Obesity

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Gresham College 2021

Obesity is not new. But it has increased and is increasing.

- Should we worry?
- And what should we do about it if so?

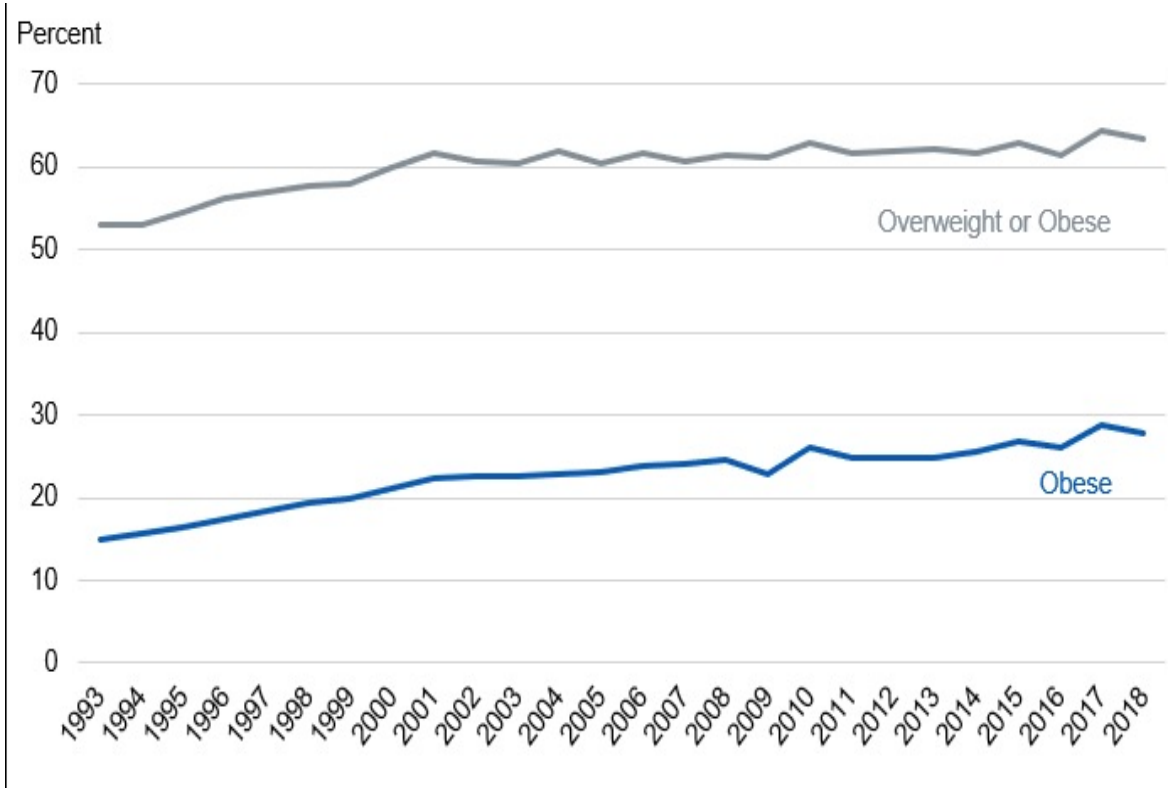
This lecture will cover:

- Epidemiology of obesity.
- Health impacts.
- Interventions at an individual level.
- Interventions at a societal level.

Balzac by A. Rodin, 1893.
Sailko

Obesity in the UK.

- Over 2 decades (BMI>30) from 15%-26%.
- More stable last few years.
- 11,117 hospital admissions directly attributable to obesity 2019.
- 876,000 hospital admissions where obesity a factor.
- 20% of year 6 children classified as having obesity.



Percentage obesity (BMI>30) by year.
Health Survey for England / NHS Digital.

Change in obesity over time, adults. Body mass index- BMI. Weight in kg / height $m^{2\cdot}$ If ≥25 overweight, >30 obesity.

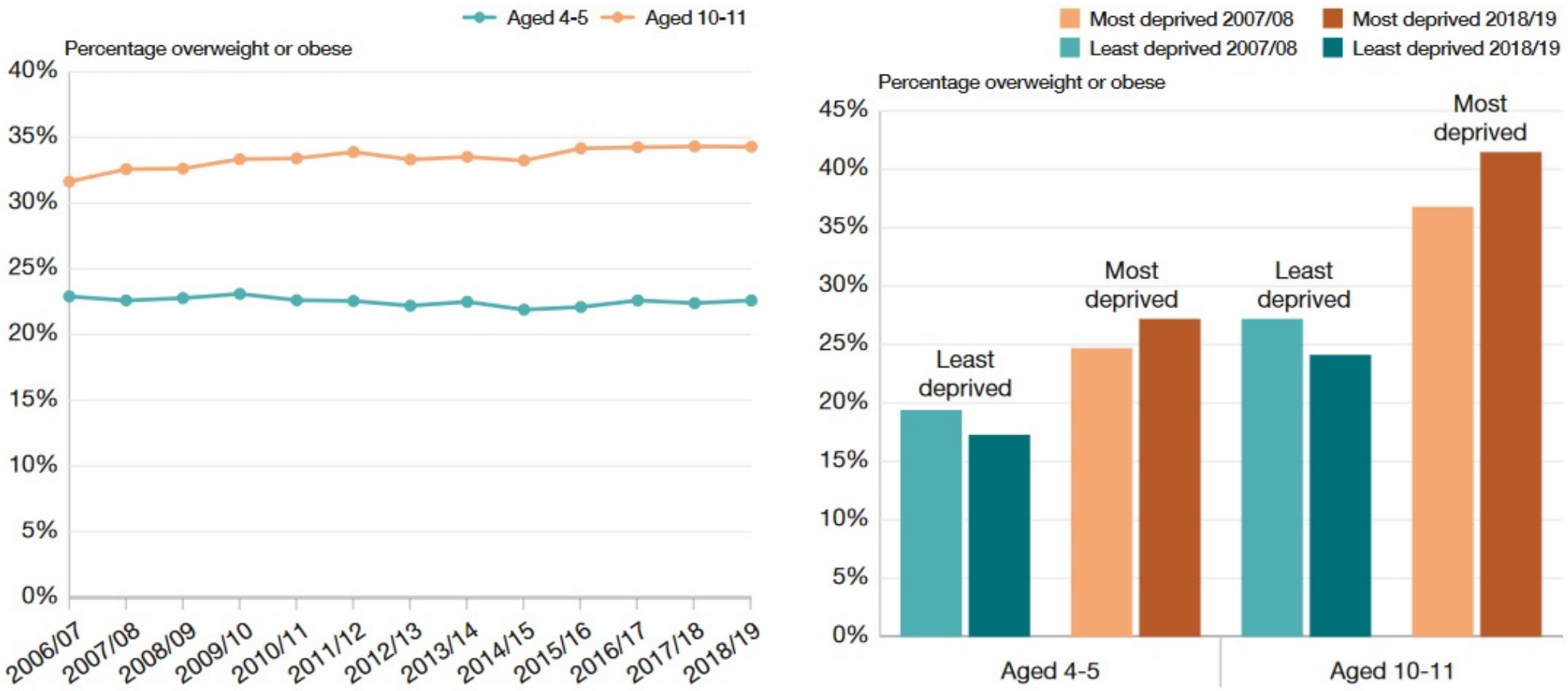
CMO Annual Report 2020

Proportion of adults who are overweight, obese or underweight as measured by body mass index (BMI) in adults aged 16 and over. Analysis of NHS Digital, Health Survey for England

Source: Nuffield Trust and The Health Foundation (2020), *QualityWatch. Obesity*

Steady increase in obesity in older children, especially in most deprived areas. 2007/8, 2018/19. Age 4-5 (L), 10-11 (R).

(CMO Annual Report 2020)



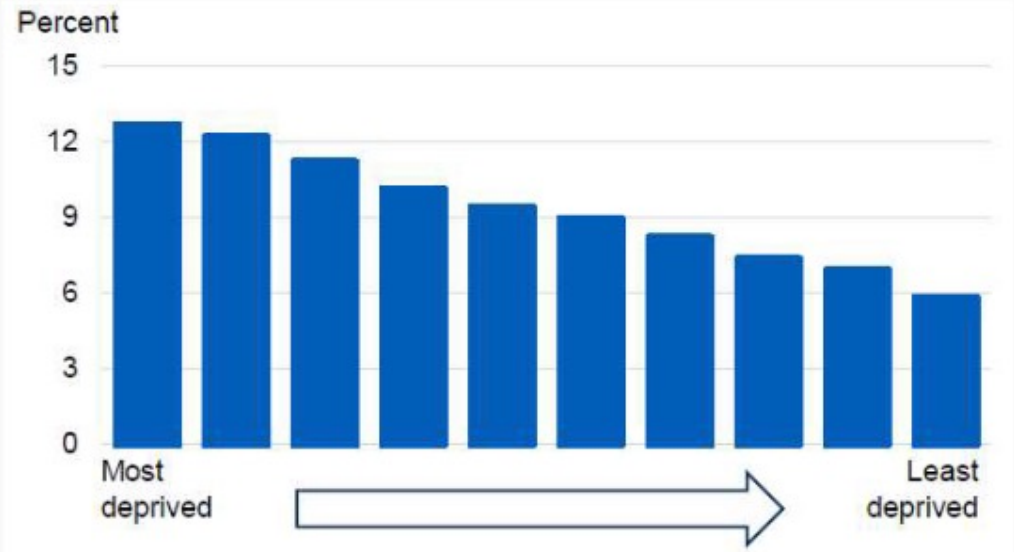
Proportion of children overweight or obese in Reception Year and Year 6 in England, over time (left) and by deprivation category (right)

Source: Royal College of Paediatrics and Child Health (2020), *State of Child Health, Healthy Weight*

The finding of a link between childhood obesity and deprivation is a consistent one in many high income countries.

