during the COVID-19 pandemic, an increase that has only been partly reversed in Year 6 children (10–11 years).

Childhood obesity is also a significant public health challenge in Italy. Data from 2023 indicate that 28.8% of children were overweight (according to International Obesity Task Force criteria) and 9.8% were living with obesity. These levels have been declining slowly in recent years.

In both countries, childhood obesity shows marked geographic and socioeconomic gradients. In the UK, for example, the prevalence of obesity is twice as high for children living in the most-deprived areas compared with those living in the least-deprived areas. In Italy, prevalence rates show more limited variation but are higher when comparing North versus South regions.

Initiatives and insights

In a series of background talks, participants from the UK and Italy highlighted ongoing initiatives to better understand the causes and impact of childhood obesity, as well as attempts to reduce its prevalence.

Complications from excess weight (CEW) clinics

Professor Simon Kenny, Consultant paediatric surgeon at Alder Hey Children's NHS Foundation Trust, National Clinical Director for Children and Young People, and Chair of the Women's and Children's Specialised Commissioning Programme of Care within NHS England, discussed a multifaceted pilot programme to support weight loss among children with severe obesity and complex needs.

The NHS Long Term Plan included a commitment to treat an additional 1000 children a year for obesity-related complications. CEW clinics are a pilot programme taking an integrated approach to address the causes and impact of child obesity and to generate evidence to inform future practice. It is focusing only on the most extreme cases – a small fraction of the 2.7 million children aged 2–17 years who are overweight or living with obesity in England.

The programme includes 37 clinics, which have defined their own approaches but adhere to a shared minimum dataset and an integrated approach that includes social care as well as healthcare. It also incorporates a platform for evaluating interventions or tools and has a strong focus on patient and public involvement. Launched in 2020, it is in an active care phase and is undergoing a formal evaluation.

A child with severe obesity at age 4 has a life expectancy of just 39 years. Even small changes in weight can have an impact on life expectancy and comorbidities, and data from the CEW programme will shed light on the degree of weight loss that is clinically meaningful in childhood and later life.

Among the CEW participants recruited to date, around half are aged 13–17 years, with equal representation of males and females, and a diverse mix in terms of ethnicity and socioeconomic status Many participants have other challenges, such as autism or attention-deficit hyperactivity disorder (ADHD), emphasising the importance of adopting an integrated multidisciplinary approach. Data suggest that the programme's work is achieving weight loss, most strikingly among young age groups (0–4 years), with progressively smaller effects seen with increasing age – again highlighting the importance of intervening early. Final data, on weight loss and other outcome measures, such as school and college attendance, are expected to be available in 2026.

Childhood obesity and overweight in Italy

Professor Giovanni Capelli, Director of the CNaPPS (National Centre for Disease Prevention and Health Promotion) of the Italian National Institute of Health (ISS), summarised recent trends in childhood obesity in Italy. Three key data sources are available to researchers in Italy:

- **COSI:** Childhood Obesity Surveillance Initiative (ages 8–9 years), known as 'Okkio alla Salute' ('Watch out for your Health') in Italy, launched in 2008
- **HBSC:** Health Behaviour in School-Aged Children (ages 11–15 years), launched in 2000
- **PASSI:** Progress in Assessing Adult Population Health in Italy (ages 18–69 years), launched in 2005

COSI data suggest that childhood obesity levels are high but show signs of a declining trend: between 2009 and 2023, the prevalence of obesity fell from 12.0% to 9.8% (using International Obesity Task Force (IOTF) criteria; with WHO criteria, levels are higher but show the same trends). Overweight levels fell from 35.2% to 28.8% over the same period. However, over the past decade, the rate of decline of overweight has slowed and obesity levels have hardly changed.

According to COSI data, Italy has the fourth highest levels of obesity and overweight in Europe. Within Italy, prevalence varies by region, showing a marked north–south divide – from 15.3% to 43.2% (IOTF cut-offs) – that corresponds to the country's socioeconomic gradient.

HBSC data show that overweight or obesity is more common among males. Levels have been stable since 2010, and for any given year are slightly lower in older age groups. Regional variation is similar to that seen with COSI data.

PASSI data also show relatively high levels of obesity and overweight, with little change seen since 2008. Levels are higher among men and increase with age. Regional differences exist but are slightly smaller than at earlier ages.

Italy has developed a National Prevention Plan (Piano Nazionale della Prevenzione, PNP), plus many other policy documents relating to physical activity and other factors affecting weight. The PNP adopted an integrated, multisectoral approach, encompassing diet and physical activity, targeting health inequities, and incorporating a life-course perspective.

Italy has a devolved model for health, with the PNP informing regional implementation plans. The PNP includes a menu of public health programmes that regional authorities can choose to introduce, or they can select their own initiatives to implement. The PNP and regional implementation initiative is running from 2020 to 2025, and more than 50 programmes have been implemented targeting childhood obesity.

WHO acceleration plan to stop obesity

Francesco Branca, Director of the Department of Nutrition and Food Safety at the World Health Organization (WHO), summarised the steps being taken by the WHO to counter the global rise in obesity. Globally, more than one billion people are living with obesity. It is the sixth biggest cause of deaths (5 million a year) and is the third biggest cause of years living with disability. The 2022 World Health Assembly (WHA75) endorsed an acceleration plan,[8] through which 32 forerunner countries, with a combined population of 1.25 billion, are taking coordinated steps to address obesity.

