ECONOMIST IMPACT

The science of obesity

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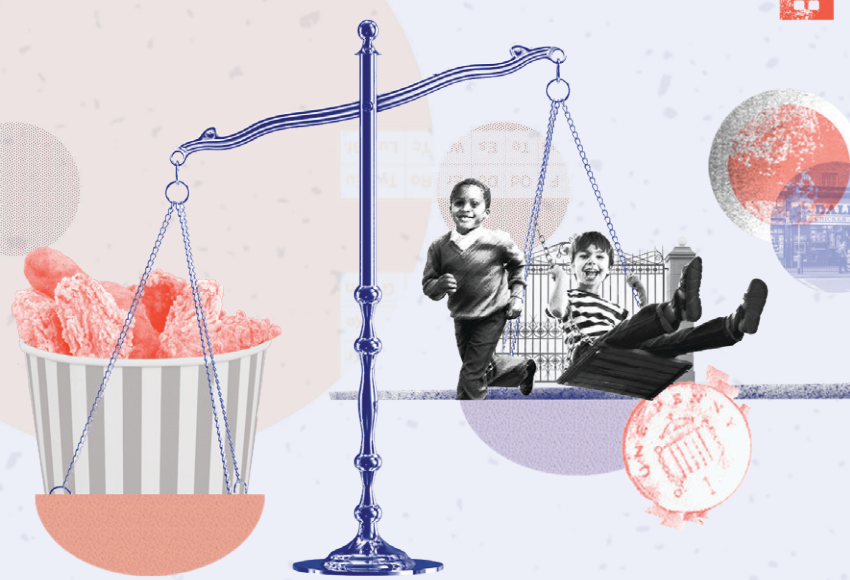

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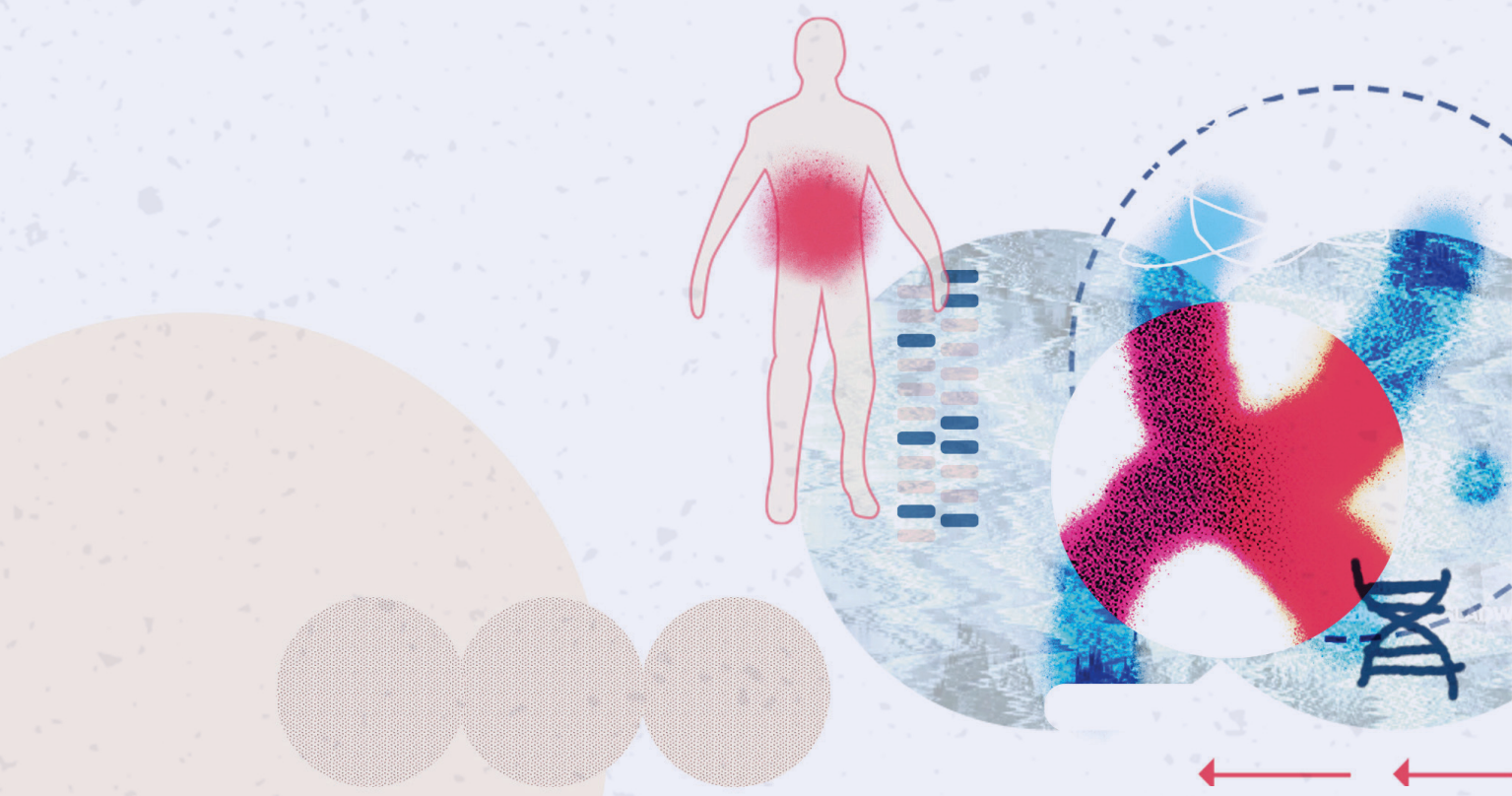


Obesity is a truly global challenge, with rising prevalence across all regions in the world. In the Science of Obesity series, we explore common misconceptions around obesity and show how an all-of-society approach is necessary to prevent and manage this complex and chronic disease.

This booklet is a collection of four written articles that explain the key underlying drivers of obesity and address misconceptions. The series also contains two videos and two audio articles, further exploring these themes.

Science of obesity booklet contents:

1 What is obesity and why does it matter?

What is obesity?

In 2020, nearly 1 billion people around the world were living with obesity.[1] There are no signs that rates are stabilising in any country, let alone falling. The World Obesity Federation estimates that **by 2035 this figure will continue to rise, with half of the world's population living with overweight or obesity (Figure 3).**[1]

Most worrying is the number of children and adolescents with obesity, as this is likely to continue into adulthood. Whereas in 1975 less than 1% of all children aged 5-19 were affected by obesity, that figure is now 8-10% and is predicted to rise to 18-20% by 2035.[1, 2] Obesity levels rose more quickly than predicted during the covid-19 pandemic, especially in children under five years old.[3]

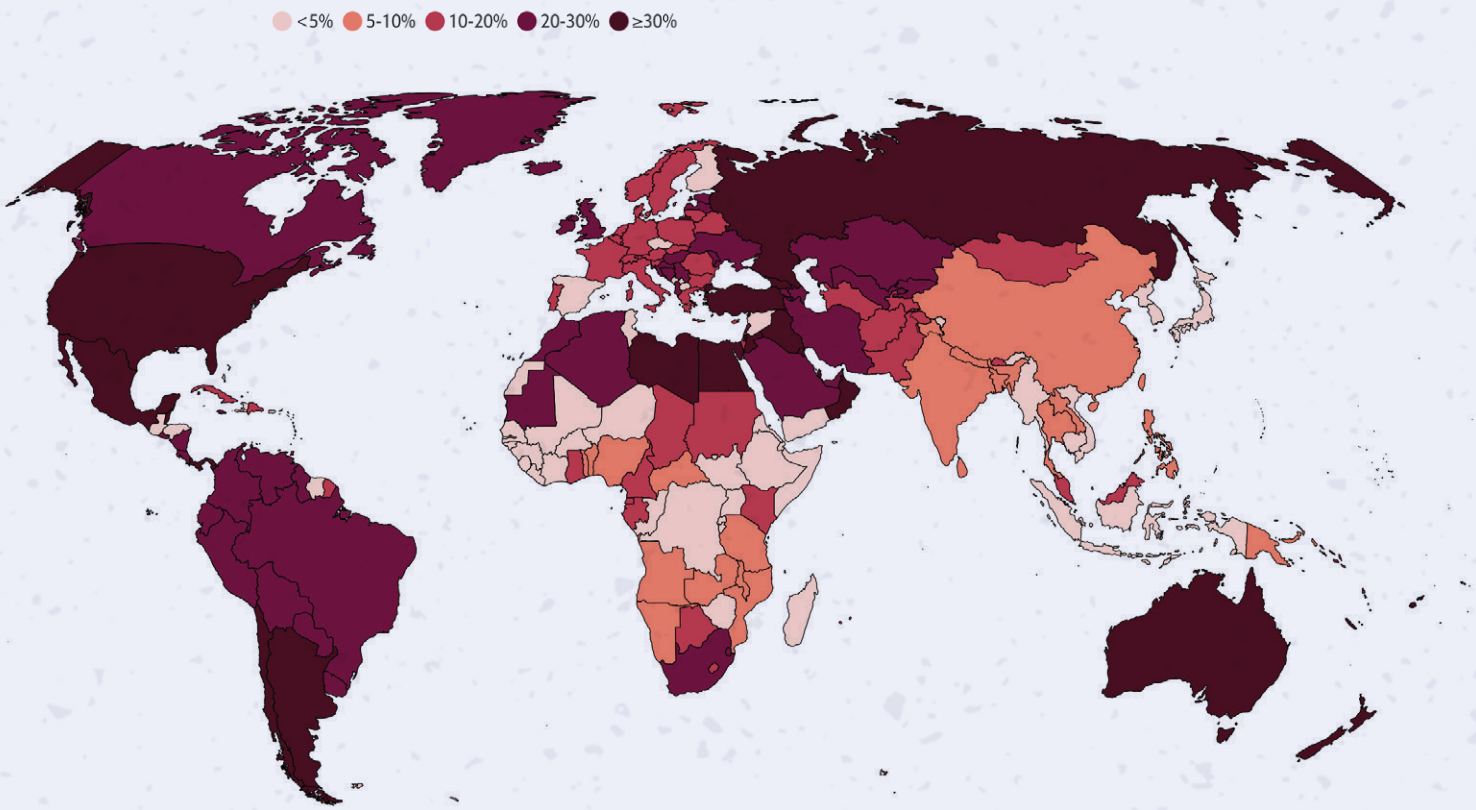
> **"There is no country in the world in which obesity is not a significant problem."**
>
> Professor Arya Sharma, Founder of Obesity Canada