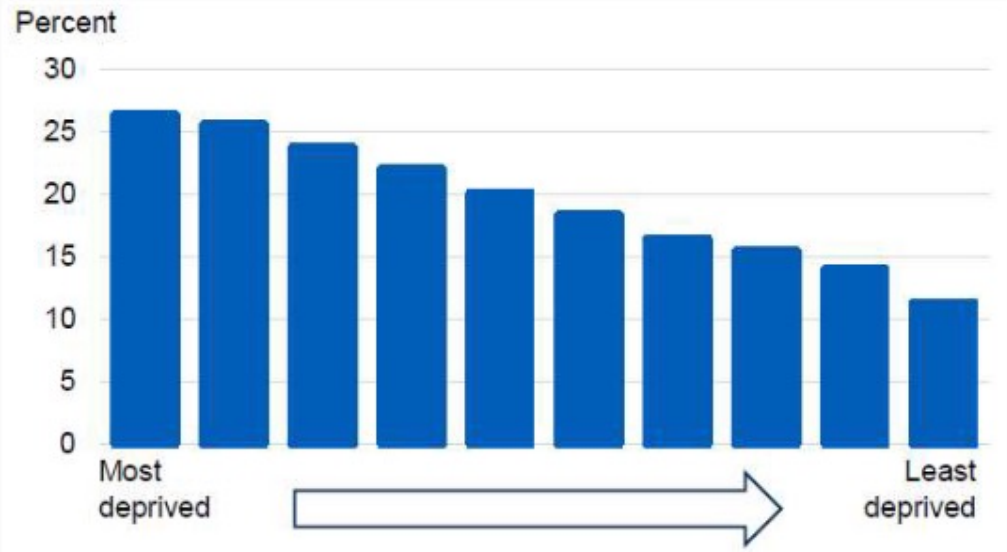
Reception year

13% of children living in the most deprived areas were obese compared to 6% of those living in the least deprived areas.



Year 6

26% of children living in the most deprived areas were obese compared to 11% of those living in the least deprived areas.

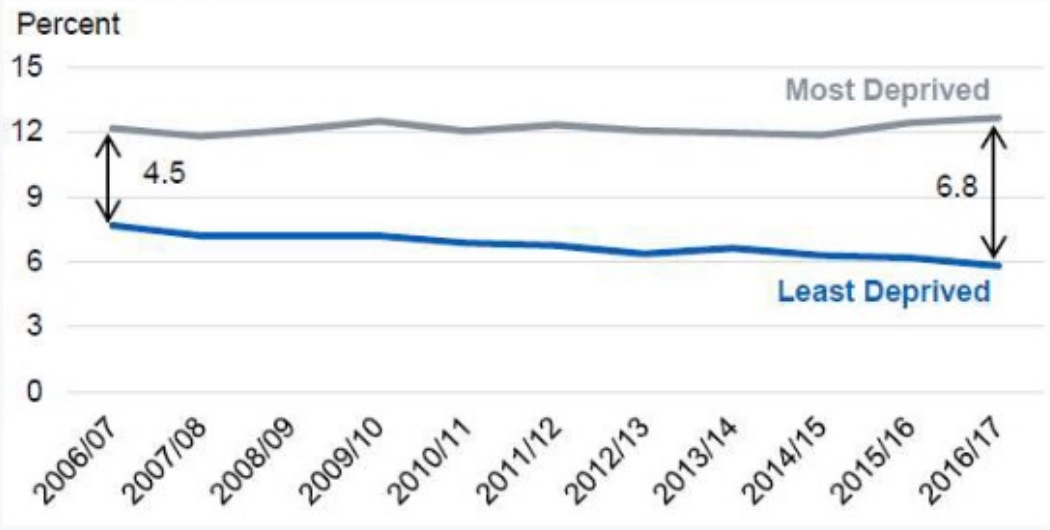


NHS Digital / Newcastle

The difference between the most and least deprived is growing.

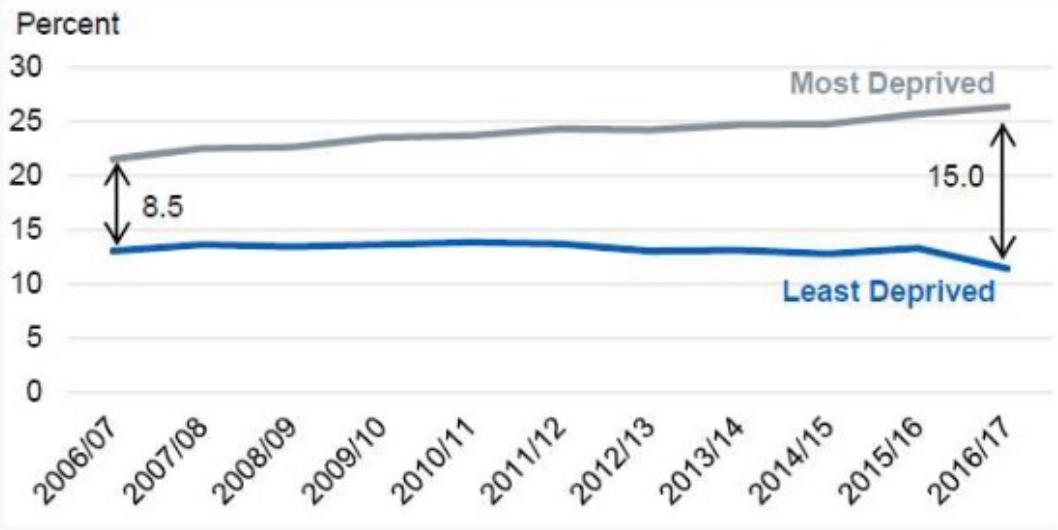
Reception year

Between 2007/08 and 2016/17, the difference between obesity prevalence in the most and least deprived areas has increased from 4.5 to 6.8 percentage points.



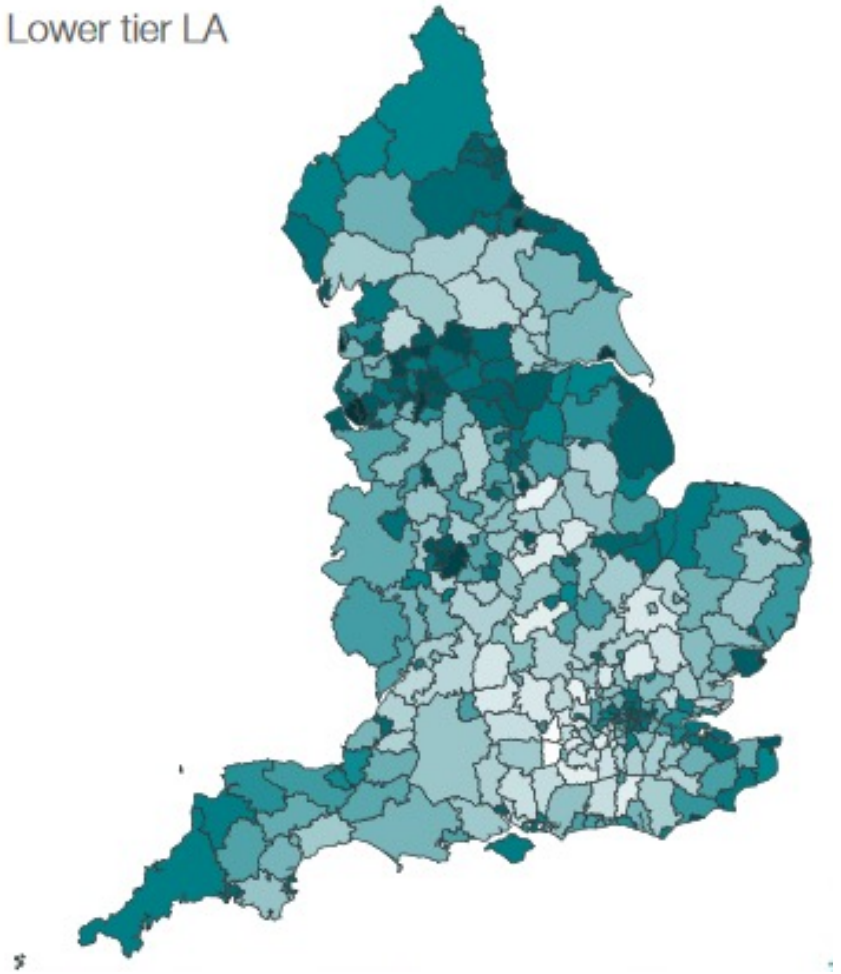
Year 6

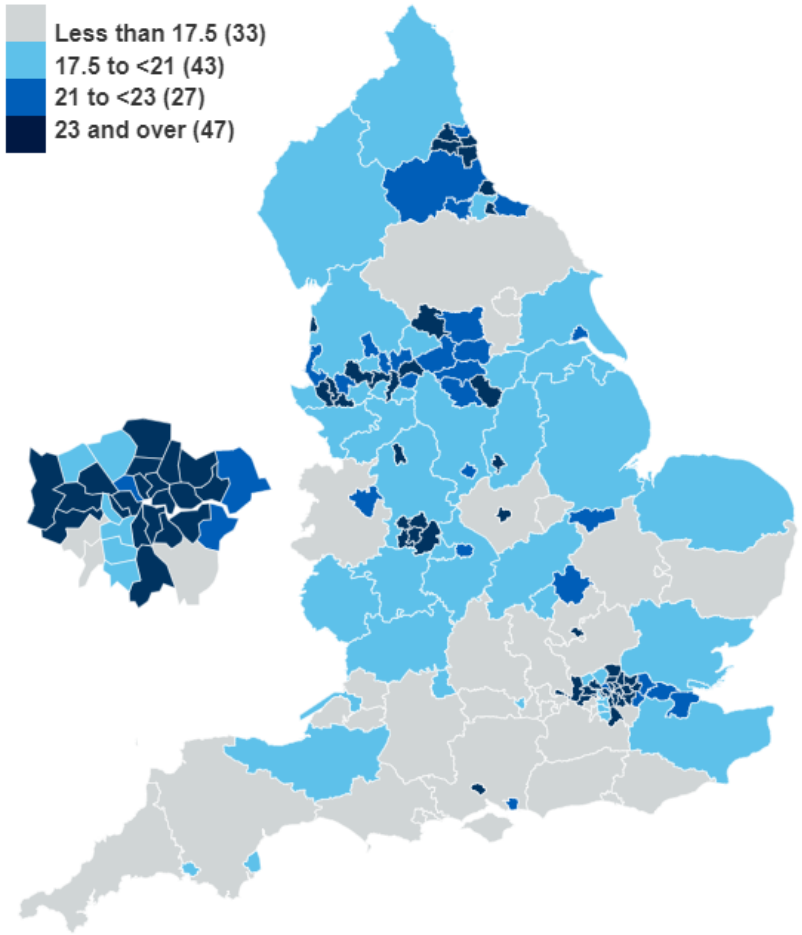
Between 2007/08 and 2016/17, the difference between the most and least deprived areas has increased from 8.5 to 15.0 percentage points.