8. World Health Organization (2023). WHO acceleration plan to stop obesity. https://www.who.int/publications/i/item/9789240075634

WHO has developed a technical package covering multiple policy areas. These include recommendations relating to breastmilk substitutes and promotion of breastfeeding, and on food and beverage marketing to children.[9] Guidelines also cover issues such as tax policy on unhealthy foods and front-of-pack food labelling.

WHO has developed guidelines on promotion of breastfeeding to reduce the risk of obesity.[10] A systematic review by the EarlyNutrition project found that the strongest evidence for metabolic disease prevention in later life was for breastfeeding.[11]

Procurement of food by public agencies is an opportunity to facilitate healthy eating.[12] In theory, non-sugar sweeteners could lead to reduced calorie intake. However, because of limited evidence that their use contributes to sustained weight loss, the WHO has made a 'conditional' recommendation against replacement of sugars with non-sugar sweeteners.[13] The general level of evidence, including that for adverse health outcomes, was currently insufficient for this to be made a 'strong' recommendation.

WHO has also produced physical activity guidelines for different age groups, as well as a health service delivery framework to guide the design of services to prevent and manage obesity.[14] Guidelines for management of adolescents with obesity are in development, alongside a similar resource for infants and children.

The obesity field is being greatly impacted by GLP-1 receptor agonists such as semaglutide. There is currently limited evidence of their effects in children and adolescents, but they could potentially be part of the solution to child obesity. However, continuing use would be necessary to maintain weight loss and the financial costs of widespread use of such drugs would be substantial.

Young people with obesity: consequences and prevention

Dr Tim Lobstein, Senior Consultant, World Obesity Federation, highlighted what is known about interventions designed to reduce levels of obesity in children.

The absolute number of school-aged children affected by overweight or obesity vividly illustrates the scale of the childhood obesity crisis. In the UK, 1.3 million children are living with obesity and a further 2.3 million are overweight; in Italy, the equivalent figures are 0.8 million and 1.5 million. Hundreds of thousands of young people in the UK have worryingly high levels of metabolic markers associated with non-communicable diseases.

Many interventions have been designed to address excess weight in different settings, including schools. However, a 2019 Cochrane review of randomised controlled trials found very little evidence that individual interventions targeting diet or physical activity, or both, are effective at achieving sustained weight loss.[15] A more recently published Cochrane review came to similar conclusions.[16] An Australian modelling study found that, given the relatively small effects, scaling of interventions would be expensive and of questionable cost-effectiveness, particularly compared with public health policy interventions, several of which were projected to deliver overall cost savings.[17]

9. World Health Organization (2023). Policies to protect children from the harmful impact of food marketing: WHO guideline. https://www.who.int/publications/i/item/9789240075412
10. World Health Organization (2023). E-Library of Evidence for Nutrition Actions (eLENA). https://www.who.int/tools/elena/interventions/breastfeeding-childhood-obesity
11. Zalewski BM, *et al.* (2017). *Nutrition of infants and young children (one to three years) and its effect on later health: A systematic review of current recommendations (EarlyNutrition project).* Critical Reviews in Food Science and Nutrition **57(3),** 489–500.
12. World Health Organization (2021). Action framework for developing and implementing public food procurement and service policies for a healthy diet. https://iris.who.int/bitstream/handle/10665/338525/9789240018341-eng.pdf
13. World Health Organization (2023). Use of non-sugar sweeteners: WHO guideline summary. https://iris.who.int/handle/10665/375565
14. World Health Organization (2023). Health service delivery framework for prevention and management of obesity. https://www.who.int/publications/i/item/9789240073234
15. Spiga F, *et al.* (2024). *Interventions to prevent obesity in children aged 5 to 11 years old.* Cochrane Database of Systematic Reviews, issue **5,** CD015328. doi: 10.1002/14651858.CD015328.pub2
16. Spiga F, *et al.* (2024). *Interventions to prevent obesity in children aged 12 to 18 years old.* Cochrane Database of Systematic Reviews issue **5,** CD015330. doi: 10.1002/14651858.CD015330.pub2
17. Ananthapavan J, *et al.* (2019). *Cost-effectiveness of community-based childhood obesity prevention interventions in Australia.* International Journal of Obesity **43(5),**1102–12. doi: 10.1038/s41366-019-0341-0

The socioeconomic gradient in childhood obesity is seen in all European countries but is particularly steep in England. The Best-ReMaP project has assessed whether diet-related policy interventions have affected health inequities and has developed a simple tool to assess the potential impact of particular policy initiatives.[18]

Additional emerging challenges include: (1) the aftermath of the COVID-19 pandemic and lockdowns, which saw a sharp surge in childhood obesity levels; (2) environmental pollution with endocrine disrupters, which may affect child physiology and energy homeostasis; and (3) social media use driving a decline in physical activity.

Learning from mother–child cohorts: the Born in Scotland study

Professor Rebecca Reynolds, Dean International, College of Medicine and Veterinary Medicine, University of Edinburgh, Professor of Metabolic Medicine, University of Edinburgh, and Honorary Consultant Physician in Diabetes and Endocrinology, NHS Lothian, described how the Born in Scotland pregnancy cohort will shed more light on early-life impacts on health.