Obesity definition

Obesity is defined by excessive fat that can impair health.[4] It is a complex disease resulting from a combination of genetic, social, psychological and environmental factors. According to European guidelines, obesity is crudely measured using a body mass index (BMI, derived from an individual's mass and height) greater than or equal to 30 kg/m^2 in adults. Lower BMI cut-off points of 27.5 kg/ m^2 apply to some ethnic groups (such as South Asian and Middle Eastern populations). In children under the age of five, obesity is weight-for-height greater than 3 standard deviations above the World Health Organisation (WHO) Child Growth Standards median.[4] For children aged 5-19, it is 2 standard deviations above the WHO Growth Reference median.[4]

The WHO has classified obesity as a chronic disease.[4] It is now considered to be an epidemic with multiple, complex causes including inequalities and social determinants of health, and is not simply due to an individual's lack of willpower.[4]

Figure 1: Estimates of obesity prevalence in adults (BMI≥30 kg/m^2) [5]



Why does obesity matter?

The burden of obesity for an individual is immense. Overweight and obesity account for more than 1.3m deaths globally each year and are linked to more deaths worldwide than underweight.[6,7] **Obesity is directly linked to at least 38 noncommunicable diseases (NCDs)** including diabetes, hypertension, cardiovascular disease, chronic kidney disease, metabolic dysfunction associated fatty liver disease, osteoarthritis, depression and 13 types of cancer.[8] These conditions are often interlinked, increasing the risk of simple multimorbidity (two conditions) and complex multimorbidity (four or more conditions), with higher risks for people with more severe obesity.[8] Indeed, after increasing age, obesity is the second predictor of covid-19 complications or mortality.[9] Having multiple conditions reduces individuals' quality of life and puts a strain on healthcare resources.

Childhood obesity is linked to lower self-esteem, poorer school performance, bullying and poorer health, including metabolic disorders such as type 2 diabetes.[10] In 2021 around 41,600 new cases of type 2 diabetes were diagnosed in children and adolescents worldwide.[11] This is particularly alarming because type 2 diabetes is preventable and leads to earlier complications when it develops in childhood.[12]

The World Obesity Federation predicts that the continuing rise in overweight and obesity is likely to cost at least US$4.3trn by 2035 in terms of global direct healthcare costs (treatment costs for obesity and associated diseases) and indirectly through lost employment, early retirement and premature death.[1] **There are clear individual, social and economic cases for investing in obesity prevention and management today to reduce these future costs.**

"In the last 30 years, we've seen obesity rates skyrocket. We are truly facing a public health crisis.

Dr David Sarwer, Director for Obesity Research and Education, Temple University

What are the misconceptions around obesity?

The traditional view that obesity is due to lack of individual responsibility needs to be dispelled, as it does not take into account the many physiological, biological, genetic, social, cultural and environmental factors that may affect someone's risk of developing obesity. This inaccurate and simplistic view is also stigmatising, leading to discrimination.[13, 14]

For instance, globally our environment is becoming increasingly obesogenic—in other words, more and more it facilitates obesity.[15] Advertising and marketing have influenced social and cultural norms around food and drink in many societies, including by normalising fast-food consumption and promoting the consumption of unhealthy foods. Technological and digital advances have led to more sedentary jobs and pastimes. We explore the role of these broader social determinants of health in impacting obesity in a separate article in the Science of Obesity series.

Interventions that are aimed at supporting individuals to change their diet and increase physical activity tend to follow a pattern of weight loss, plateau then progressive weight regain.[15, 16] One reason for this is that hormonal changes that influence appetite regulation occur in the body as a defence mechanism, making further weight loss more difficult.[15, 16] We explore the role that biology plays in influencing obesity outcomes in another article within this series. Encouraging people living with obesity to focus on making sustainable, positive changes to their diet quality and physical activity whilst seeking guidance and support from healthcare professionals can be more beneficial and motivating than focusing solely on weight loss as an indicator of "success" or "failure".[13, 15]Also, as one study puts it, "long-term benefits require long-term attention", so people living with obesity who are making such lifestyle changes require sustained support.[15] All people living with obesity also require access to obesity prevention and management services.[17]

"Our behaviour is so strongly influenced by these external environmental variables that are beyond our control."

Dr David Sarwer, Director for Obesity Research and Education, Temple University

A common misconception is that reducing one's caloric intake and becoming more active is a "one size fits all" solution for treating obesity. However, the reality of the matter is that there is substantial evidence showing that obesity is influenced by various drivers that lie outside of an individual's control. For instance, on a biological level, the body's innate physiological response can play a significant role in defending against weight loss. On a broader societal level, environmental factors such as a lack of access to affordable healthy food options or limited opportunity to safely and affordably engage in physical activities can influence obesity outcomes.[18] **Policy interventions must recognise the role of factors outside of an individual's control if they are to effectively address obesity rates.**

What has been done so far and why hasn't it worked?

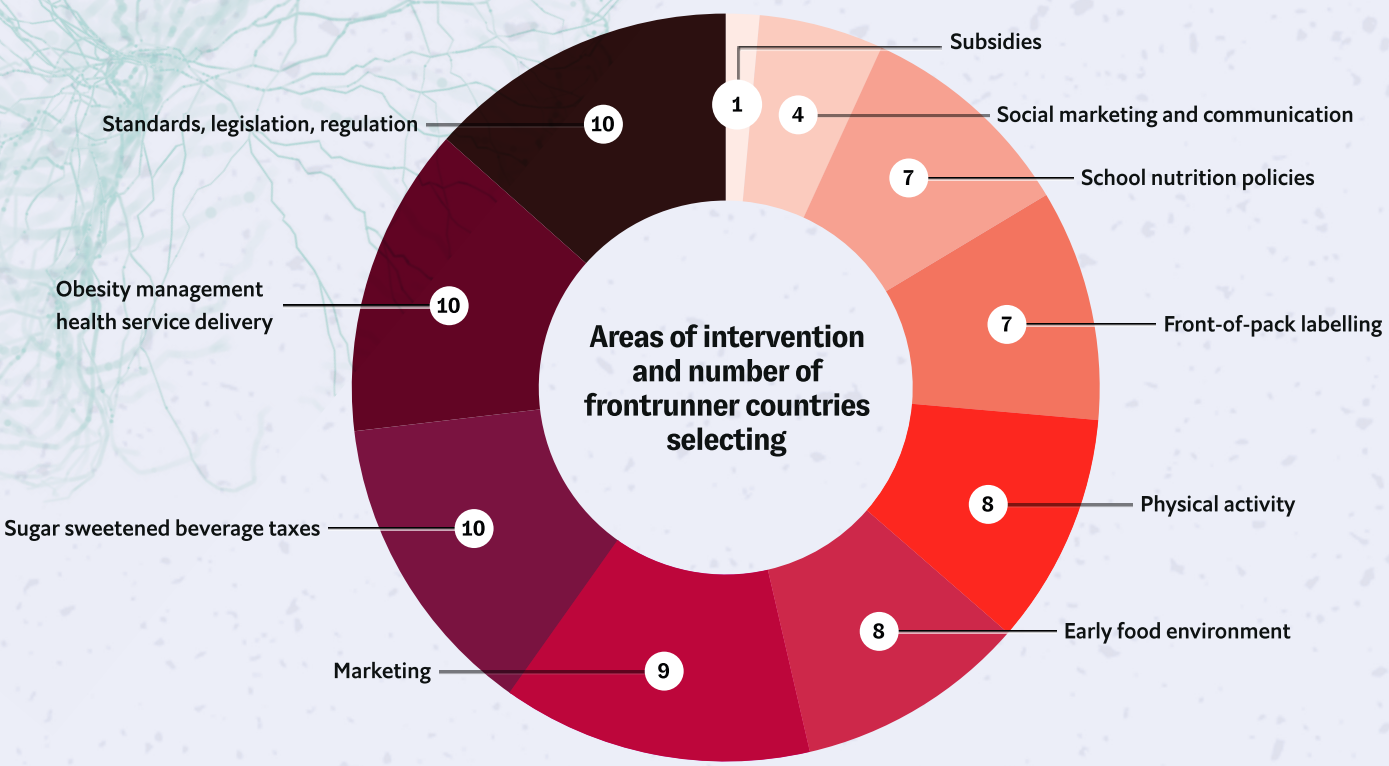
The WHO officially recognised obesity as a global epidemic in 1997.[19] **Efforts since then could be described as well-intended but inadequate at a national and global level.** No country is on track to meet the two Sustainable Development Goals most relevant to obesity—reducing premature mortality from NCDs by a third and ending malnutrition (wasting and overweight) in children under 5 by 2030.[4] **Without tackling obesity, these targets will not be met.**[4] One explanation for why these efforts may not have worked so far is because they fail to address the key societal and cultural factors that determine food choices and activity levels, says Arya Sharma, professor of medicine at the University of Alberta, Canada.