NHS Digital data / Newcastle

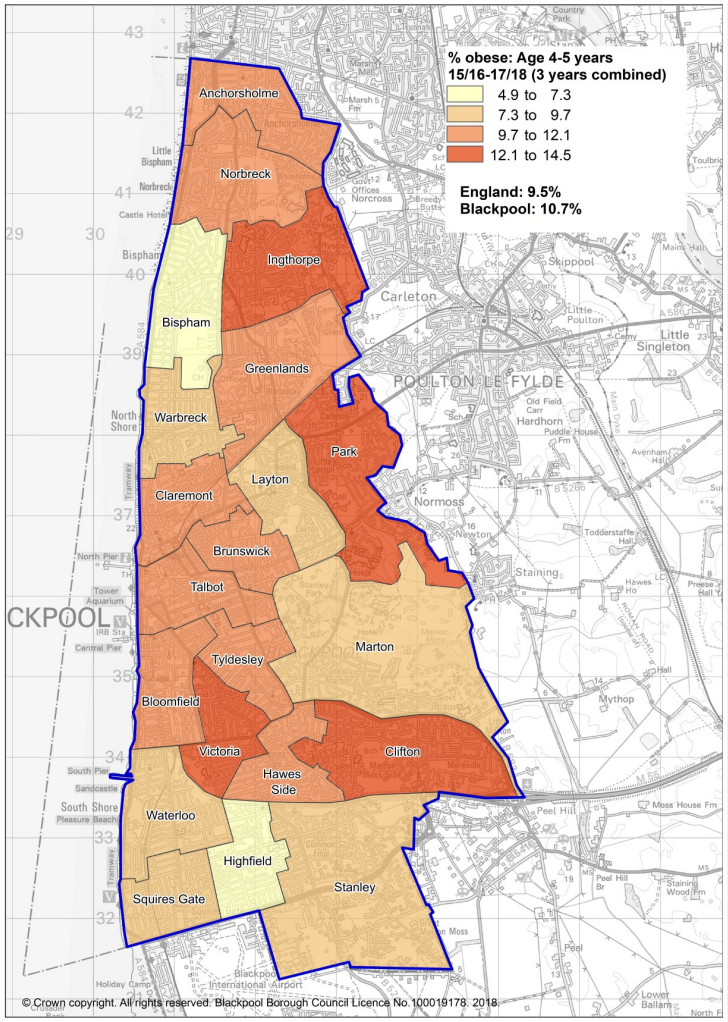
Index of multiple deprivation (L), child obesity prevalence Year 6 (R).

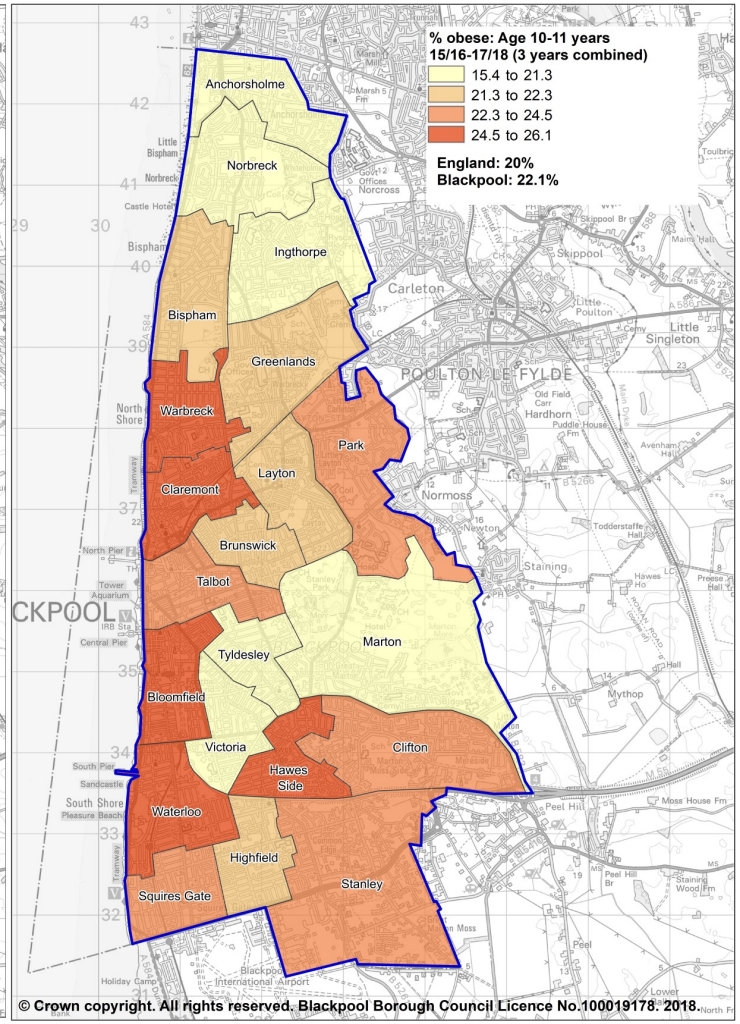


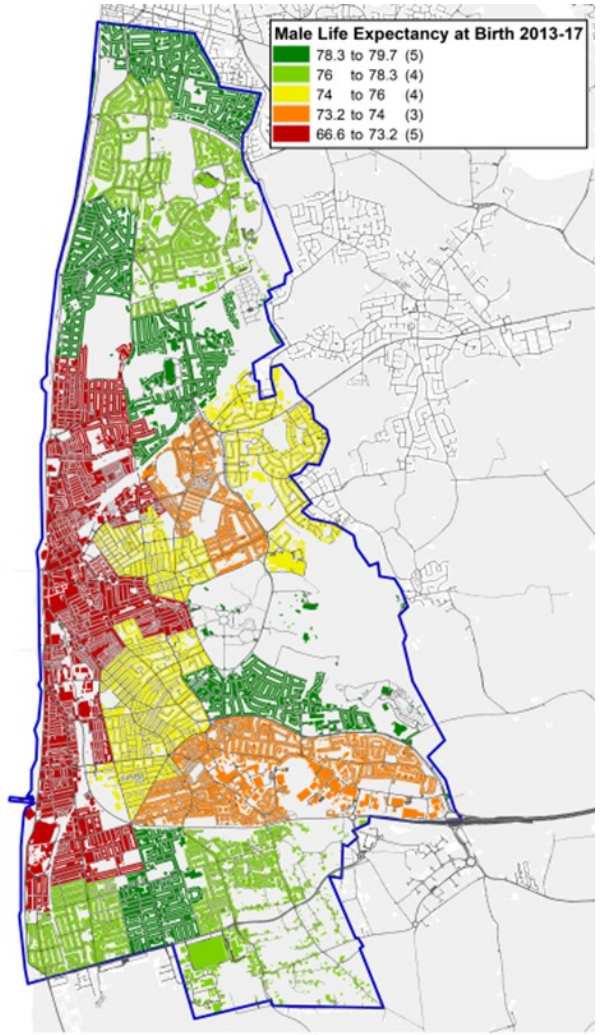


ONS/DHSC/CMO Annual Report

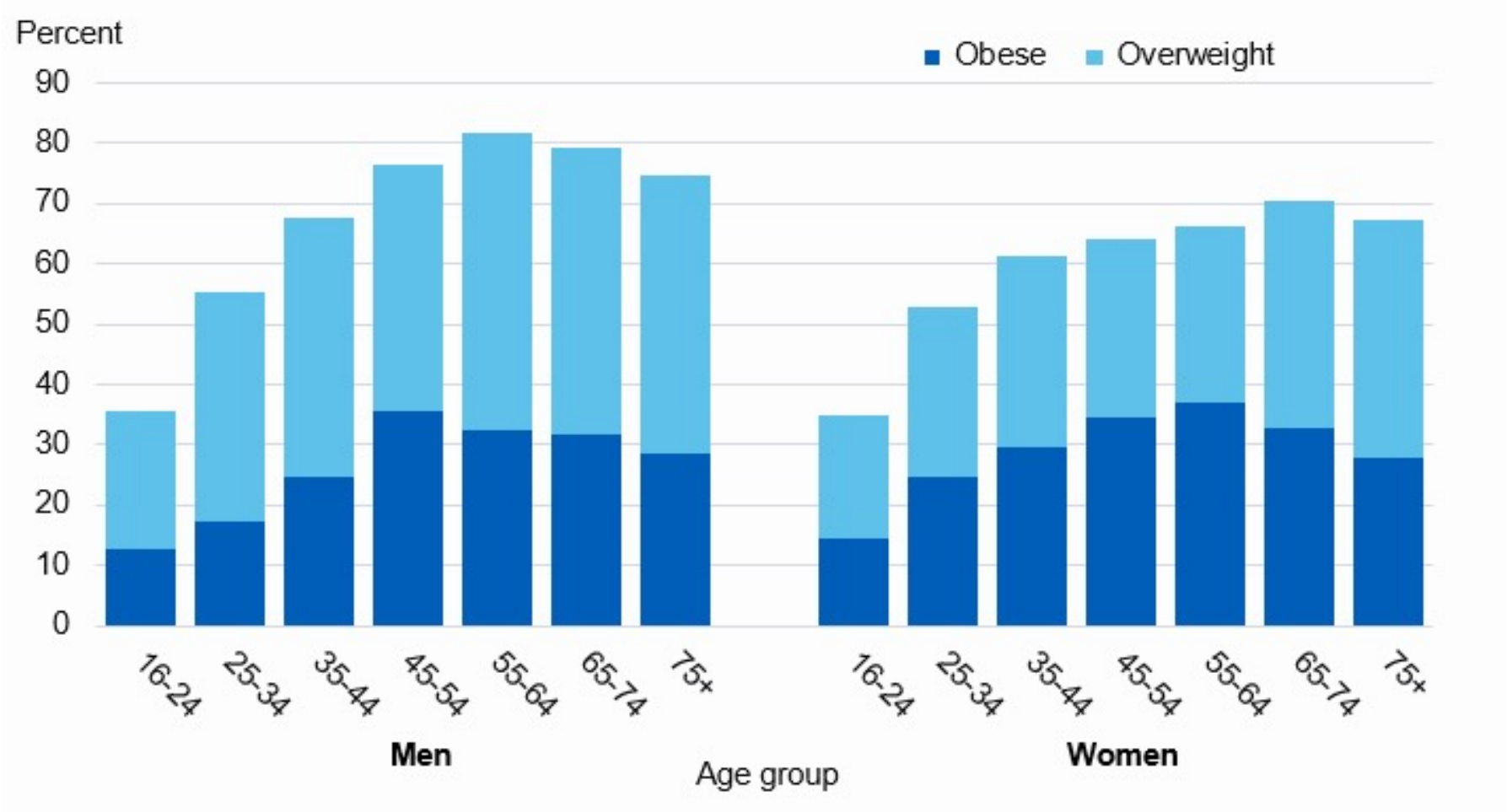
The ill health effects of deprivation start early. Obesity age 4-5 (L), age 10-11 (M), male life expectancy (R), Blackpool. (JSNA)