Maternal obesity increases the risk of cardiovascular and metabolic diseases, including type 2 diabetes, when their offspring reach adulthood. The Born in Scotland cohort is designed to provide additional insights into this effect.[19]

It is recruiting women early in pregnancy as they interact with routine care systems. It requires little additional contribution from participants, who give permission for researchers to access routine health data and to undertake additional analyses of routinely collected samples. Linkage to other data sources will allow analyses of social as well as health outcomes.

The programme is piloting different opt-in and opt-out models, and is striving to ensure good participation across social strata to shed light on health inequities. Among those recruited to date, 18% are living with obesity and 26% are overweight.

The programme is part of the **Mother and Infant Research Electronic Data Analysis (MIREDA)** partnership, which is developing new resources and tools to facilitate research into maternal and infant health using routinely collected data.[20] Its work aligns with Scotland's Women's Health Plan[21] and the Global Strategy for Women, Children and Adolescent Health.[22]

Interplay between the obesity epidemic and the environmental crisis

Professor Paolo Vineis highlighted how factors contributing to obesity are also impacting on climate change, creating opportunities to deliver benefits and unify messaging across both domains.

The world's food production systems are both contributing to and affected by climate change, with the agriculture and land use sector accounting for more than 20% of greenhouse gas emissions (although estimates are uncertain). Meat production is particularly environmentally damaging, responsible for approximately 50% of greenhouse gas emissions from the agricultural sector.

Diet has many well-established links to health. In recent years, it has become clear that diet can also affect health through impacts on bacterial communities in the gut, the gut microbiota.

18. Best-ReMaP (n.d.). Best-ReMaP – a Europe-wide Joint Action (2020-2023). https://bestremap.eu
19. University of Edinburgh (n.d.). Born in Scotland. https://cardiovascular-science.ed.ac.uk/born-in-scotland
20. National Centre for Population Health & Wellbeing Research (n.d.). Mother & infant research electronic data analysis (MIREDA). https://ncphwr.org.uk/portfolio/mireda/
21. Scottish Government (2021). Women's health plan. https://www.gov.scot/publications/womens-health-plan/
22. World Health Organization (n.d.). Global Strategy for Women's, Children's and Adolescents' Health Data Portal. https://platform.who.int/data/maternal-newborn-child-adolescent-ageing/global-strategy-data

The complexity of the biological and social factors affecting weight gain argue for a systems-wide approach. The 'exposome' represents the total sum of external exposures to which people are exposed throughout life.[23] The impact of these exposures can be assessed at a systems level through use of various 'omics' technologies, which can track changes in gene expression and different types of biomolecules, such as proteins, lipids and metabolites.

Multiple studies have demonstrated an association between the built environment and childhood obesity.[24] As with all observational studies, however, it is difficult to establish causality. Cohort studies have also demonstrated links between consumption of ultra-processed foods and obesity. A randomised controlled trial found that, when presented with a limitless diet rich in ultra-processed foods, participants ate more and gained more weight than those presented with a healthier control diet.[25] Research within the Avon Longitudinal Study of Parents and Children (ALSPAC) cohort has also explored the metabolic impacts of ultra-processed foods, highlighting possible mechanisms through which its consumption might influence weight control.[26]

The Science and Technology in Childhood Obesity Policy (STOP) project has developed a set of six policy briefs, covering various aspects of diet and physical activity.[27] Published in 2022, these provide policymakers with a range of short-term and long-term approaches that can create more opportunities for children to adopt healthier lifestyles.

Child obesity: socioeconomic determinants and policy

Professor Franco Sassi, Imperial College Business School, London, UK, drew attention to the links between obesity in childhood and socioeconomic status.

Obesity and economic disadvantage can create a vicious cycle: obesity is associated with reduced economic opportunities, which in turn are associated with an increased risk of weight gain. The largest impacts are seen in girls, especially around adolescence.

One key impact is on educational attainment at age 23. Mediating factors linking childhood obesity to educational underachievement include depression (in both sexes), externalising symptoms (anger and aggressive and destructive behaviour) in girls, and experience of bullying in boys. The impact of obesity on adverse employment outcomes appears to be mediated through effects on educational attainment.[28]

Systematic reviews informing the STOP policy briefs have collated evidence on the impact of policy options.[29] WHO has also provided guidance on tax policies to promote healthier diets.[30] For example, there is good evidence that taxes on sugar-sweetened beverages reduce sales.[31]

The UK policy change on sugar-sweetened beverages was announced in advance, providing time for manufacturers to reformulate their products. The policy had twin effects, influencing both product availability and consumer behaviour. No changes in behaviour were seen for products excluded from the tax, suggesting that the pricing policy was responsible for changing behaviour, rather than a general shift towards healthier purchasing.