The WHO Acceleration Plan to Stop Obesity focuses on supporting 28 countries across the six WHO regions to adopt a range of evidence-based, multi-sectoral strategies.[4] The idea is to share learnings, refine interventions and roll them out to other, comparable countries. However, only a handful of the proposed policy interventions have been prioritised by these countries in their obesity plans so far (Figure 2).

"But what is stopping us from effectively treating obesity as a chronic disease? One is certainly cost, the other is the ideology that obesity is largely under a person's control and only requires some will-power to overcome."

Professor Arya Sharma, Founder of Obesity Canada

Figure 2: Number of frontrunner countries prioritising each obesity intervention category identified by the WHO[4]



In 2023 the WHO launched a new framework for the health system component of the Acceleration Plan to Stop Obesity that highlights the need for management of obesity as a chronic disease that requires sustainable universal health coverage for obesity management before comorbidities occur.[17]

To advance obesity primary prevention efforts, UNICEF advocates for an integrated, whole-systems approach based on:[20]

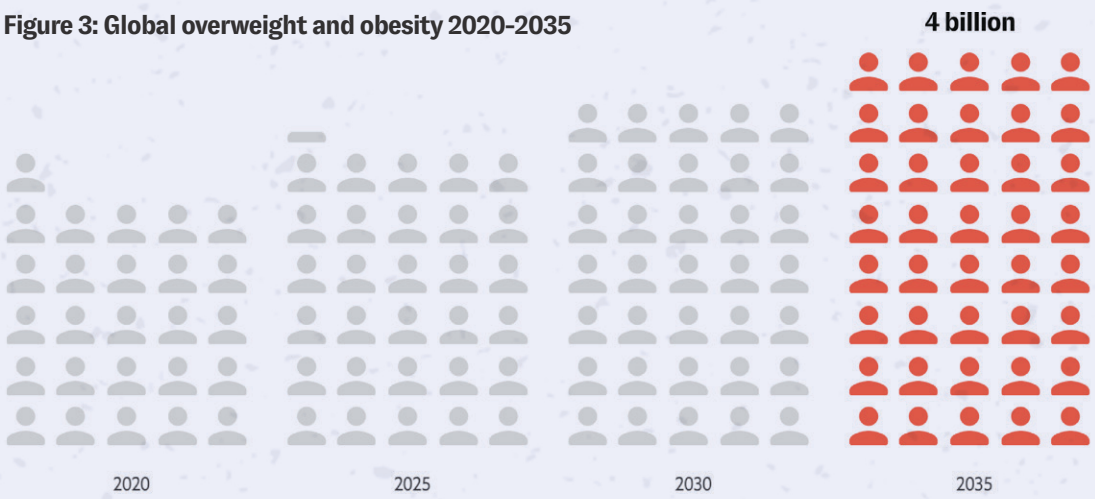
- promoting healthy diets for children and adolescents through clearer messaging and education, plus access to healthier food at school, home and in the community;
- regulating the food and beverage industry to restrict marketing unhealthy foods to children and require clear front-of-packaging labelling and sugar taxation;
- promoting physical activity in the school curriculum, as well as better urban design and transport infrastructure.

The question remains, why are interventions that are evidence-based, impactful and cost-effective not being implemented? "**The solution to the obesity epidemic is political will, a plan of action and the resources and commitment to deliver," says the WHO.** However, the poor uptake of evidence-based policy interventions suggests that further action is needed, even in countries considered global frontrunners in addressing obesity.[4]

"This is not an area where there is one single thing that will solve it. It is an area where a whole set of approaches need to happen in concert."

Dr Sara Bleich, Professor of Public Health Policy, Harvard University

Figure 3: Global overweight and obesity 2020-2035



Source: https://data.worldobesity.org/publications/WOF-Obesity-Atlas-V5.pdf

What do we need to do next?

Obesity-related policy would support progress towards 13 out of the 17 Sustainable Development Goals, including those relating to health, climate change, sustainability, equality and poverty.[21] However, progress towards advancing obesity prevention and management will require strong and sustained political commitment.

“There’s often not the political will to implement evidence-based policies that are going to make a difference.”

Dr Sara Bleich, Professor of Public Health Policy, Harvard University

- No single sector or actor alone can address the obesity challenge. In order to halt rising obesity rates globally, obesity management and prevention cannot continue to be the sole responsibility of health ministries. Rather, a coordinated approach involving multi-sectoral engagement and action will be necessary to achieve meaningful reductions in obesity rates.
- The impacts of obesity are felt by society at large, so we all share a joint responsibility to tackle this issue. The downstream societal impacts of tackling the obesity epidemic cannot be understated. Reimagining obesity-related policy interventions as an investment to reduce the predicted US$4.3trn costs of obesity, rather than seeing them as a cost today, would also help to achieve necessary political buy-in and long-term, sustained commitment.[1, 4, 20]
- There is a pressing need to correct the pervasive misconception that obesity is a matter of individual responsibility. Doing so would enable us to address obesity in a way that is effective and sustainable for individuals, societies and the planet. There is no quick or easy answer, but the world cannot afford not to act through a combination of policy, education and healthcare improvements.
- Given the complex drivers of obesity and its broad impacts, it is clear that prioritising a whole-of-government and whole-of-society response will be needed to reverse rising obesity rates because obesity impacts the whole of society.

“We have exhausted personal responsibility. We need to change the global food environment.”

Dr Uku Vainik, Associate Professor, Institute of Genomics, University of Tartu

Overweight and obesity is likely to cost at least

$4.3 trillion

by 2035 in terms of global direct healthcare costs

Source: https://www.worldobesity.org/resources/resource-library/world-obesity-atlas-2023'

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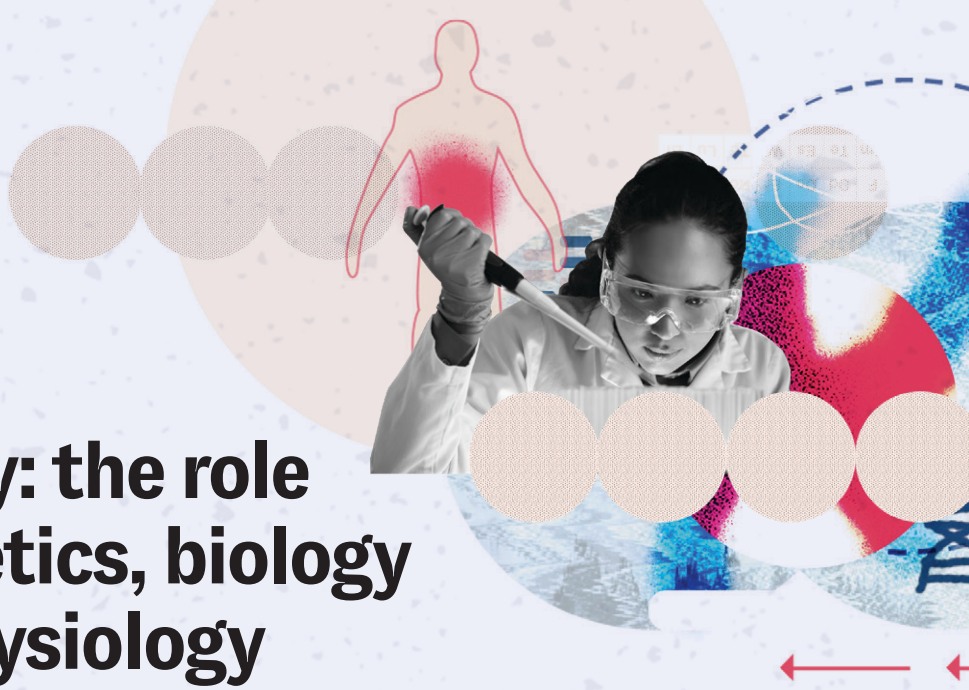


2 Obesity: the role of genetics, biology and physiology

How is food intake regulated?

The human brain and body has evolved a finely tuned system to balance energy intake and expenditure (and, ultimately, body weight) to enable us to deal with disease, feast or famine. In this article, we explore this system to understand the implications for how and why people develop obesity.

This complex, dynamic system consists of three systems that work together:[1]

- **The homeostatic system**—we are not consciously aware of the brain processing hormonal and nerve feedback from organs such as the stomach and gut that regulates our energy intake and expenditure. This feedback stimulates chemical pathways in the brain, making us feel hungry or full, and affects our metabolism. These processes are also linked to the hedonic system.
- **The hedonic system**—this system is largely unconscious. Our senses (smell, sight, texture, hearing and taste) stimulate the brain to release chemicals such as dopamine that are linked to pleasure.
- **Executive function (cognitive decisions)**—executive function is where conscious decisions are made. Theoretically we are able to override our natural hunger or desire to eat certain foods, but it takes a constant effort to counter the underlying biological processes of the homeostatic and hedonic systems.[2]

Problems and disruptions in any of these three systems can make people more likely to develop obesity. The way that these systems work together is explained in Figure 1.

Figure 1: How food intake affects our brain (Adapted from Campos et al. 2022)[1]

Homeostatic system

Gut hormones and nerves signal fat cells to release leptin, helping regulate the body's energy balance.

Hedonic system

Before and during eating, senses trigger pleasure and reward

Executive function

Conscious cognitive brain areas

How are our genetics linked to these systems?

There are over 1,000 gene variants associated with obesity.[3] Each variant has a small effect, but they add up when a person has several of them, predisposing that individual to obesity (polygenic obesity).[3] It is rare that someone has a single genetic defect that affects a key hormone within the homeostatic system, causing obesity—only around 5% of people with obesity have this type of "monogenic obesity".[3]

However, genetics does not fully explain the rise in obesity over the past 40 years, a period that is too short for genetic mutations to have evolved across populations, neither does it explain variation across different socioeconomic groups. What has changed is our sociocultural and food environment.[4] Research has shown that high-fat diets can disrupt both the hedonic and homeostatic systems, highlighting how the biology of our bodies is affected by the environment that we live in.[5]

"You can try and trick the hedonic system, but you can't give up food."