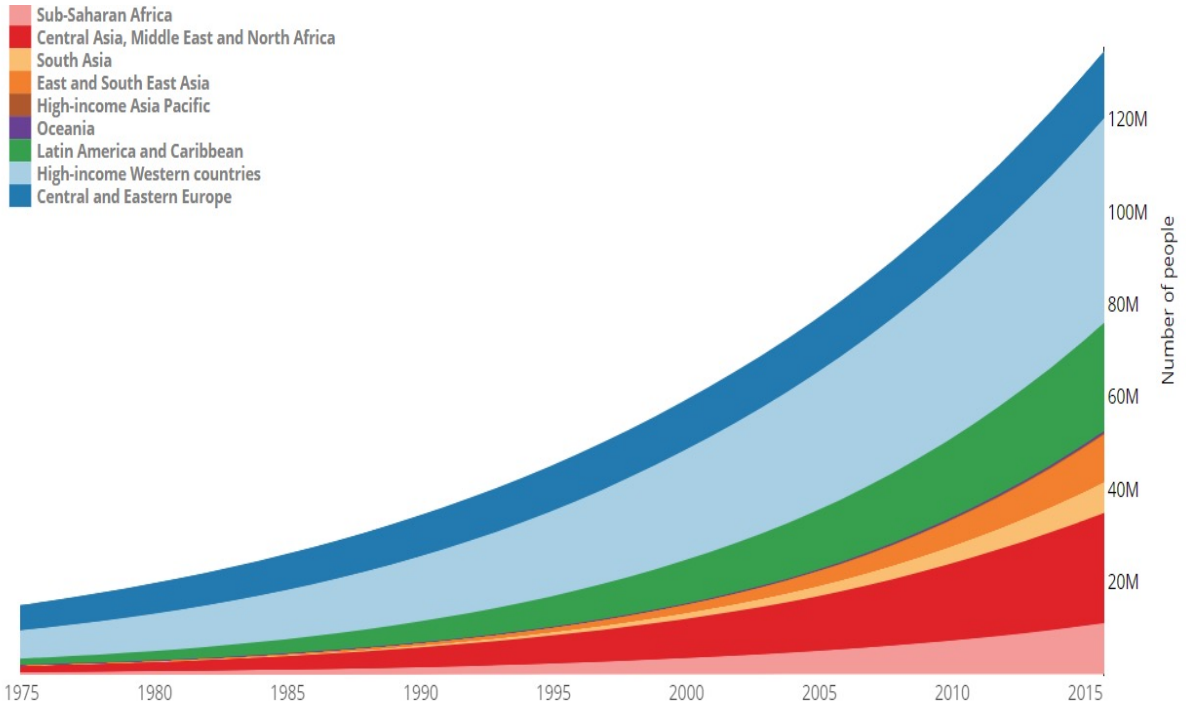


Obesity tends to increase to late middle age. Proportion with obesity and overweight by age. NHS Digital 2020.

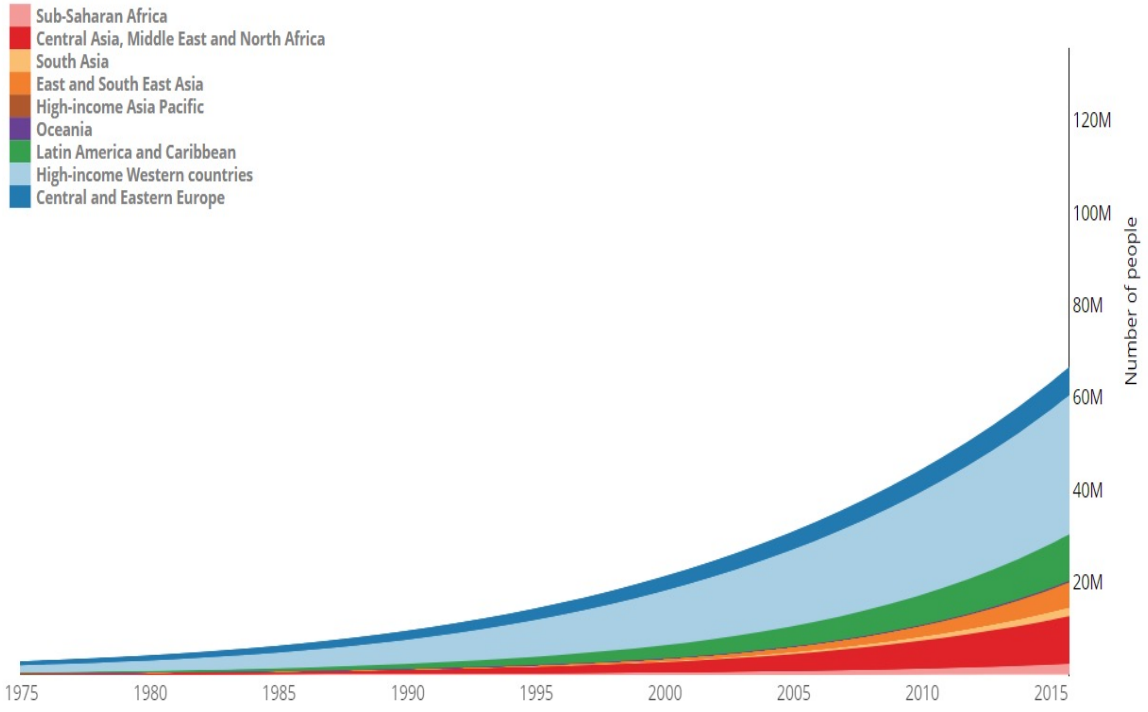


Obesity prevalence globally 1975-15. NCD.RisC

Females

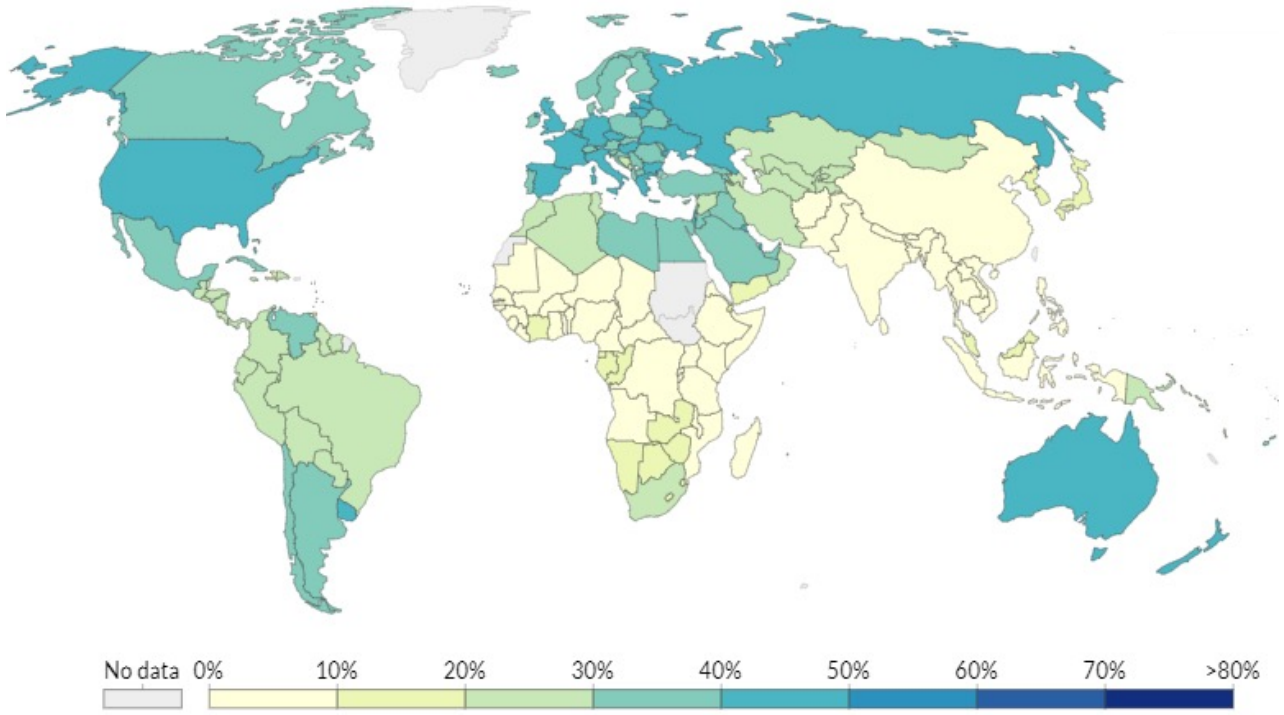


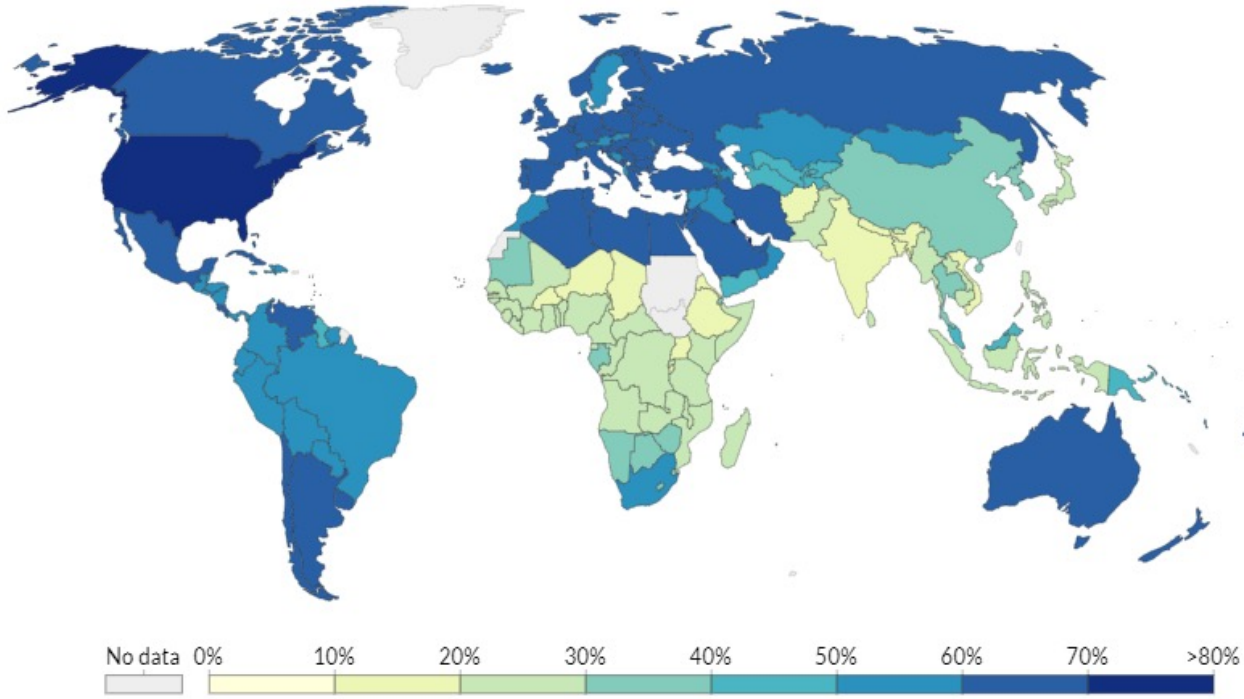
Male



Proportion of adults overweight (BMI ≥25 kg/m^2) 1975-2016.