23. Niedzwiecki MM, *et al.* (2019). *The exposome: molecules to populations.* Annual Review of Pharmacology and Toxicology **59,**107–27. doi: 10.1146/annurev-pharmtox-010818-021315
24. Malacarne D, *et al.* (2022). *The built environment as determinant of childhood obesity: a systematic literature review.* Obesity Reviews **23 Suppl 1(Suppl 1),** e13385. doi: 10.1111/obr.13385
25. Hall KD, *et al.* (2019). *Ultra-processed diets cause excess calorie intake and weight gain: an inpatient randomized controlled trial of ad libitum food intake.* Cell Metabolism **30(1),** 67–77.e3. doi: 10.1016/j.cmet.2019.05.008
26. Vineis P, *et al.* (2023). *The contribution to policies of an exposome-based approach to childhood obesity.* Exposome **3(1),** osad006. doi: 10.1093/exposome/osad006
27. Science and Technology in childhood obesity policy (n.d.). STOP Policy Briefs. https://www.stopchildobesity.eu/policy-briefs/
28. Segal AB, *et al.* (2021). *The impact of childhood obesity on human capital in high-income countries: a systematic review.* Obesity Reviews **22(1),** e13104. doi: 10.1111/obr.13104
29. Branca F, Chambers T & Sassi F. (2021). *How to tackle childhood obesity? Evidence and policy implications from a STOP series of systematic reviews.* Obesity Reviews **22(2),** e13181. doi: 10.1111/obr.13181
30. World Health Organization (2024). Fiscal policies to promote health diets: WHO guideline. https://www.who.int/publications/i/item/9789240091016
31. Andreyeva T, *et al.* (2022). *Outcomes following taxation of sugar-sweetened beverages: a systematic review and meta-analysis.* JAMA Network Open **5(6),** e2215276. doi: 10.1001/jamanetworkopen.2022.15276

A perinatal and infant perspective on child obesity

Professor Neena Modi FMedSci, Professor of Neonatal Medicine and Vice-Dean (International), Faculty of Medicine, Imperial College London, UK, and President of the European Association of Perinatal Medicine, highlighted how life before birth can affect childhood obesity and later-life health.

Several perinatal factors affect infant growth and body composition, including intrauterine growth restriction, preterm birth, maternal weight and maternal glycaemia.

Although breastfeeding is recommended to reduce the risk of obesity, and has clear benefits for cognitive development, not all studies have found it to be protective.[32] The PROBIT interventional trial, for example, successfully increased breastfeeding rates but had no impact on offspring obesity levels at age 11.[33] The picture is complex, and responses to infant feeding regimens depend on infant phenotype (such as weight at birth), as well as types of feed, age at weaning, and other factors such as development of satiety responses and self-regulation.

Lockdown measures during the COVID-19 pandemic saw a spike in childhood obesity. While obesity among 4–5-year-olds has returned to pre-pandemic levels, it remains elevated in 10–11-year-olds, suggesting that weight gain is 'stickier' in older childhood. The biggest impact on weight gain was seen among the socioeconomically disadvantaged. These effects are likely to have an estimated £800 million impact on healthcare costs and £8.7 billion wider cost to society.[34]

Modelling suggests that the longer children remain at a healthy weight, the less likely they are to become overweight or obese in adulthood.[35] While cut-offs based on BMI are useful for defining overweight and obesity, increasing BMI,[36] even within the normal range, can have negative health consequences.

The impact of metabolic/environmental mismatch

Professor Mark Hanson, Emeritus Professor of Human Development and Health and BHF Professor at the University of Southampton, UK, highlighted the impact of a 'mismatch' between the physiology of infants established *in utero* and in early postnatal life, and the environment in which they grow up and live as adults.

According to the developmental origins of health and disease concept, the prenatal environment and early-life experience are critical factors affecting the risk of metabolic disease in later life. These factors affect not just the disease risk trajectory across the life-course but also sensitivity to a mismatch between the environment to which metabolism has been 'tuned' and the environment actually experienced – an obesogenic environment therefore has a greater impact on disease risk in those at higher initial risk. These effects have been demonstrated in the Southampton Women's Survey, which has examined the impact of childhood diet on weight at age 9. The negative impacts of an unhealthy diet are progressively larger for those who grew slowest during late stages of pregnancy.

Maternal and offspring diet quality are correlated and highly stable from before birth to mid-childhood, and less healthy diets are associated with higher BMI and adiposity at age 8/9.[37] Cardiorespiratory fitness at age 12–13 years is also affected by childhood diet at earlier ages.

32. Owen CG *et al.* (2005). Breast-feeding and cardiovascular risk factors and outcomes in later life: evidence from epidemiological studies. Proceedings of the Nutrition Society. 2011;70(4):478-484.
33. Martin RM, *et al.* (2017). *Effects of promoting long-term, exclusive breastfeeding on adolescent adiposity, blood pressure, and growth trajectories: a secondary analysis of a randomized clinical trial.* JAMA Pediatrics **171(7),** e170698. doi: 10.1001/jamapediatrics.2017.0698
34. Ochoa-Moreno I, *et al.* (2024). *Projected health and economic effects of the increase in childhood obesity during the COVID-19 pandemic in England: the potential cost of inaction.* PLoS One **19(1)**, e0296013. doi: 10.1371/journal.pone.0296013
35. Ward ZJ, *et al.* (2017). *Simulation of growth trajectories of childhood obesity into adulthood.* New England Journal of Medicine **377(22),** 2145–53. doi: 10.1056/NEJMoa1703860
37. Dalrymple KV, *et al.* (2022). *Longitudinal dietary trajectories from preconception to mid-childhood in women and children in the Southampton Women's Survey and their relation to offspring adiposity: a group-based trajectory modelling approach.* International Journal of Obesity **46(4),** 758–66. doi: 10.1038/s41366-021-01047-2

UK Scientific Advisory Committee on Nutrition (SACN) report on Feeding Young Children aged 1–5 years

Professor Lucilla Poston, Professor of Maternal and Fetal Health in the Department of Women and Children's Health at King's College London, summarised the work carried out by SACN to collate evidence on young children's diets in the UK. The 2023 SACN report[38] was a comprehensive analysis of diet, weight and health at ages 1–5 years, including growth and body composition, and their links to adult health. Its conclusions were drawn mostly from systematic reviews and meta-analyses.