Professor Arya Sharma,
Founder of Obesity Canada

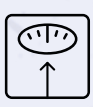
"There are differences in genetic predisposition. If I expose people to the exact same diet and exact same level of physical activity, some people will gain weight and some won't."

Professor Arya Sharma, Founder of Obesity Canada

Can we influence our genetic make-up?

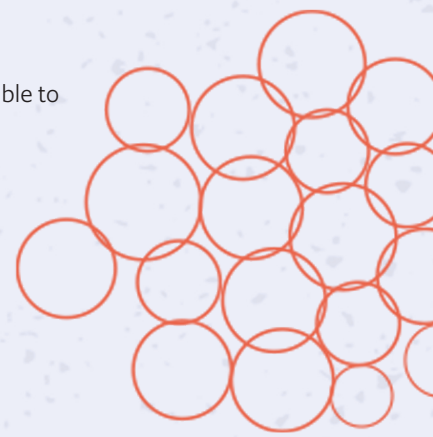
When multiple genetic variants combine to make an individual more susceptible to obesity, they can cause metabolic changes that:[6]

conserve energy, burning fewer calories



increase the tendency to store fat

reduce the ability to burn fat for energy



Although we cannot change our genes, we can influence the level of "gene expression"—the way your body reads and uses the gene sequence—termed "epigenetics". For example, eating a high-fat diet can change the function of the finely tuned pathways in the homeostatic system in as little as a week.[5] However, we can also positively influence gene expression in fat cells, skeletal muscle and the liver through exercise.[7] So although genetics affect our predisposition to developing obesity, it is not an unavoidable certainty.

Why it isn't as easy as fewer calories in, and more calories out

Though it is easy to think of obesity as the outcome of an imbalance between energy consumption and expenditure, it is not so simple. Our individual biology, genetics and our environment interact to influence our weight (see Figure 2).[8]

Our basal metabolic rate—the calories that a person's body needs for basic functions—is determined by our body weight, gender, age and genetics.[8] This is largely beyond voluntary control. One famous study saw 16 people fed an excess of 1,000 calories per

"We see individuals who have a genetic predisposition to obesity, where the disease goes back generations."

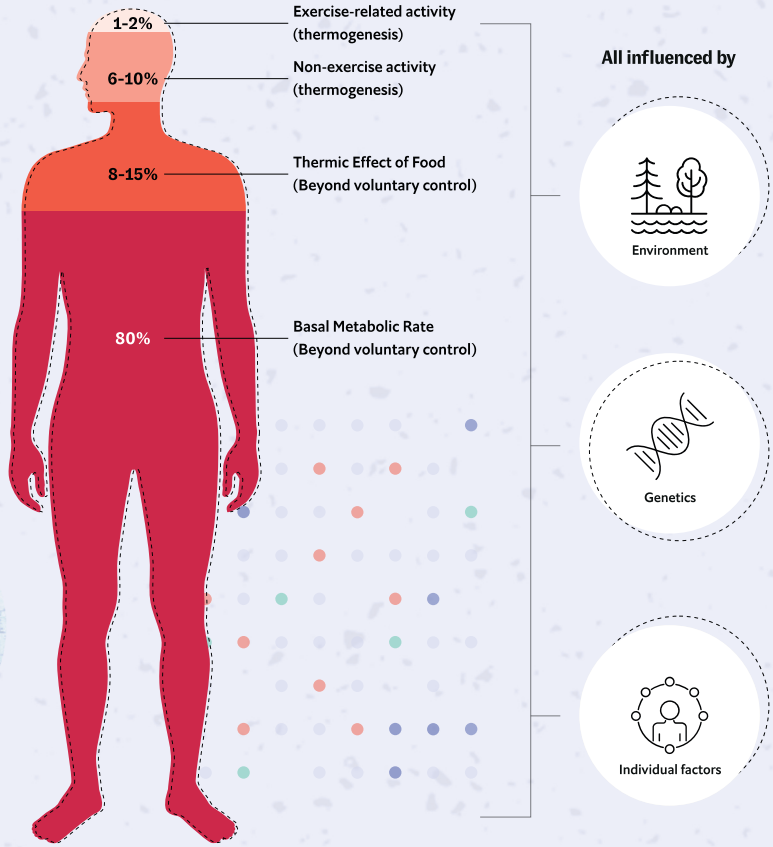
Dr David Sarwer, Director for Obesity Research and Education, Temple University

day—by the end of eight weeks some had gained 4kg whilst others only gained 0.5kg, highlighting how differently their bodies responded to the same conditions.[9]

Weight management is challenging because the body's systems change in response to our weight. Weight loss is difficult to sustain because the body perceives famine, and its systems compensate in terms of how it uses energy to "protect" us, making it easy to regain weight.[4] Whereas when we gain weight our metabolic needs increase, so our homeostatic system sends chemical signals telling us to eat more. We then get used to this increase in consumption and so the cycle continues. There is also some evidence that losing weight causes changes to the chemical signals in our body associated with appetite—for example, increases in feelings of hunger that do not return to pre-weight-loss levels even after a year.[10]

Figure 2 shows the different influences on our energy expenditure and highlights how daily activity throughout the day has a greater effect than exercise.[8] Hence, sedentary jobs have a big impact on weight management because they keep us still for long periods when we might otherwise be moving.

Figure 2: Influences on energy expenditure (Adapted from von Loeffelholz et al. 2022)[11]



*Thermic effect of food refers to the increase in metabolic rate that occurs after a meal. The basal metabolic rate is the metabolic rate during rest, while the person is awake.

"We still have a tremendous amount of work to do to re-design our environment in a way that promotes health and sustained weight control over time."

Dr David Sarwer, Director for Obesity Research and Education

What is the physiological impact of obesity?

Obesity is not just excess body weight—the World Health Organisation (WHO) defines it as a "chronic complex disease defined by excessive adiposity [body fat] that can impair health", and the World Obesity Federation characterises it as a "chronic relapsing disease process".[4, 12] Storing fat is a normal part of a healthy body's function; issues arise when there is excess body fat. When we have excess fat, the fat cells become enlarged and accumulate around organs, causing inflammation and hormonal imbalances, which contribute to a host of chronic conditions.[4, 13]

These physiological changes can lead to the body becoming resistant to insulin and the individual developing type 2 diabetes.[4, 14] In addition, inflammation and high cholesterol in the blood stream contribute to the development of cardiovascular diseases.[4] Obesity can also result in mechanical issues in the body, such as back pain, osteoarthritis and sleep apnoea.[7] Figure 3 maps out how some of the physical impacts of obesity can lead to other conditions.[4]