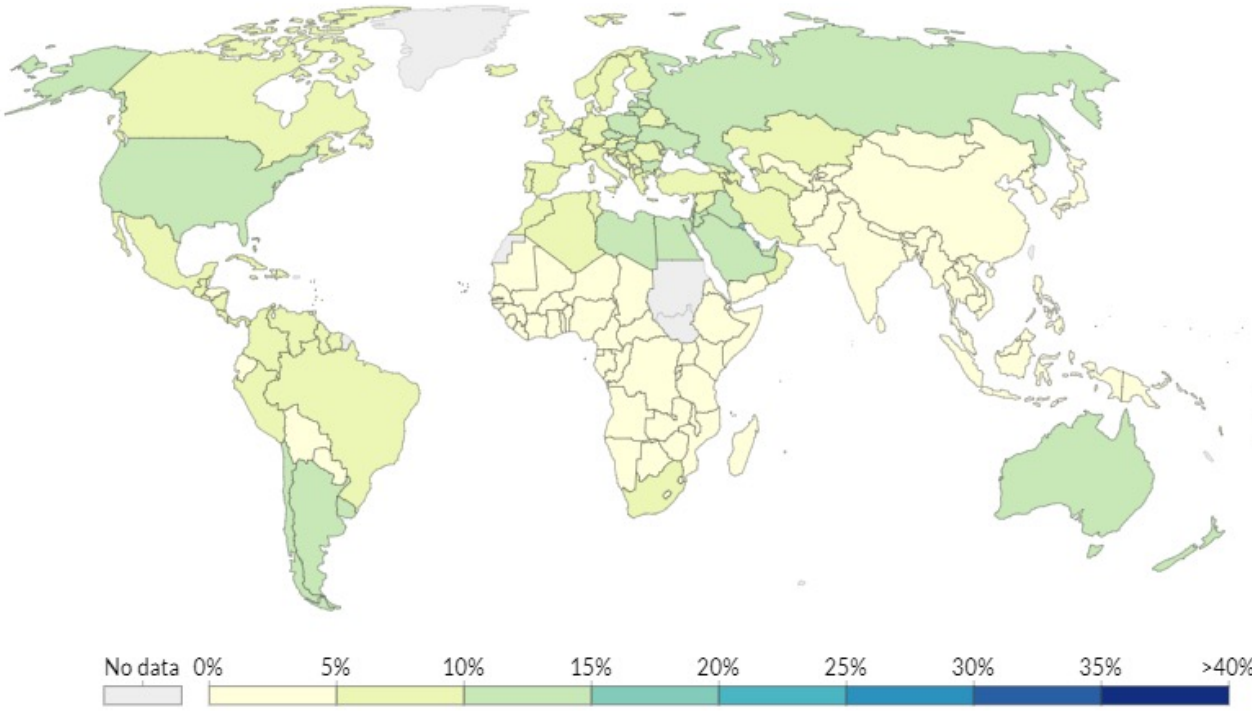
Our World in Data / WHO

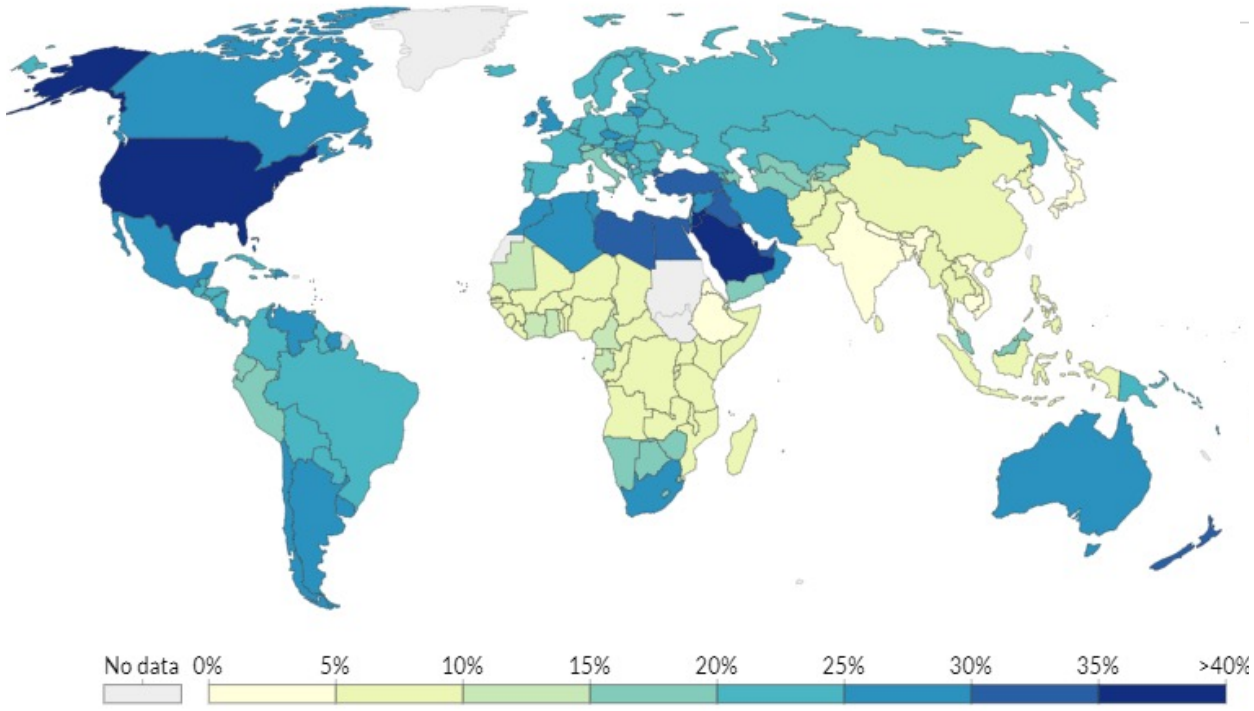




Proportion of adults with obesity (BMI ≥30 kg/m^2) 1975 to 2016.

Our World In Data /IHME/ WHO.

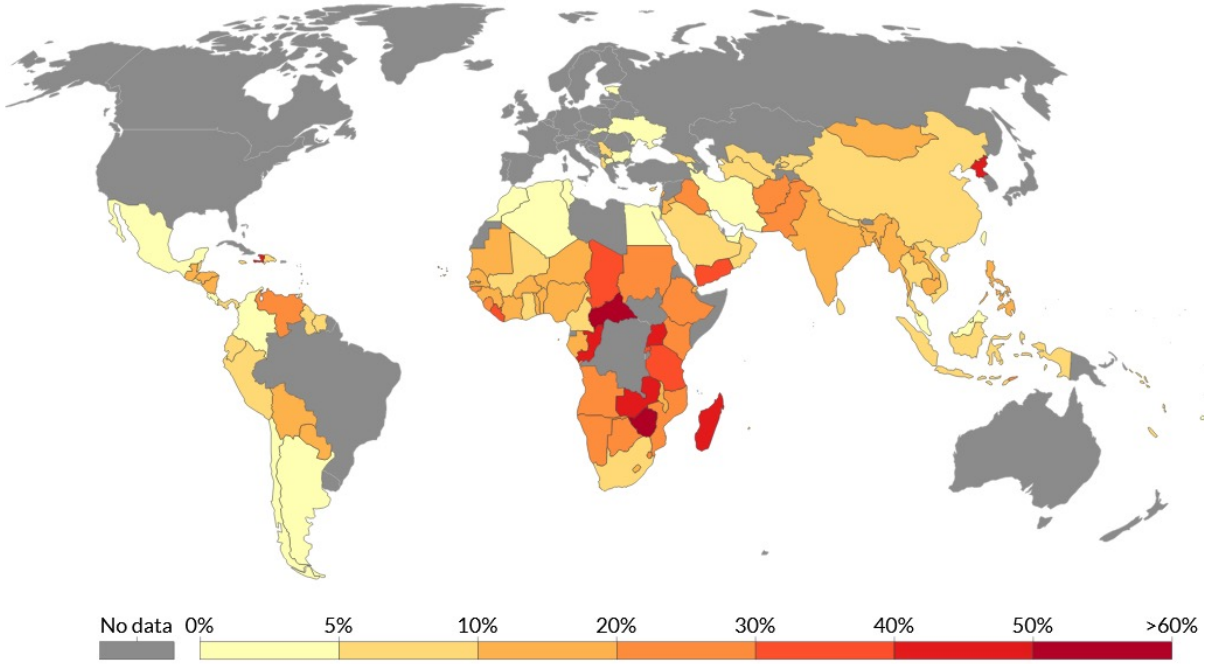




Calorific undernutrition is still with us.

- Historically was the consequence of poverty everywhere.
- Many countries now have a double problem of undernutrition and overnutrition.