There are relatively few data available for the 1–5 age group. Key data sources include the Diet and Nutrition Survey for 12–18-month-olds, which dates back to 2011 (so may not reflect current diet), the National Diet and Nutrition Survey, which focuses on 18–60-month-olds and covers the period 2016/17–2018/19, and the ongoing National Child Measurement Programme.

At Reception age, 22.3% of children meet criteria for being overweight or obese; by Year 6, this reaches 37.8%. Consumption of sugar-sweetened beverages is associated with an increased risk of childhood overweight or obesity. Dietary surveys suggest that young children are consuming too much energy, saturated fats, free sugars and protein, and not enough fibre. Consumption of ultra-processed foods is common.

Multiple products are marketed specifically to young children and their parents. This includes follow-on formula milk, which has high sugar content and is not necessary for those beyond 1 year of age. The SACN report also concluded that semi-skimmed milk is suitable for children as young as 12–18 months.

Young children are consuming large quantities of sugars in fruit juice drinks, but consume fewer sugar-sweetened beverages than older children. The report made a range of recommendations on diet for young children, encouraging more consumption of water and milk (including semi-skimmed milk) and reduced consumption of products with free sugars, and no use of sugar-sweetened beverages.

38. UK Government (2023). SACN report: feeding young children aged 1 to 5 years. https://assets.publishing.service.gov.uk/media/662a4a4d690acb1c0ba7e616/SACN-Feeding-young-children-aged-1-to-5-full-report-revised.pdf

Case studies

To stimulate group discussion, three case studies examined specific issues in more depth.

The Reggio Emilia experience

Dr Paolo Georgi Rossi, Director of the Epidemiology Service at the Reggio Emilia Local Health Authority and Research Hospital (AUSL – IRCCS), discussed policies in the province of Reggio Emilia that are tackling child obesity.

Childhood obesity levels in the province of Reggio Emilia are moderate by Italian standards. They are being addressed through the BMInForma initiative, a multilevel public health programme that provides a platform for prevention research. For example, a trial of a family paediatrician-led motivational interview for parents of overweight children aged 4–7 years demonstrated an impact on girls (although effects waned over 2 years of follow-up).[39]

The families of overweight young girls are offered this intervention. Obese children are referred to a multidisciplinary team, including family paediatricians, dieticians and psychologists. This creates heavy demands on the multidisciplinary team. To increase its sustainability, a trial is evaluating a group intervention.

A synthesis of the evidence, including effects of health inequalities, combined with work on the many causes and mediators of obesity, fed into the Co-creation of Service Innovation in Europe (CoSIE) project. This took a more holistic view of a child's environment and, among other approaches, examined the role that a smartphone app for parents could play in facilitating healthier behaviours within a family. This project had a strong focus on co-creation with health professionals and community members.[40]

39. Broccoli S, *et al.* (2016). *Motivational interviewing to treat overweight children: 24-month follow-up of a randomized controlled trial.* Pediatrics **137(1).** doi: 10.1542/peds.2015-1979

40. Giorgi Rossi P, *et al.* (2020). *Describing the process and tools adopted to cocreate a smartphone app for obesity prevention in childhood: mixed method study.* JMIR mHealth and uHealth **8(6),** e16165. doi: 10.2196/16165

Children's physical activity

Professor Attilio Carraro, Professor of Sport and Exercise Sciences at the Faculty of Education of the Free University of Bozen-Bolzano (unibz), Italy, drew attention to physical activity as a way to counteract obesity.

There are three major independent factors related to people's habits and lifestyles: the amount of physical activity; low cardiovascular fitness; and sedentary behaviour. The WHO, several other international and national organisations, and governments have issued guidelines on physical activity levels, although these are rarely applied, particularly among adolescents and girls.

Physical activity levels and fitness correlate inversely with overweight or obesity. Both physical activity and fitness, particularly aerobic forms, showed a marked decline in recent decades, whereas sedentary behaviour increased, with significant differences across European countries.[41,42]

Systems-based approaches are needed to address the multiple factors that affect physical activity and sedentary behaviour. The International Society for Physical Activity and Health (ISPAH) has identified eight areas where policies have proved to be effective in different sectors to increase physical activity.[43]

41. G.R. Tomkinson; T.S. Olds (2007). Pediatric Fitness: Secular Trends and Geographic Variability. https://karger.com/books/book/2559/Pediatric-FitnessSecular-Trends-and-Geographic
42. FitBack (n.d.). https://www.fitbackeurope.eu/en-us/
43. ISPAH (n.d.) 8 investments. https://ispah.org/resources/key-resources/8-investments/

Can we prevent obesity from the first year of life? Evidence and policy implications

Professor Atul Singhal, Professor of Paediatric Nutrition at the UCL Institute of Child Health and Honorary Consultant Paediatrician at Great Ormond Street Hospital, London, UK, made the case for breastfeeding as an important protector against childhood obesity.