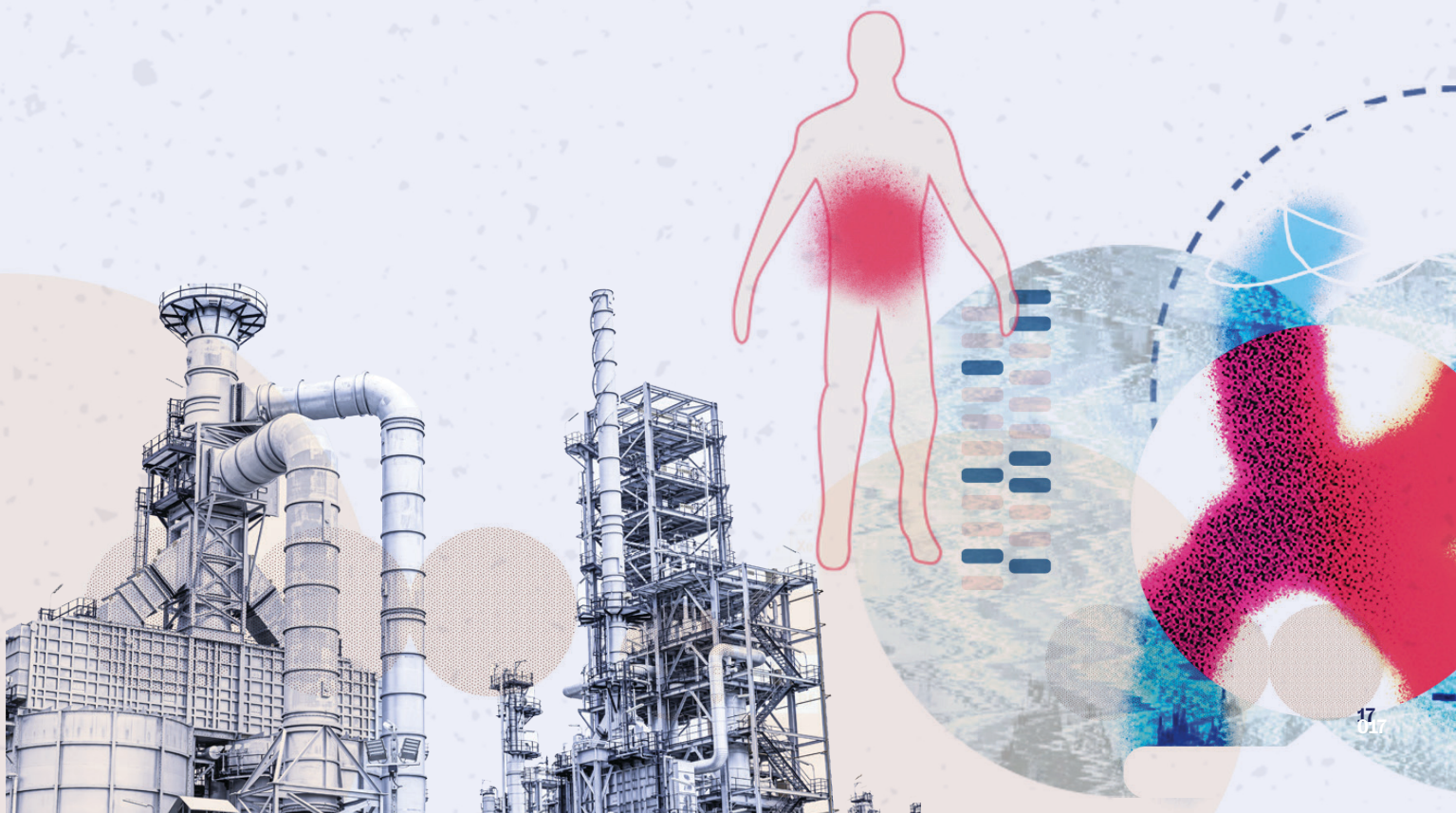
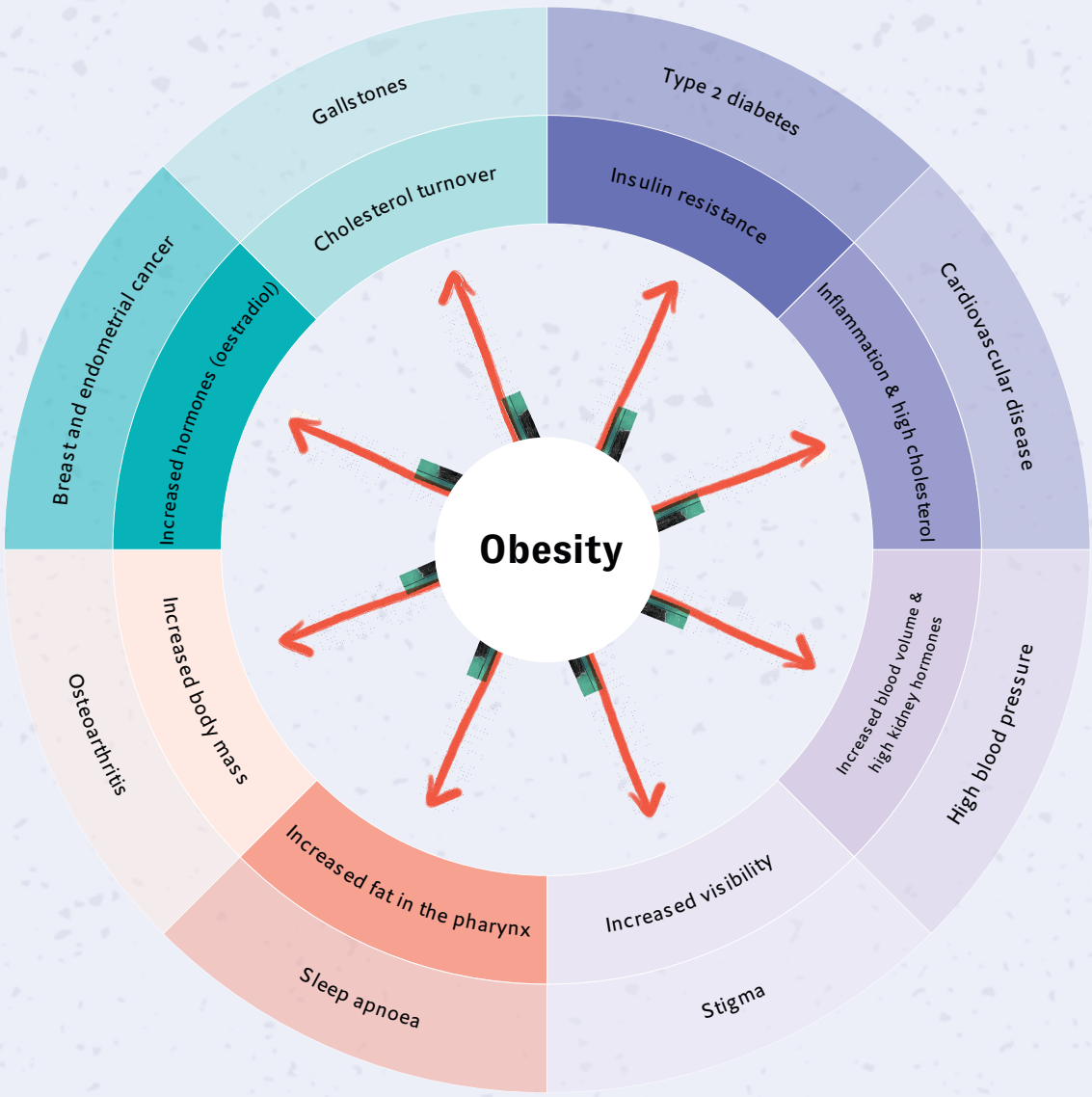


Figure 3: The relationship between obesity and other key chronic conditions (Adapted from Bray et al. 2017)[4]



Obesity can directly cause other health conditions, but it also indirectly affects how straightforward those conditions are to manage. In the case of cancer, obesity is a risk factor for developing breast cancer and is associated with a poorer prognosis—the risk of death is more than doubled for women with a BMI of 40 kg/m^2 or more.[15]

What needs to be done?

We see the complex ways in which our individual biological systems, genetics and environment interact in ways that can be damaging to our health. It is clear that only advising people with obesity to diet and exercise is setting them up to fail. The global rise in obesity looks set to continue unless we make some radical changes.

- Tackling misconceptions and increasing overall understanding of the biology of obesity is critical to policymaking. The drivers of obesity are complex and interconnected, and understanding the biological processes involved in obesity can support the design of policies that provide long-term support for people living with obesity that is sustainable and evidence-based. Recognising obesity as a disease in its own right (rather than as a risk factor) would further support addressing it alongside other chronic conditions.
- A long-term and sustainable whole-of-government and whole-of-society response is needed. To prevent and manage obesity, there is a need for investment of money and political will across the whole of government and whole-of-society —not just health ministries.
- Policy needs to reflect all drivers of obesity and not just focus on individual-level action. This involves implementing policies and initiatives to reduce our obesogenic environment and address the social determinants of health. This includes the food and drink industry, transport, leisure, and employment practices. These are not new ideas—the WHO and the World Obesity Federation have set out clear strategies, but uptake has been inadequate so far.

"We know what works and what doesn't work and yet a lot of our policy is still at its heart focused on individual-level interventions."

Dr Sara Bleich, Professor of Public Health Policy, Harvard University

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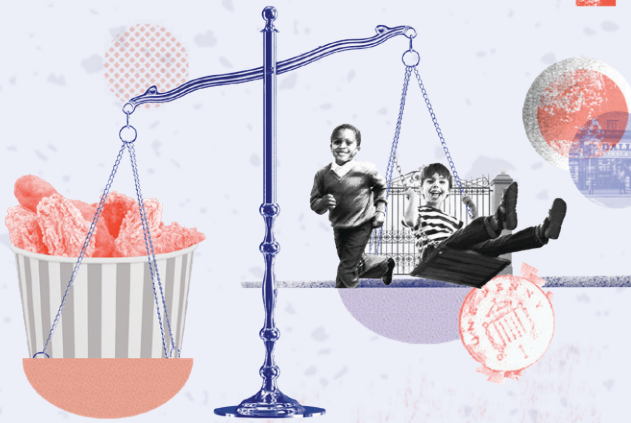


3 Social determinants of health and obesity

Obesity—ignore the wider environment at your peril

Shockingly, obesity rates have nearly tripled since 1975.[1] The common misconception is that individuals are to blame for developing the disease through choices they make. However, in reality, obesity is driven by a complex combination of genetic and biological factors and our broader socio-economic environment, all of which are largely out of individuals' control. The effect of genetic and biological influences on obesity is explored elsewhere in the Science of Obesity series.

In this article, we focus on the social determinants of health—those environmental and societal conditions that affect people's health, greatly restrict and reduce personal choice, and can increase the risk of obesity.[2]

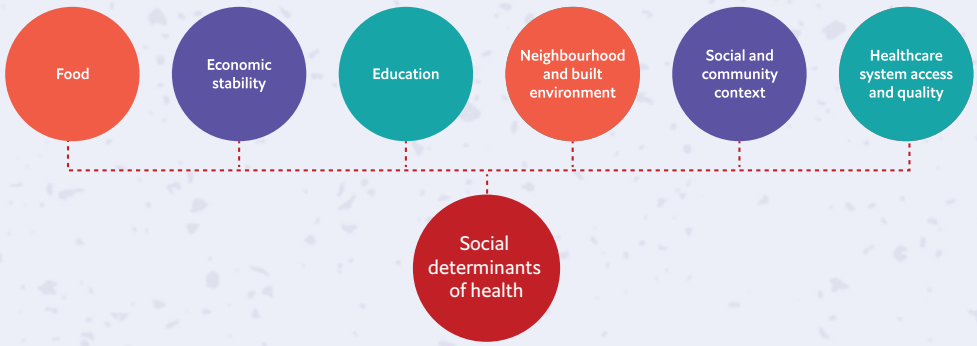
How social determinants of health impact obesity

Social determinants of health are the environmental conditions of where we are born, live, work, play, worship and age that have an impact on our health and quality of life.[2] The impact of social determinants of health can be seen globally. It has been estimated that they impact 50% of the variation in health outcomes in the US.[3] For instance, there is extensive evidence that social factors, such as education, employment status and income level, can have a considerable impact on how healthy an individual is. The lower an individual's socio-economic status, the greater their risk of obesity.[4]

The social determinants of health broadly fall into six categories that are fairly universal (Figure 1).[5]

> **"What is driving us to overeat, what is driving us to be physically inactive is really our broader social environment."**
>
> Dr Sara Bleich, Professor of Public Health Policy, Harvard University

Figure 1: Critical to tackling obesity: six domains of the social determinants of health (adapted from Jilani et al. 2021)[6]



Food—pervasive marketing of unhealthy products

Unhealthy food options are often a convenient choice, as they are available almost everywhere. Our food environment plays an important role in influencing access to healthy options, with a greater concentration of fast-food chains located in areas of greatest social disadvantage.[7] Unhealthy food options are also designed to be tasty and contain high amounts of fat, sugar and salt, making them cheaper to produce and purchase.[7] Pervasive marketing of junk food can also promote unhealthy dietary choices, which ultimately influences an individual's behaviour and attitudes to food.