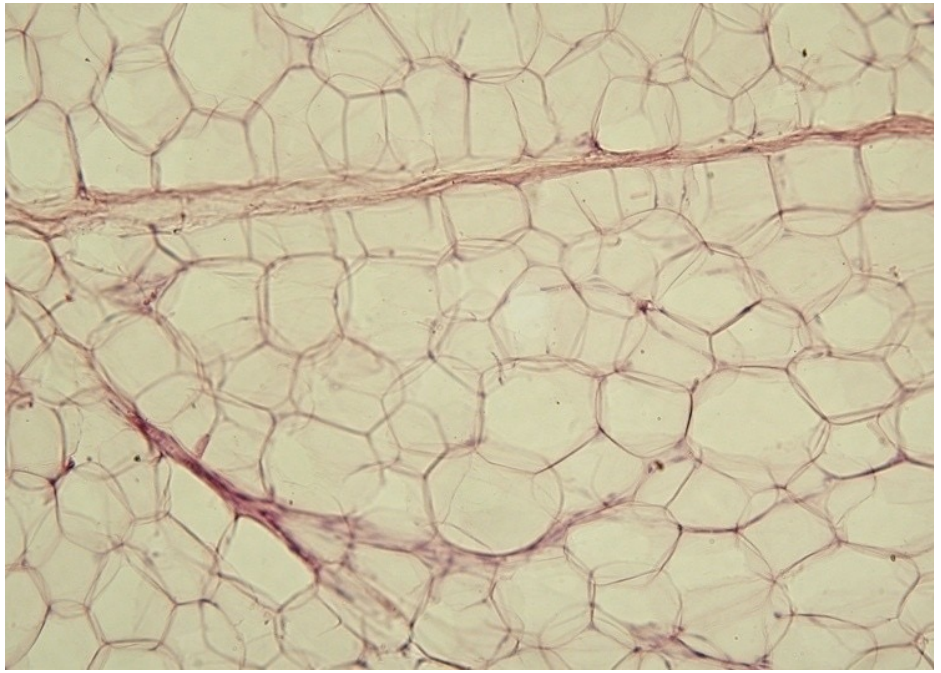
Oliver Twist



% whose calories below requirement. FAO/Our World in Data

Obesity causes health problems through multiple mechanisms.

- Mechanical: weight related e.g. poor physical functioning
- Metabolic: adipose tissue is metabolically active.
- Insulin resistance.
  - Changes in several hormones- include leptin and oestrogen.
  - Inflammation (e.g. IL-6 TNFα).
  - Clotting
  - Lipid metabolism.



Adipose tissue. Department of Histology, Jagiellonian University Medical College

Osteoarthritis (OA).

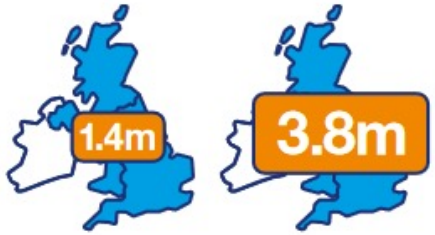
- Strong association of osteoarthritis and obesity.
- Knee joints frequently affected- load bearing.
- 5-unit increase in BMI associated with 35% increased risk of knee OA, 11% of hip OA.
- UK study: 69% of knee replacements and 27% of hip replacements obesity related.
- Increase in OA in joints which are not load bearing- suggesting additional mechanism.

Dr Jeremy Jones, Radiopaedia.org

Around 90% of diabetes in UK is Type 2. Prevalence of Type 2 diabetes rose very rapidly from the 1960s.

- Rising obesity the major driver.
- Diabetes has many consequences- direct, and indirect including:
- Heart disease.
- Stroke.
- Kidney disease.
- Eye disease.

The number of people diagnosed with diabetes has **more than doubled in 20 years.**



In 1996 there were 1.4 million people diagnosed. In 2019 there are **3.8 million.**

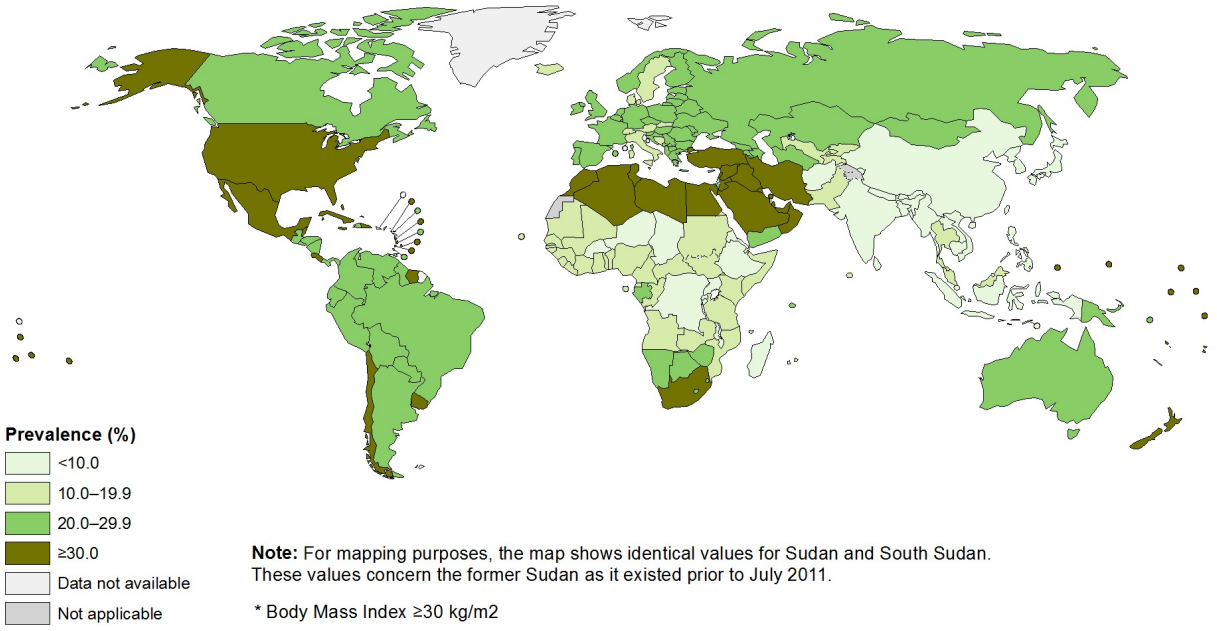
The major risk for Type 2 diabetes is being overweight.

- 80-85% of Type 2 diabetes is accounted for by people being overweight or having obesity.
- An increase with deprivation (cf Type 1).

- Where people with Type 2 diabetes lose weight diabetes may go into remission.

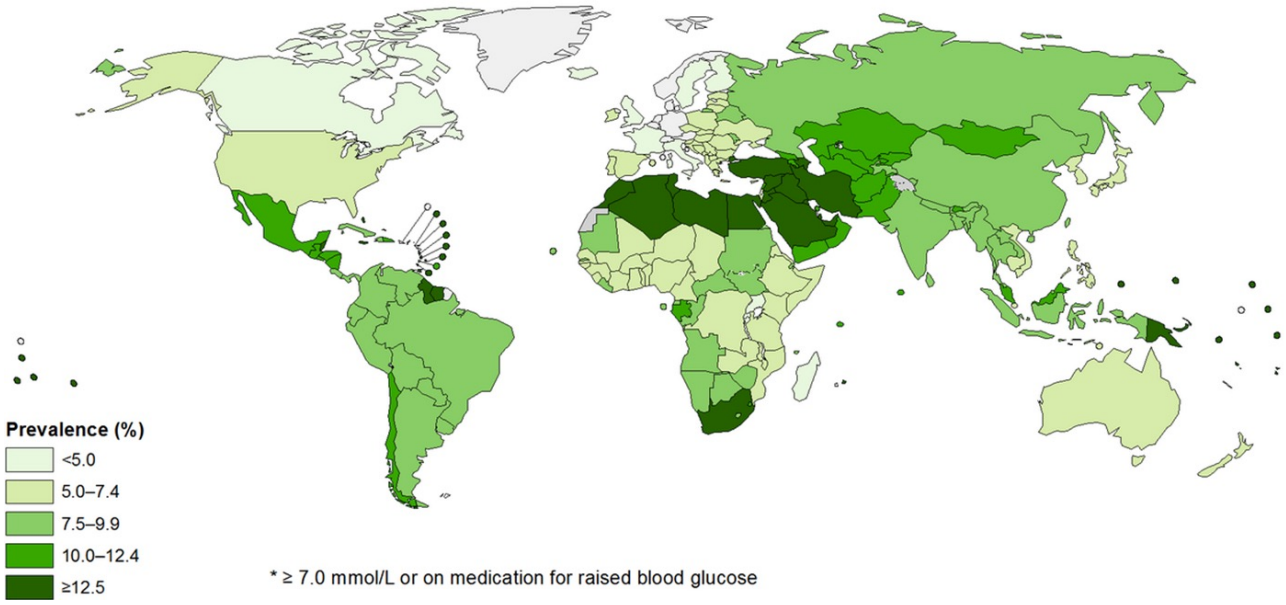
Diabetes.co.uk

Prevalence of obesity age 18+ female (L), raised blood fasting sugar (R). Obesity and Type 2 diabetes closely linked. *WHO 2017*.



Note: For mapping purposes, the map shows identical values for Sudan and South Sudan. These values concern the former Sudan as it existed prior to July 2011.

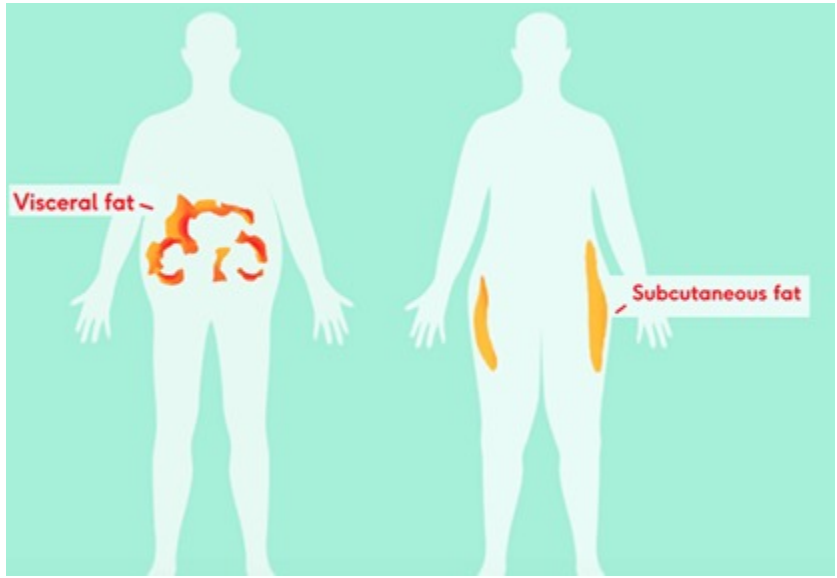
* Body Mass Index ≥30 kg/m2



* ≥ 7.0 mmol/L or on medication for raised blood glucose

In general, for each unit of BMI increment, the risk of coronary heart disease (CHD) increases by around 8%.

- Fat, especially visceral fat around the organs is associated with:
  - Raised cholesterol.
  - Raised blood pressure.
  - Type 2 diabetes.
- Increased waist circumference is as important as BMI.
- Especially high risk for certain ethnic groups- e.g. people of South Asian heritage.