Systematic reviews have concluded that breastfeeding reduces the risk of obesity in offspring and into adulthood.[44] The effects are greatest for exclusive breastfeeding. Interventional studies aiming to promote breastfeeding show a modest effect of increased breastfeeding on risk of obesity.[45]

Breastfeeding may protect against a 'grow now, pay later' effect, whereby early overnutrition and faster growth in infancy has negative impacts on weight in later childhood and adulthood.[46] Trials have demonstrated that use of formula milk with a lower protein content is associated with slower infant growth and reduced risk of obesity.[47]

WHO has developed guidelines on promotion of breastfeeding to reduce the risk of obesity.[48] A systematic review of policy documents by the EarlyNutrition project found that the strongest evidence for metabolic disease prevention in later life was for breastfeeding.[49]

44. Zheng M, *et al.* (2024). *Breastfeeding and the longitudinal changes of body mass index in childhood and adulthood: a systematic review.* Advances in Nutrition **15(1),** 100152. doi: 10.1016/j.advnut.2023.100152
45. Giugliani ER, *et al.* (2015). *Effect of breastfeeding promotion interventions on child growth: a systematic review and meta-analysis.* Acta Paediatrica **104(467),** 20–9. doi: 10.1111/apa.13160
46. Doñate Carramiñana L, *et al.* (2024). *Rapid growth between 0 and 2 years old in healthy infants born at term and its relationship with later obesity: a systematic review and meta-analysis of evidence.* Nutrients **16(17),** 2939. doi: 10.3390/nu16172939
47. Totzauer M, *et al.* (2018). *Effect of lower versus higher protein content in infant formula through the first year on body composition from 1 to 6 years: follow-up of a randomized clinical trial.* Obesity (Silver Spring) **26(7),** 1203–10. doi: 10.1002/oby.22203
48. World Health Organization (2023). e-Library of Evidence for Nutrition Actions (eLENA). https://www.who.int/tools/elena/interventions/breastfeeding-childhood-obesity
49. Zalewski BM, *et al.* (2017). *Nutrition of infants and young children (one to three years) and its effect on later health: A systematic review of current recommendations (EarlyNutrition project).* Critical Reviews in Food Science and Nutrition **57(3)**, 489–500. doi: 10.1080/10408398.2014.888701

Key themes from discussions

Following these presentations, participants discussed key issues in breakout groups. Feedback from breakout groups highlighted several key themes:

Intervene early
Participants agreed that there was a need to intervene early to prevent weight gain becoming a health issue. The first 1000 days of life, including time spent in the womb, represent a critical period that strongly influences later childhood and adult health. Beyond the age of 5 years, addressing overweight or obesity becomes much more challenging.

Pregnant and breastfeeding women are a key group to engage to ensure healthy pregnancies and good early-life nutrition. Breastfeeding, when feasible for mothers, offers many health advantages, which likely include prevention of unhealthy weight gain (although not all studies demonstrate this effect). Participants strongly supported efforts to promote breastfeeding, particularly exclusive breastfeeding, for extended periods (the WHO and UNICEF recommend exclusive breastfeeding for the first 6 months of life and continued breastfeeding up to the age of 2 years or beyond). It is important to ensure that environments are supportive of breastfeeding, without stigmatising those who do not wish or are unable to breastfeed their babies.

The key goal is to establish and maintain a healthy developmental trajectory in infancy and beyond, reducing the risk of obesity and its comorbidities in childhood and into adulthood.

Take a systems approach
It was generally acknowledged that childhood obesity is a complex challenge, with multiple contributory factors. Evidence suggests that simple interventions targeting single behaviours are generally ineffective. When they do show positive impacts, they are dependent on the existence of an enabling environment. In the absence of 'magic bullets', participants highlighted the need for a **systems-based approach.**

There is much stronger evidence for the effectiveness of interventions targeting societal drivers of childhood obesity. Participants argued that priority should be given to creating an **enabling environment** that encourages consumption of healthier diets and greater physical activity, as well as other protective behaviours such as breastfeeding.

Participants identified the need for **multifaceted complex interventions** across multiple domains, particularly policy change, rather than simple interventions targeting single behaviours. In addition, it was noted that interventions are delivered within a **complex system,** creating the potential for a wide range of intended and unintended consequences. There is therefore a need to track multiple metabolic, psychological, behavioural and social outcomes, not just weight/BMI.

Look for cross-sectoral solutions
Given the many influences on weight, participants suggested that **actions spanning multiple sectors** are required, including food policy, formal and non-formal education, urban planning, and transport policy, to create an enabling environment. It is important that policy interventions **reinforce rather than conflict** with one another. For example, policies to increase active transport, such as encouraging children to walk to school, will be dependent on supportive urban planning and transport policies.

Participants also highlighted the importance of looking for **synergies and co-benefits** – policies that deliver 'win–wins' in different areas. For example, interventions that support walking and cycling can also lead to improved air quality through lower vehicle use, and deliver sustainability and climate gains through reduced greenhouse gas emissions.

The meeting also noted the need to consider **health inequities** and the potential for interventions to have differential effects on particular socioeconomic, ethnic or other groups. Indeed, obesity-targeting interventions may be a lever to address the widening gap between the highest and lowest socioeconomic settings, helping to break the vicious cycle between obesity and lower socioeconomic advancement. This will require careful attention to intervention design, since current interventions tend to have more impact among those in higher socioeconomic groups, which risks exacerbating inequalities.