Economic stability—how much money we have counts

An individual's income and economic stability can affect what they choose to eat and dictate how much time they have to prepare healthy meals and participate in physical activities. As income impacts where we live, choices can be limited, so there may be poor access to affordable healthy food and facilities where physical activity can be undertaken.[8] The global cost of living crisis may therefore "create the perfect storm for driving global obesity prevalence further upwards."[9]

Education—effects felt over a lifetime

Poor access to good-quality education has lifelong implications, affecting job opportunities (and thus income), housing and social mobility, all of which impact our food environment and chances of living with overweight or obesity.[10] Data from the US show that rates of childhood obesity drop as the head of the household's level of education increases.[11]

"Marketing is highly effective at driving purchasing behaviour among consumers."

Dr Sara Bleich, Professor of Public Health Policy, Harvard University

Built environment—does my neighbourhood support my health?

The built environment includes our immediate surroundings—including the presence of stable housing, with access to a kitchen and food storage facilities. Neighbourhoods also need the infrastructure to support active transport (such as walking or cycling) alongside public transportation. Lack of public parks, swimming pools and community leisure centres can reduce the opportunity for low-cost exercise. Recent data show that neighbourhood features such as walkability and proximity to parks and recreational facilities have been linked to greater levels of physical activity. [12]

Social context—our communities shape behaviours

Our social networks (family, friends, co-workers and the community) have a large influence on our choices and behaviours. Social norms around food and peer pressure can lead to individuals adopting similar eating behaviours to those around them.[13] Bullying, racism, stigma and discrimination can also contribute to poorer health outcomes, including an increased risk of obesity. The entertainment industry also reinforces negative stereotypes of people with obesity.[14]

Healthcare systems—access and quality a concern

Where we live affects our access to healthcare infrastructure in many ways. Lengthy journeys to health facilities—which are expensive in terms of time and money, especially if people are reliant on public transport—may result in delayed treatments. Also, many primary care systems are not yet identifying obesity as a condition in its own right. In Australia, 60 out of every 200 children who visit their GP are living with overweight or obesity, but of these only 1 in 200 is offered weight management support.[7] Trust in healthcare professionals and healthcare systems also varies among different groups—such as ethnic minorities and refugees—for a variety of historical and current factors, making these communities less likely to seek treatment and have poorer health outcomes as a result.[15]

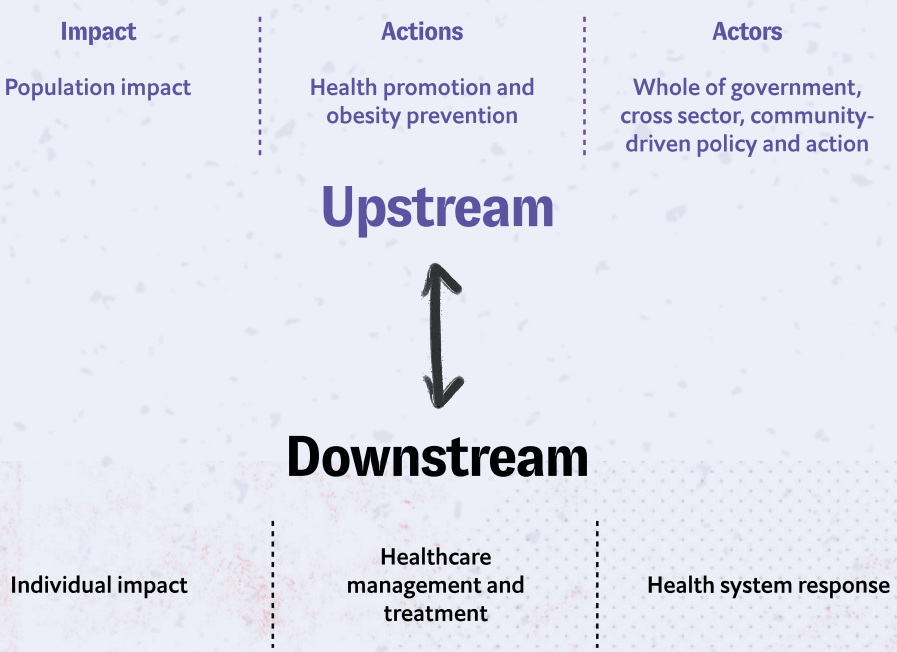
"We need to find ways to not only make our sidewalks and parks safer and more amenable to physical activity, but also figure out ways to encourage people to use them."

Dr David Sarwer, Director for Obesity Research and Education, Temple University

We can tackle obesity by addressing social determinants of health

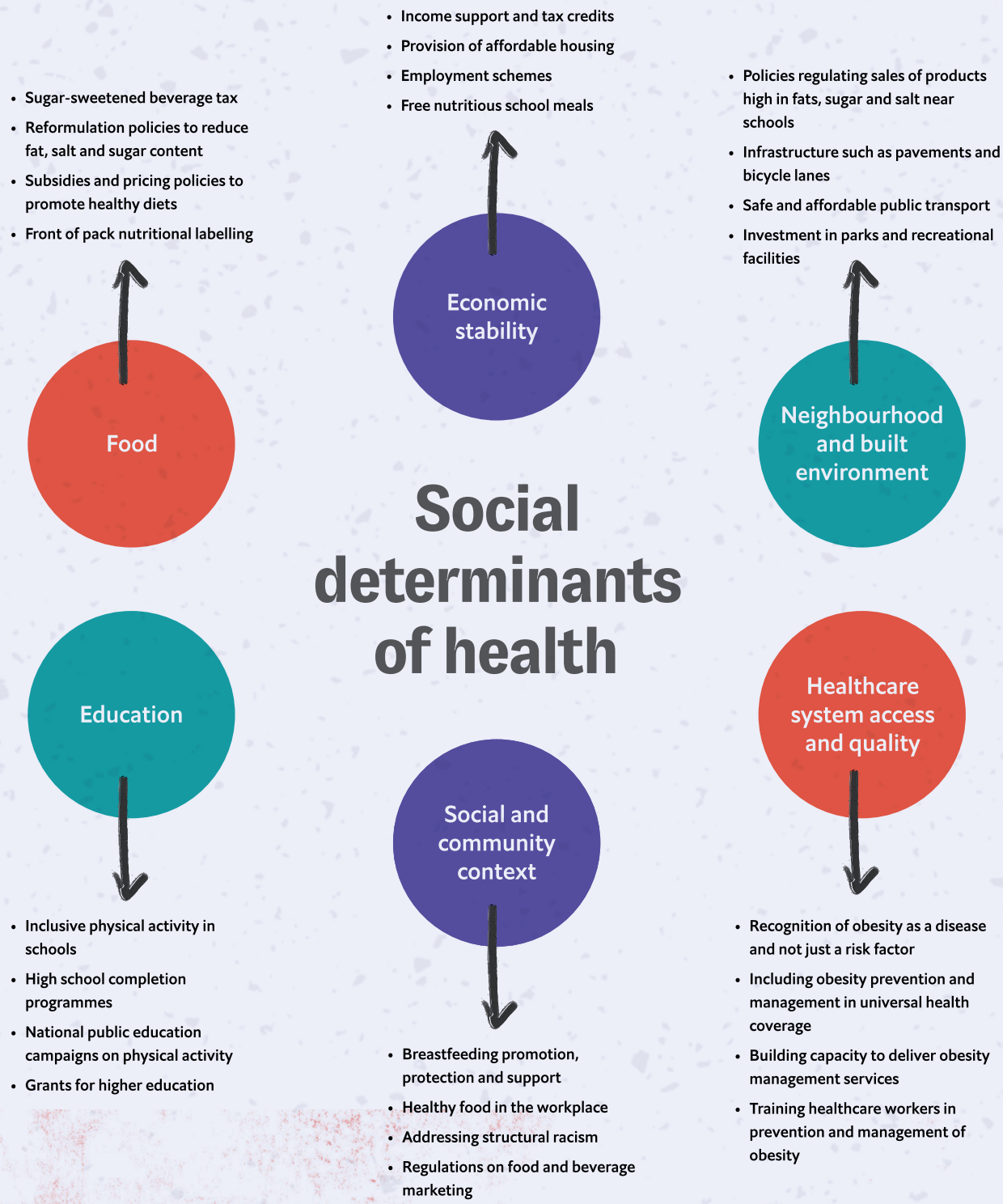
As we have seen throughout the Science of Obesity series, obesity is the result of a number of individual, socioeconomic and environmental factors. If we view obesity as a health problem and only address it via the healthcare system, we will not succeed in reversing rising obesity rates. Figure 2 shows how obesity requires a response across the whole of government, including upstream policy interventions (focused on macro-level factors) and downstream policy interventions (focused on micro-level factors), to achieve population impact. If we continue to focus mainly on individual-level interventions that target individuals' behaviour, we will not see population-level impact.

Figure 2: Illustration of the actions needed to address obesity, including key actors and level of impact (adapted from Whitman et al)[2]



Nobody is saying that obesity will be an easy issue to address. But Figure 3 shows that there are a large number of evidence-based interventions that address the key social determinants of health with the potential to impact on population health—both in terms of obesity and overall health status.