‘Apple’ and ‘Pear’ fat.
Apple is worse. BHF.

Strong association between obesity and stroke, especially young stroke.

- Strongest association with increased waist-hip ratio (WHR).
- Also BMI.

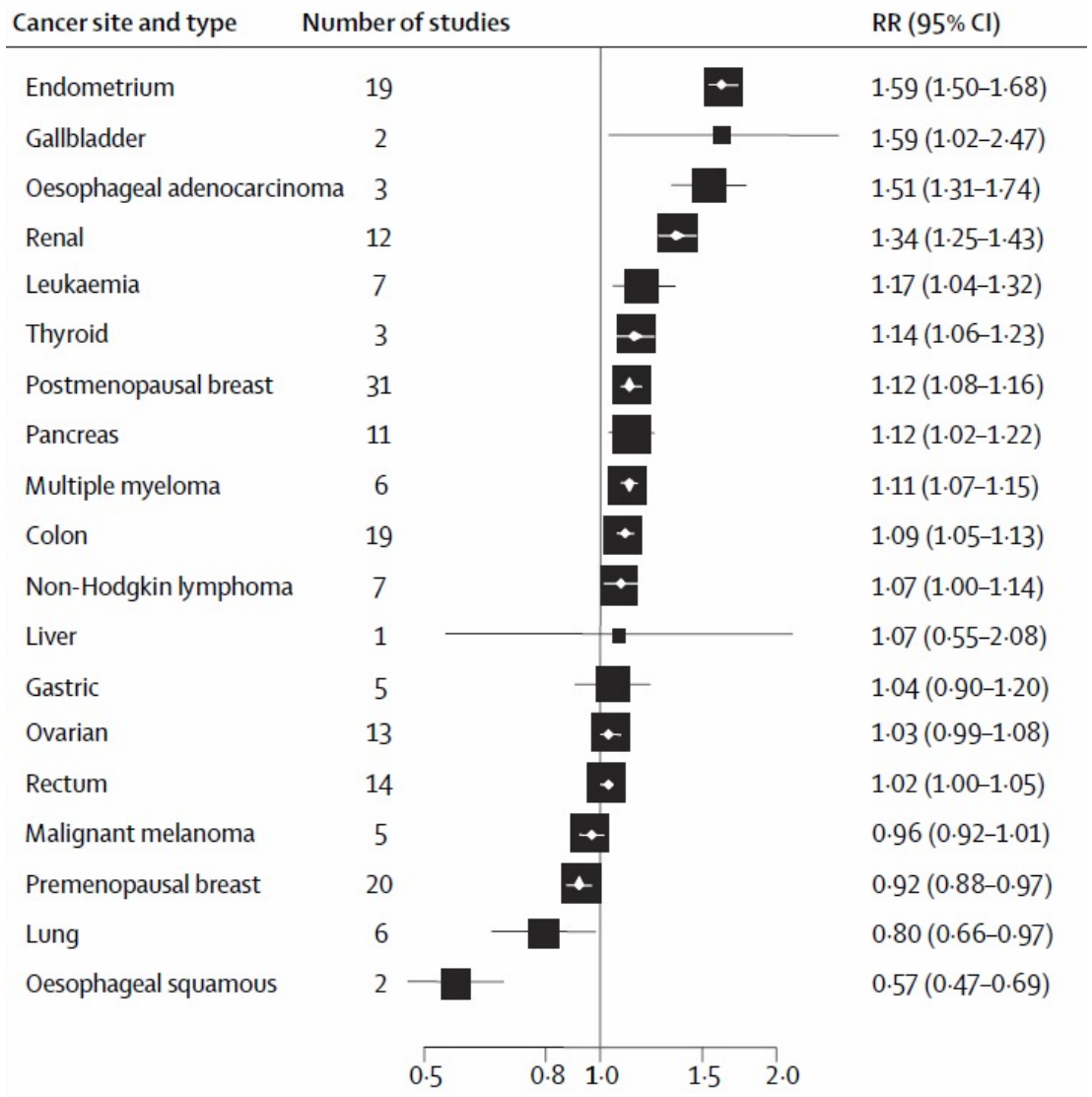
- One study from USA increased WHR (Suk et al):
- <65 years of age: OR, 4.4
- ≥65 years of age: OR, 2.2

Association between cancer and BMI. Data for women.

- Associations between increase in BMI and several cancers including:
- Endometrial (uterine) cancer.
- Oesophageal adenocarcinoma.
- Postmenopausal breast cancer.
- Renal (kidney) cancer.

Obesity/overweight is a significant risk for uterine/endometrial cancer- around 30% of cases.

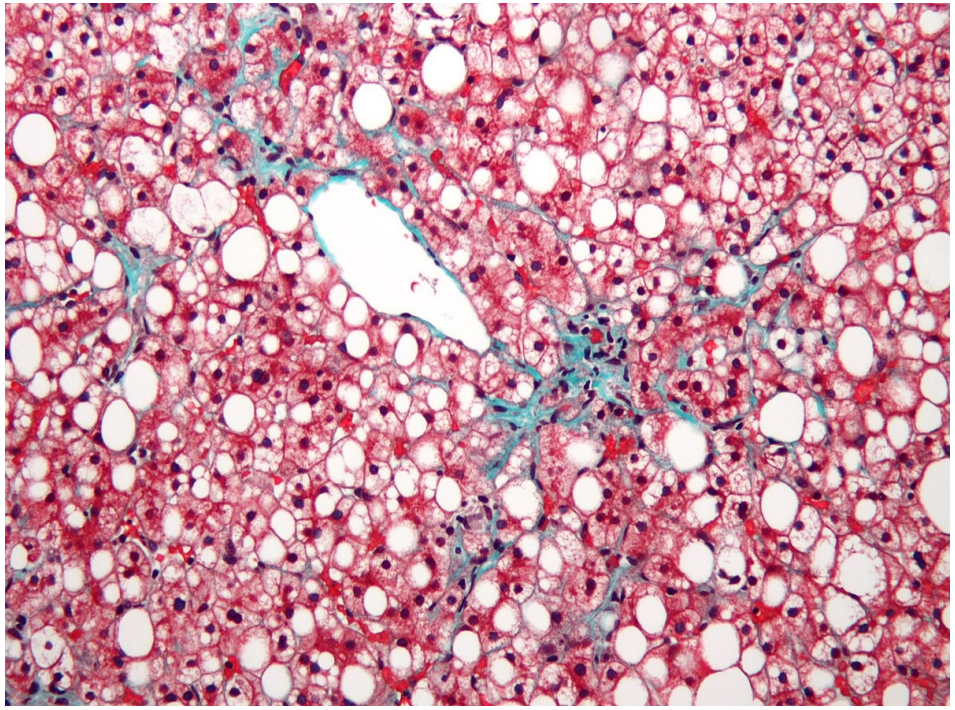
A modest risk for postmenopausal breast cancer- but breast cancer is common. Estimated 8% of cases.



Renehan et al 2008

Liver disease.

- Non-alcoholic fatty liver disease common with obesity.
- More dangerous non-alcoholic steatohepatitis (NASH).
- Can progress to cirrhosis, liver cancer.
- Second most common reason for liver transplant.



Non-alcoholic fatty liver disease.
Nephron/wiki

Obesity and pregnancy outcomes.

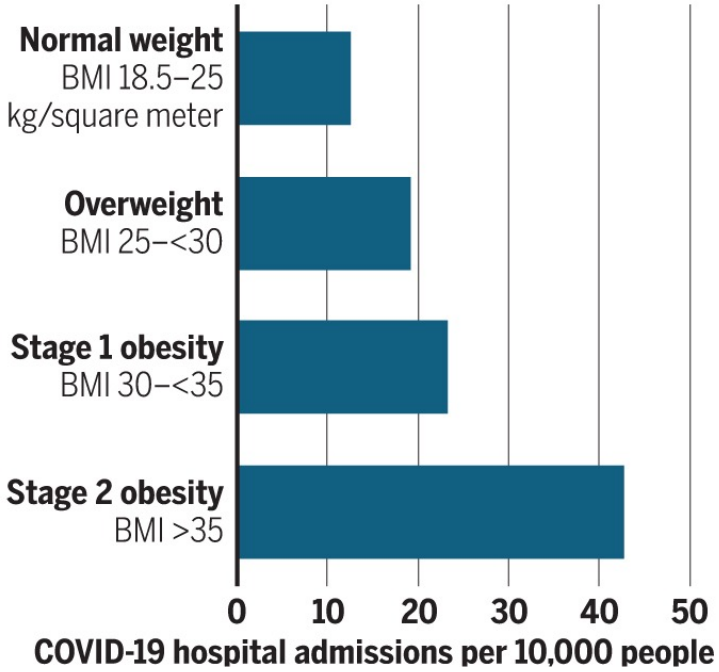
- Overall chance of miscarriage under 12 weeks is 1 in 5 (20%); if you have a BMI ≥30 kg/m^2, the chance is 1 in 4 (25%).
- Gestational diabetes.
- Blood clots.
- High blood pressure and pre-eclampsia.
- Difficulties during delivery.

Marcus Gheeraerts II 1620

Infections and obesity- COVID-19.

- A clear association between obesity and:
  - Admission to hospital with COVID-19.
  - Admission to ICU with COVID-19.
  - Dying from COVID-19.