Participants argued for a **robust approach to food policymaking,** recognising the major impact that unhealthy diets are having on child health. Legislation was felt to be more effective than voluntary agreements, with good evidence existing on the positive effects of taxation of unhealthy products and the potential to subsidise healthier options. Manufactured foods targeted at young children and their parents were seen to be mostly unnecessary, and in some cases positively harmful, particularly formula milk for older infants and sugar-sweetened beverages at any age.

The importance of engaging the food industry and manufacturers was emphasised to highlight the health consequences of current dietary habits and the evidence regarding the relative effectiveness of interventions targeting activity or diet. The food industry has attempted to focus attention on physical activity as a route to healthier childhoods. While this is an important aspect, the evidence indicates that childhood obesity challenges will not be solved without a strong focus on diet.

One key challenge is that unhealthy food products are highly appealing and convenient. Similarly, physical activity options available to children may not be attractive to all. For example, not all children are interested in competitive sport in schools. Providing a range of options and creating environments that offer multiple opportunities for active play and exercise can enable children to find a physical activity that best suits them.

Participants highlighted the need to work with the public and patients to inform policymaking and the design of interventions – targeting diet and/or physical activity – to increase the likelihood of widespread adoption and to ensure accessibility.

Refine messaging to mobilise support

Participants suggested that more attention should be given to **communication around childhood obesity.** Childhood overweight or obesity is seen as undesirable primarily because of their health consequences, particularly later in life. Framing the issue as one relating to health, rather than, say, conforming to social norms or aesthetics, could help to strengthen support for action. For families, goals would then focus on the benefits of health gain rather than just weight loss for its own sake.

A challenge for research is to understand better what is motivating for the public and people living with obesity, so that messaging and communication campaigns can be designed more effectively. The role of healthcare and social care workers in communication also needs to be considered, so they are better equipped to engage with the public to encourage and facilitate behaviour change.

Importantly, participants noted that communication activities run the risk of stigmatisation and counterproductive psychological impacts. In the current environment, maintaining a healthy weight is difficult, yet being overweight may be perceived as a character flaw or create a sense of failure. This reinforces the need to embed messaging within a public health rather than an obesity strategy.

Healthcare professionals are generally well trusted and ideally positioned to communicate around weight optimisation, although it is recognised that this can be a difficult issue to raise with people living with obesity and families in settings such as family care. It is also important to consider other channels of communication and mediators, including 'communication brokers' who have particular influence with young people. With many young people now spending more time online and using social media, engaging with groups such as influencers and social media content creators may be important to address misinformation and harmful communications, to mediate communication of reliable public health information, and to advise on communication strategies.

Public health messaging can be a challenging field. Issues were brought to the fore during the COVID-19 pandemic, when public support for social interventions and vaccination was important and antagonistic messaging was also being generated. Lessons could be learned from the approaches to communication that were taken at the time and were (or were not) successful.

It was also suggested that the co-benefits argument could reinforce public messaging around obesity. For example, arguments relating to the climate benefits of dietary change and active transport could particularly resonate with young people and encourage behaviour change.

Strengthen research and researcher–policymaker engagement

Researchers have a key role to play in closing remaining knowledge gaps. Cohort studies are still required to generate a deeper understanding of the causal chain through which biological and environmental influences predispose to childhood obesity, and the pathways from obesity to the multitude of resulting health issues. Novel data linkages are needed to explore social and environmental exposures and impacts. Interventional studies are still required to assess complex interventions and to gain mechanistic insights. Innovative study designs may be needed to take account of the complex systems in which interventions are typically situated.

Although convenient, BMI was considered by participants to be an imperfect and crude metric. Further research is needed to evaluate other potential markers, including those that are more directly linked to adiposity and fat distribution. Early predictors of later health problems would also be valuable to detect those at risk and as biomarkers to assess the effects of interventions.

Participants also noted that further work was needed on policy interventions, such as pilot studies, evaluations of new policy initiatives, and investigation of 'natural experiments'. Such studies should be broad in scope to explore a range of outcomes, and ideally with integrated health economic analyses. The cost of inaction should also be assessed when costs and benefits of policy options are evaluated.

It was emphasised that researchers needed to work closely with policymakers to understand their needs and priority questions, and how best to communicate the latest evidence. Participants stressed the need to present clear and straightforward messages to policymakers, acknowledging but not overplaying uncertainties.

It was also suggested that researchers should be opportunistic and identify 'teachable moments' when policymakers might be most open to dialogue with researchers and receptive to the latest evidence.

Progress could also be accelerated by fostering political consensus around the childhood obesity crisis and the kind of measures required to address it. This could help to establish a stable policy environment able to achieve long-term systemic change.

Conclusions

The prevalence of childhood overweight and obesity are alarmingly high in the UK and Italy, as they are in most high-income countries and increasingly in low- and middle-income countries. As well as the immediate issues this presents, it also has profound implications for future health, with today's children at increased risk of a host of chronic diseases in adulthood, if current trends are not reversed. People living with obesity are also more vulnerable to emerging health threats, such as pandemics and climate change. Of particular concern is the disproportionate increase in obesity in deprived settings.

The high prevalence of childhood overweight or obesity in the uk is contributing to the wider concern about declining child health and wellbeing and the consequences for future population health and economic prosperity, as outlined in a recent Academy of Medical Sciences report.[50] Poor health is an economic double whammy – increasing treatment costs and leading to lost productivity, affecting both individuals and wider society.