Figure 3: Interventions to address social determinants of health to tackle obesity[2, 8]



Focusing on a few key examples where policy interventions that address social determinants of health have positively impacted obesity and its risk factors, we see that:

- Evidence from the US suggests the **provision of school meals** can contribute to improvements in health and social outcomes, including obesity rates and student performance.[16] Such universal policies can also play an important role in reducing stigma for children in poverty.
- **Creating healthy food environments** in childcare facilities, hospitals and worksites could help to change societal attitudes and behaviours. Many countries are already mandating nutritional labels on restaurant and fast-food menus. Additional proactive steps could include providing incentives for supermarkets to be located in underserved areas.[2]
- **Prioritising resources to enable physical activity in areas and populations that lack access to parks or recreational spaces** can also support behaviour change. Evidence shows that children with better access to public parks and recreational programmes are less likely to experience increases in body mass index (BMI) over time.[17]

"Innovation with cheap food has caught up with us, so there is massive pressure to overeat, in a way it's more odd that more people *don't* gain weight."

Dr Uku Vainik, Associate Professor, Institute of Genomics, University of Tartu

If we know what to do, why aren't we doing it?

It is possible to slow and reverse global obesity rates, but it will take many years of concerted effort, strong political will and a radical shift in attitudes across society and policymaking.[18]

Many **public health interventions** can take years or even a generation to achieve notable results, whereas elected officials may favour tangible, shorter-term outcomes that coincide with their time in office. Sustained and constructive dialogue between health officials and political leaders is needed to address the challenges at hand and ignite strong political will for action.[19]

There continues to be widespread misconceptions of obesity being a consequence of individual behaviours, despite evidence disproving this. Even among a study of over 3,000 people living with obesity, it was found that 82% believed it was completely their own responsibility.[20] This disconnect between public perceptions and scientific evidence needs to be rectified to generate sufficient **political will—both from politicians and their electorate**.

Food industry changes are needed when it comes to formulation, labelling, pricing and advertising.[21, 22] However, policymakers cannot rely on industry to implement these changes. Rather, public policy interventions must mandate and incentivise such change. We can certainly learn from the experience of tobacco control to align commercial and public health interests to avoid the lobbying and bad advertising practices that sought to weaken the connection between tobacco use and lung cancer even amid the ongoing consequences of over 8m deaths per year (mostly in low- and middle-income countries).[23, 24]

"It is really important to insert community voices and expertise into both the development and implementation of effective policy approaches."

Dr Sara Bleich, Professor of Public Health Policy, Harvard University

A radical and collaborative approach is needed

Globally, obesity rates continue to climb thus necessitating urgent action and strong political will. A number of key approaches can be considered to reverse rising rates of obesity:

- **Greater awareness and prioritisation of the various drivers influencing obesity is needed across all government departments.** Health ministries, which are often tasked with the health of the nation, need to make tangible relationships with other government departments (finance, transport, trade, culture, agriculture and food industry) to explain the critical role that they can play in addressing social determinants of health. **A coordinated approach involving multi-sectoral engagement and action will be necessary to halt rising rates of obesity globally**.
- **People power and buy-in.** Changing embedded behaviours will be difficult. As such, it is necessary that local people are key actors in how their communities change the obesity landscape, from what is sold near schools, to what publicly funded physical exercise facilities are available. This will require buy-in and action from both the public and private sectors. Some countries, such as Australia, have developed comprehensive obesity action plans that include engaging people with obesity and communities at higher risk of obesity.[7]
- **Prioritising a whole-of-government and whole-of-society response** is needed to address rising obesity rates globally. Multilateral bodies like the World Health Organisation (WHO) have convening power, not only as technical experts but also through their ability to raise issues such as obesity globally—as the WHO did with smoking, ultimately leading to the WHO Framework Convention on Tobacco Control. The WHO is working hard to convince countries to implement a "whole-of-government, health-in-all-policies" approach.[8] Such a multisectoral response is needed to address all domains of the social determinants of health that impact on obesity status.

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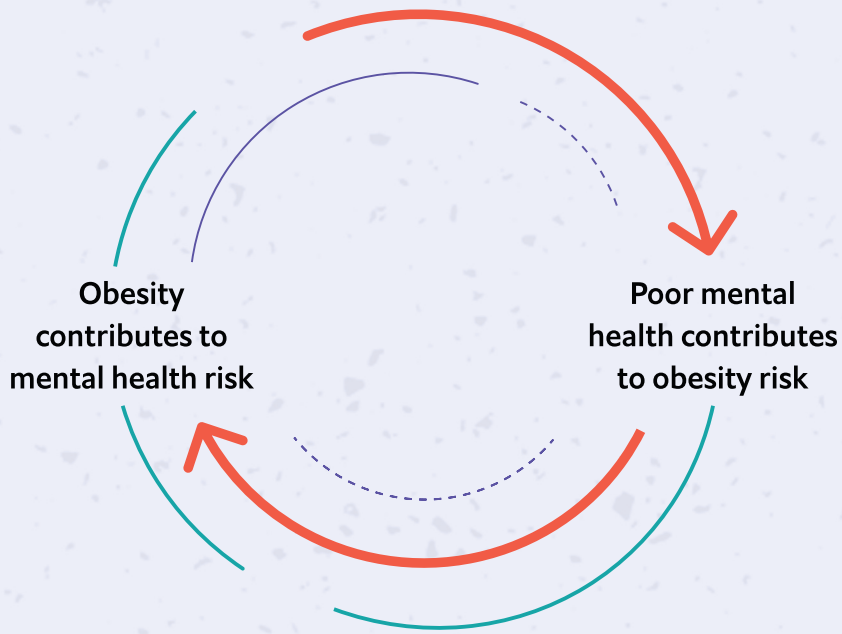
4 Mental health aspects of obesity

How do obesity and mental health interact?

Obesity rates have risen dramatically across the globe over the past 40 years; by 2035 it is estimated that half of the world's population will live with overweight or obesity.[1] Obesity is a global challenge affecting every country and all socioeconomic groups. Obesity is also recognised for its complex bidirectional relationship with mental health, which impacts quality of life. As stated in other articles in this series, the rising prevalence of this multifactorial disease is not down to one factor such as an individual's lack of willpower. Overweight and obesity are associated with changes in our socioeconomic and food environment, such as the proliferation of affordable, calorie-dense food, coupled with biological mechanisms that favour weight gain.[2]

Mental health and obesity are linked in a complex bidirectional relationship.[3] Figure 1 shows how they interact.

Figure 1: bi-directional relationship between obesity and mental health



People living with obesity are 32% more likely to develop depression.[4] Having obesity also increases the risk of developing an anxiety disorder by 30% and this risk further escalates for people with severe obesity.[5] There is also some evidence that women are at further increased risk compared to men.[3]

This increased mental health risk among people with obesity may be due to stigma, discrimination, low self-esteem and dealing with physical conditions associated with obesity such as osteoarthritis and diabetes. Systemic inflammation and hormonal disruptions caused by obesity have also been implicated in contributing to poorer mental health.[6] Furthermore, young people living with obesity are at an increased risk of suicide. For example, a US study showed that obesity is linked to suicide ideation and planning in adolescents, even after adjusting for psychosocial factors.[7]

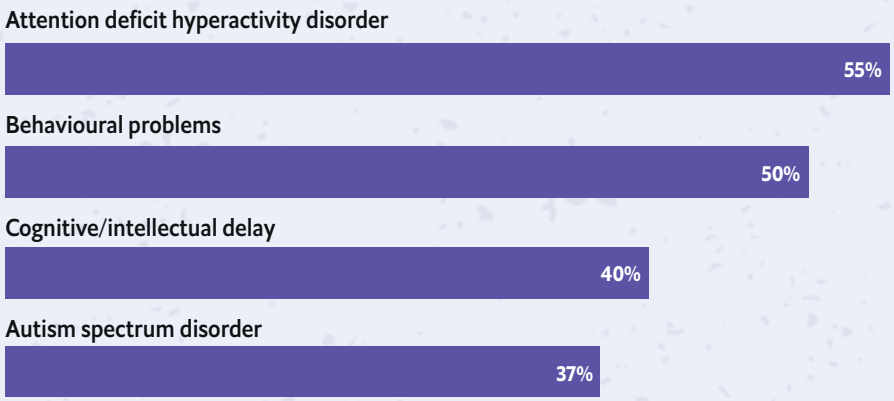
In turn, people living with mental health conditions are more likely to develop obesity.[3] Factors involved may include side effects from medication, inability to engage in physical activity, social withdrawal and comfort eating.[3]

Children and adolescents are profoundly impacted by living with obesity

Children and adolescents living with obesity are around twice as likely to have major depressive disorder compared to healthy controls.[8] Another study found that the risk of depression is higher among girls living with obesity compared to peers without obesity; this increased risk of depression continues into adulthood.[9] Children and adolescents living with obesity have lower psychological wellbeing scores and are more likely to experience difficulties in peer relationships and behavioural struggles.[10]

Exposure to obesity in the womb can also increase children's risk of developing mental health conditions. Maternal obesity increases the risk by 39% and paternal obesity increases the risk by 17%; although we do not necessarily understand exactly how or why this is happening, it is further impetus for action on obesity.[11] Table 1 highlights the increased risk of some mental health conditions among the children of women with obesity.[11]

Table 1: Increased risk of mental health conditions in children of mothers living with obesity[11]



Note: These data were mainly based on studies from US and Europe.

Obesity therefore not only affects individuals' mental and physical health across their own lifetime, but also appears to have an intergenerational impact. It affects the next generation through biological mechanisms, and through social determinants of health such as poor housing and poor access to healthy foods.

Stigma associated with obesity is prevalent

Weight stigma is the negative attitudes and stereotypes about people who live with obesity.[12] It is usually a consequence of the common misconception that a person's weight is completely under their control. As we have seen throughout the Science of Obesity series, obesity is due to a combination of factors including genetic predisposition, physiological processes and living in an obesogenic environment (that is, an environment that makes it difficult for individuals to maintain a healthy weight).