Although many uncertainties remain, there is already much evidence to guide policymaking, and clear evidence about the likely consequences of inaction. It is abundantly clear that single, simple interventions are highly unlikely to deliver the impact needed. Rather, progress is likely to depend on the cumulative effect of multiple changes, across many aspects of life, that collectively reinforce one another and create an environment that promotes and facilitates healthier development.

This requires a coordinated intersectoral approach and will be dependent on political will to prioritise child health and to drive through changes that will require cooperation across different areas of government and address powerful vested interests.

Health systems are overstretched, and questions have been raised about their long-term sustainability in the face of ever-growing demand.[51] Preventive approaches are increasingly seen as crucial to sustainability, and action to address early-life obesity should be top of the list of 'best buy' preventive strategies. Furthermore, many actions with the potential to reduce obesity could have other benefits, such as better air quality and reduced greenhouse gas emissions through urban planning, which would also help to improve people's health and make them even more cost-effective.

50. The Academy of Medical Sciences (2024). *Prioritising early childhood to promote the nation's health, wellbeing and prosperity.* https://acmedsci.ac.uk/policy/policy-projects/child-health

51. UK Parliament (2017). Select Committee on the Long-term Sustainability of the NHS. The Long-term Sustainability of the NHS and Adult Social Care. https://publications.parliament.uk/pa/ld201617/ldselect/ldnhssus/151/15102.htm

Annexe 1

Participants in the policy meeting

1. **Dr Francesco Branca,** Director of the Department of Nutrition and Food Safety, World Health Organization
2. **Professor Kathleen Boyd,** Professor of Health Economics, Director of Research (Health Economics & Health Technology Assessment), University of Glasgow, United Kingdom
3. **Professor Giovanni Capelli,** Director of the National Center for Disease Prevention and Health Promotion, Italian National Institute of Health (ISS), Italy
4. **Professor Hellas Cena,** Pro-Rector of the Third Mission of the University of Pavia, Head of the Clinical Nutrition and Dietetics Service, University of Pavia, Italy
5. **Professor Attilio Carraro,** Professor of Sport Pedagogy, Free University of Bozen-Bolzano, Italy
6. **Professor John Deanfield,** Professor of Cardiology, University College London, United Kingdom
7. **Dr Nathalie Farpour-Lambert,** Head of the Global Obesity Program, Geneva University Hospital, Switzerland
8. **Dr Stuart W Flint,** Associate Professor of the Psychology of Obesity, University of Leeds, United Kingdom
9. **Professor Mark Hanson,** Emeritus Professor of Human Development and Health and British Heart Foundation Professor, University of Southampton, United Kingdom
10. **Professor Simon Kenny OBE,** National Clinical Director for Children & Young People, NHS England, United Kingdom
11. **Professor Diana Kuh FMedSci,** Professor of Life Course Epidemiology, University College London, United Kingdom
12. **Professor Catherine Law CBE FMedSci,** Professor of Public Health and Epidemiology and a Vice Dean for Research in the Faculty of Population Health Sciences, University College London, United Kingdom
13. **Dr Tim Lobstein,** Policy Director, World Obesity Federation
14. **Professor Melania Manco,** Full Professor of Paediatrics and Associate Professor of Endocrinology, Directorate of the Bambino Gesù Children's Hospital, Italy
15. **Professor Neena Modi FMedSci,** Professor of Neonatal Medicine and Vice-Dean (International) in the Faculty of Medicine, Imperial College London, United Kingdom
16. **Professor Susan Ozanne FMedSci,** Head of the Department of Clinical Biochemistry and Professor of Developmental Endocrinology, University of Cambridge, United Kingdom
17. **Professor Carlo Patrono,** Adjunct Professor of Pharmacology, Catholic University School of Medicine in Rome, Italy
18. **Professor Lucilla Poston CBE FMedSci,** Professor of Maternal & Foetal Health, King's College London, United Kingdom
19. **Professor Rebecca Reynolds FMedSci,** Professor of Metabolic Medicine, University of Edinburgh, United Kingdom
20. **Dr Paolo Giorgi Rossi,** Director of the Epidemiology Unit, Azienda USL-IRCCS di Reggio Emilia, Italy

21. **Professor Franco Sassi,** Professor of International Health Policy and Economics, Imperial College London, United Kingdom
22. **Professor Stefano Schiaffino,** Professor Emeritus of General Pathology, Veneto Institute of Molecular Medicine (VIMM), Italy
23. **Dr Marco Silano,** Director of the Department of Cardiovascular, Endocrine-Metabolic and Aging Diseases, Istituto Superiore di Sanità (ISS), Italy
24. **Professor Judith Stephenson,** Margaret Pyke Chair of Sexual & Reproductive Health, University College London, United Kingdom
25. **Professor Tom Solomon CBE FMedSci,** Vice President International, The Academy of Medical Sciences and Director of The Pandemic Institute, United Kingdom
26. **Professor Atul Singhal,** Professor of Paediatric Nutrition, University College London, United Kingdom
27. **Professor Paolo Vineis,** Chair in Environmental Epidemiology, Imperial College London, United Kingdom

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Opinions expressed in this report do not necessarily represent the views of all participants at the event, the Academy of Medical Sciences, The Accademia Nazionale dei Lincei, or its Fellows.

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