The consequences of weight stigma are global, wide-ranging and affect people right through the life course. Weight bias manifests in many ways, including through teasing and bullying, discrimination, and social exclusion.[13] Children with obesity are more likely to have mental health problems, be absent from school and achieve lower grades.[9, 14] In the workplace, weight stigma affects people's employment, income and promotion opportunities, with women particularly affected.[15, 16]

"A lot of obesity comes back to the usual social determinants of health. It's income, it's security, it's locus of control, it's education."

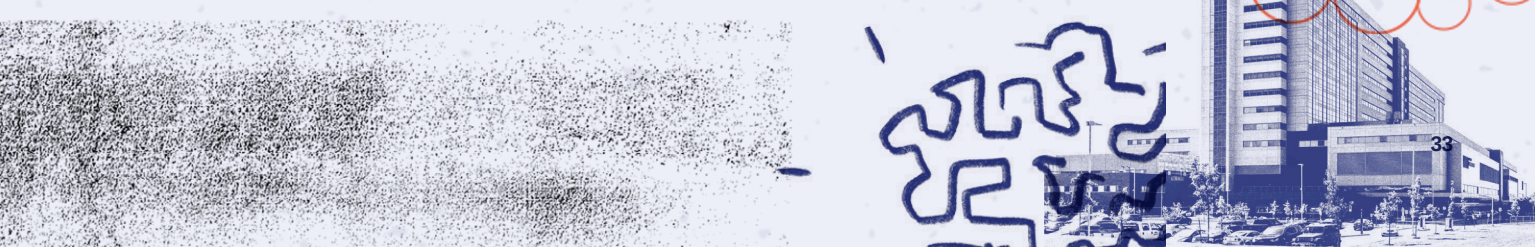
Professor Arya Sharma, Founder of Obesity Canada

On an individual level, weight stigma is associated with weight gain.[13] It can exclude people from sport and exercise settings and lead people to avoid seeking medical help, and it is also associated with binge-eating, sedentary behaviour, anxiety, depression, lower-self-esteem, stress, social isolation, healthcare disparities, substance misuse and increased risk of mortality.[13, 17-20]

An analysis of over 59,000 participants found a strong association between weight stigma and mental health.[20] This was strongest for self-stigma (when an individual is aware of the negative stereotypes about people with obesity, agrees with these beliefs and applies them to themselves).[20, 21] It is also estimated that around 40-50% of people living with overweight or obesity in the US experience self-stigma or "internalised weight bias ".[13] Weight stigma is associated with body image dissatisfaction, reduced quality of life, symptoms of depression, dysfunctional eating, symptoms of anxiety, psychological distress and low self-esteem.[20]

"We know that individuals with obesity are less likely to be hired at the same salary as someone who doesn't have the disease. We think that's probably one of these almost mindless biases."

Dr David Sarwer, Director for Obesity Research and Education, Temple University



How can we tackle weight stigma?

There is a clear imperative to address the global obesity epidemic, otherwise the consequences will cripple economies and health services across the world. The current global economic cost of overweight and obesity is estimated to be around US$2tn annually; this is predicted to increase to over US$3tn by 2030 and US$18tn by 2060.[22]

> **"What we are seeing is that those experiences of stigma and bias take an emotional toll on people as well."**
>
> Dr David Sarwer, Director for Obesity Research and Education, Temple University

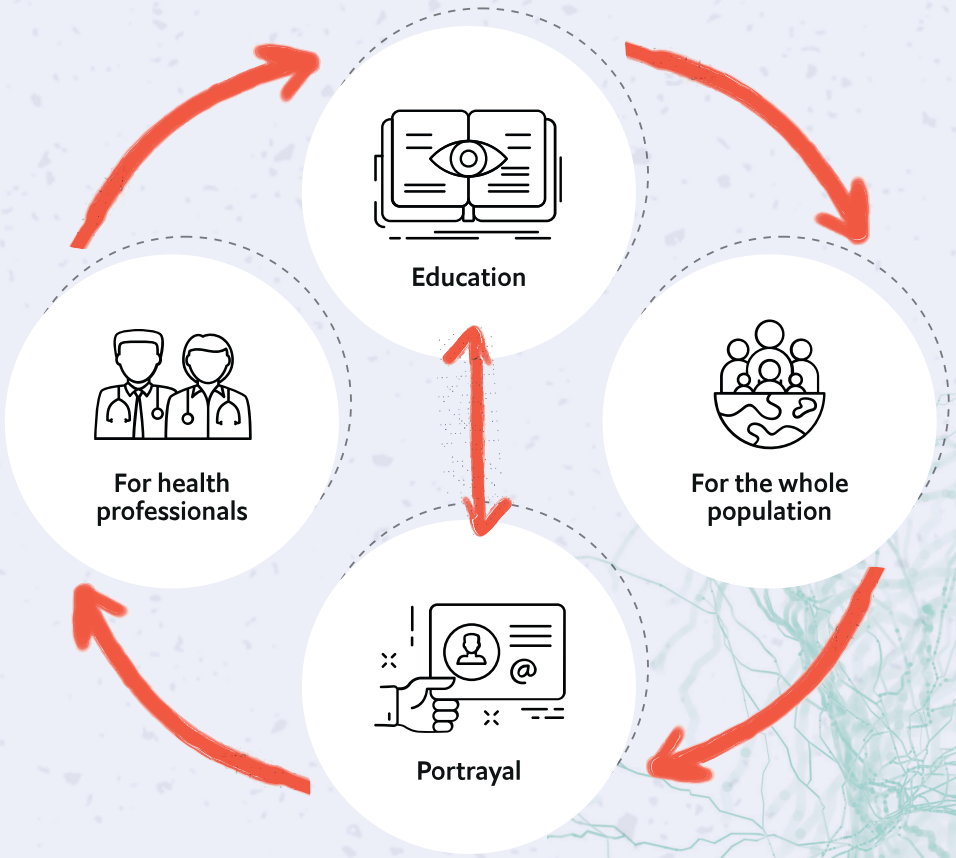
The causes of obesity are wide-ranging and require integrated polices across all areas of governments, including health, agriculture, transport, urban planning, environment, food processing, distribution, marketing and education.[23] We explore these in more detail in our article on Social determinants of health and obesity. In highlighting the importance of tackling obesity, it is imperative that messages do not perpetuate or increase weight stigma. Tackling weight stigma contributes to reducing the psychological distress of people living with obesity, but it is also an important aspect of how we address obesity as a societal issue.

Education and portrayal are two interconnected activities that could help to address weight stigma (see Figure 2).[24] Education is needed for populations and health professionals to better inform them about the causes of obesity and how we can manage it. People must better understand the underlying mechanisms of obesity, its multifactorial causes and, therefore, why tackling it is not as simple as an individual just having more willpower. The portrayal of obesity and people living with obesity in the media, in government policy and elsewhere is important as an avenue to change perceptions and reinforce education efforts. This means fairly portraying people living with obesity, not reverting to inaccurate stereotypes or deliberately shocking images, and using people-first language rather than condition-first language, where people are defined by their disease.[25]

"When you think about societal impacts, there's all the lost productivity that comes from people being sick and not being able to work. There's also the negative impact of weight stigma which is associated with depression, substance abuse and delays seeking care."

Dr Sara Bleich, Professor of Public Health Policy, Harvard University

Figure 2: Key approaches for tackling weight stigma

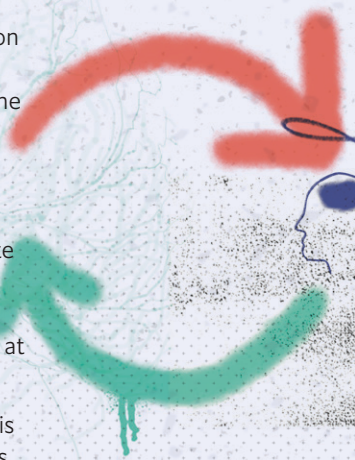


Source: Economist Impact analysis

"This is not about willpower. This is not about intelligence. This is about a physiological process which is worsening against the pressures of the environment around us."

Dr David Sarwer, Director for Obesity Research and Education, Temple University

Action needed to improve mental health and obesity

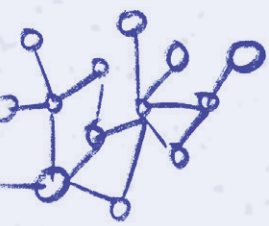


Individual-level interventions do not work for the majority of people, as the prevention and treatment of obesity is complex and requires lifelong lifestyle changes. Yet most people do not know this. Addressing this misconception by increasing awareness of the science underlying obesity will help to address stigma and contribute to better, more effective policy-making.

- **Weight bias and stigma should not be tolerated.** There is a strong imperative to address the vicious circle of obesity and mental health issues. However, with adequate and sustained multi-disciplinary professional help, people living with obesity can be supported to maintain a physically and mentally healthy life. Our societies need to refrain from using stigmatising language and encourage educational initiatives aimed at removing stigma.
- **Sustained and sustainable interventions are needed**. Mental health and wellbeing is an essential aspect of obesity management. However, there are not enough resources to give people sufficient support throughout their lifetime. Stigma should be tackled in schools, the workplace and in healthcare environments, starting with the use of people-first language.
- **Tackle the social and environmental factors at play to support obesity management and prevention efforts**. Considering the complex nature of obesity, we need a change in the environment we live in so that it no longer encourages weight gain. A strong and radical response across all of government and society—that includes evidence-based and effective regulatory measures—is required.

"To address rising obesity rates, it requires a lot of buy-in, not just from governments, but other sectors, and that sort of coordinated action has not happened effectively.

Dr Sara Bleich, Professor of Public Health Policy, Harvard University



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