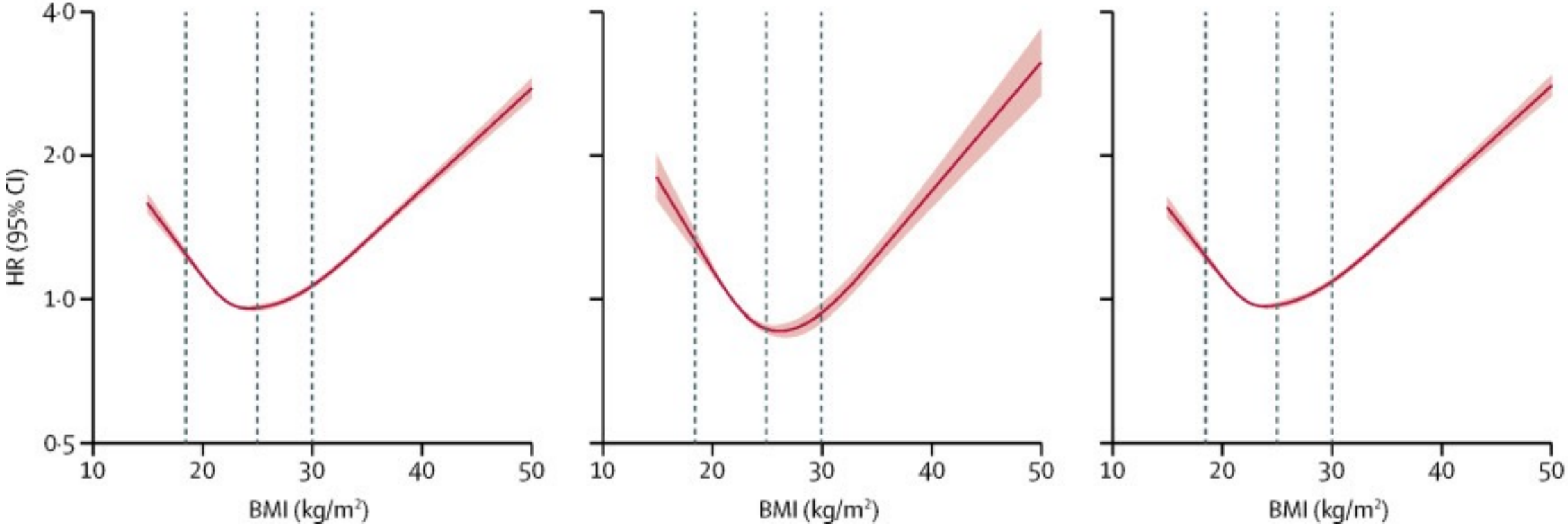
  - Countries with more obesity have had more deaths from COVID (WHO).



Study of 334,000 people in England. N. Desai/Science; (DATA) Hamer et al. PNAS.

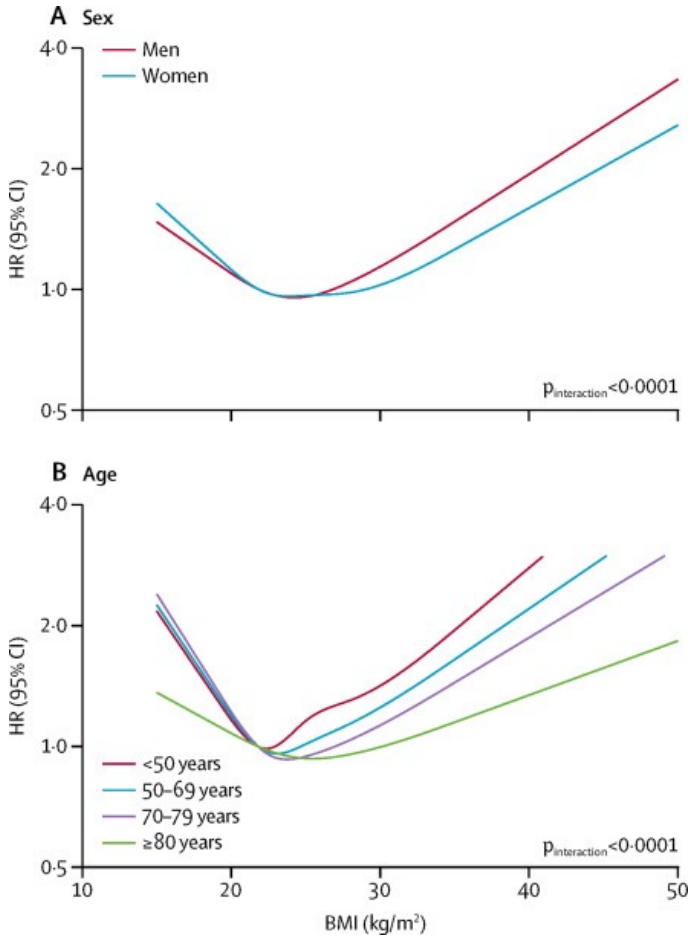
All-cause (L), communicable, non-communicable (R) association between obesity and mortality. Study of 1,969 648 people who never smoked in GP databases, UK.

Bhaskaran K et al 2018. Lancet Diabetes and Endocrinology.



An association between obesity and increased mortality irrespective of age, gender and smoking status.

- Overweight and obesity increasing in the UK and globally.
- Strong association with many poor health outcomes including cardiovascular, cancer, type 2 diabetes, pregnancy and mortality.
- This represents a major future problem for individuals, families, society and the NHS.



Bhaskaran K et al 2018. Non-smokers.

Recognising obesity is a major health issue is easier than tackling it. But we must. And there is a way through this.

- It is difficult for people to lose weight and sustain that loss. They need support.
- Overweight and people with obesity often feel highly stigmatised.
- Many people, especially those living in areas of deprivation, live in a highly obesogenic environment.
- A tendency to blame individuals for being relatively overweight is both unhelpful and scientifically wrong.
- Individuals, society, health services and industry all have a role to play.

Henry VIII c1520 (English School) and 1542 (H Holbein)

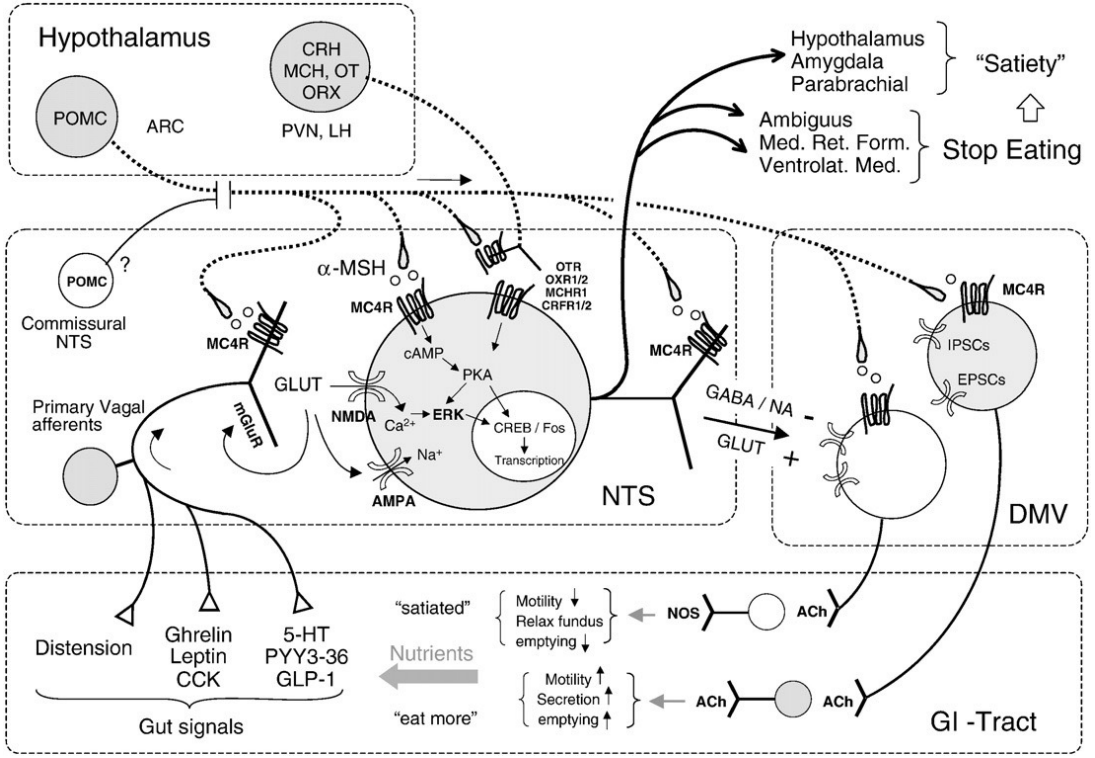
Why is obesity not universal?
Why has it increased over time?

- Obesity is, crudely,
  - calories in
  - and absorbed
  - compared to calories expended.

- Most people enjoy eating.
- The control of how much we want to eat, satiety, is highly regulated biologically.
- A strong genetic component.

Frans Snyders & Jan Wildens. *Fruit Stall.* Circa 1620.

The key to how much we want to eat is the brain, especially hypothalamus, and multiple systems which act on it.



Berthoud, HR. Regulatory peptides.

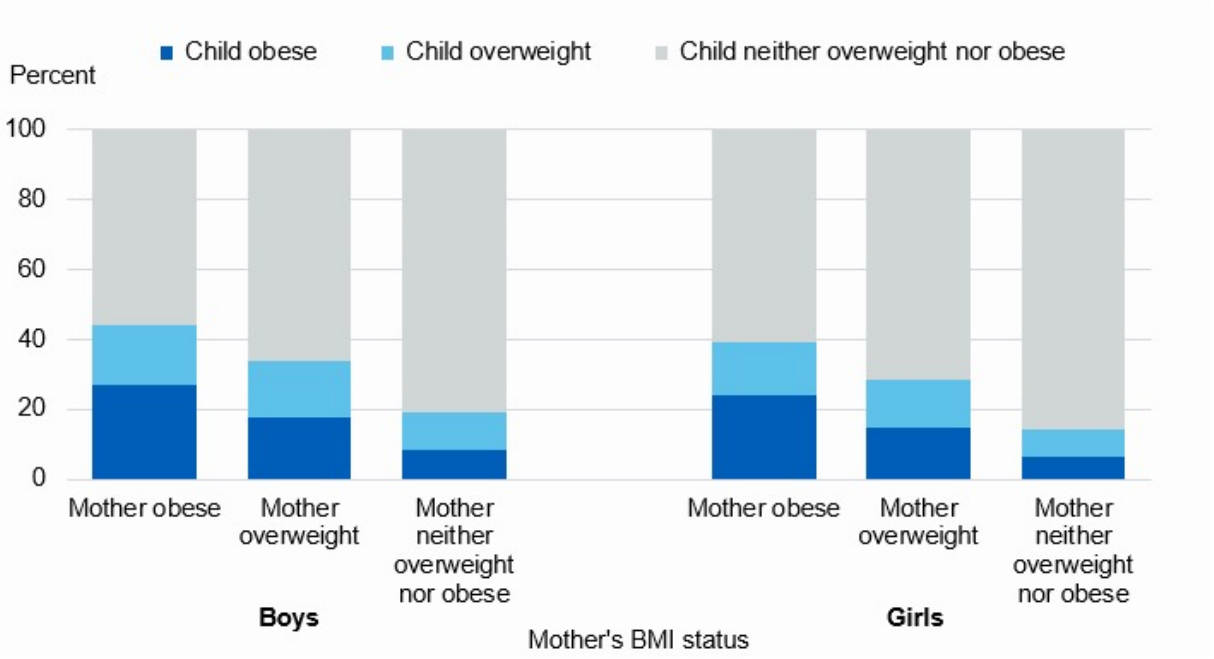
Strong genetic component.

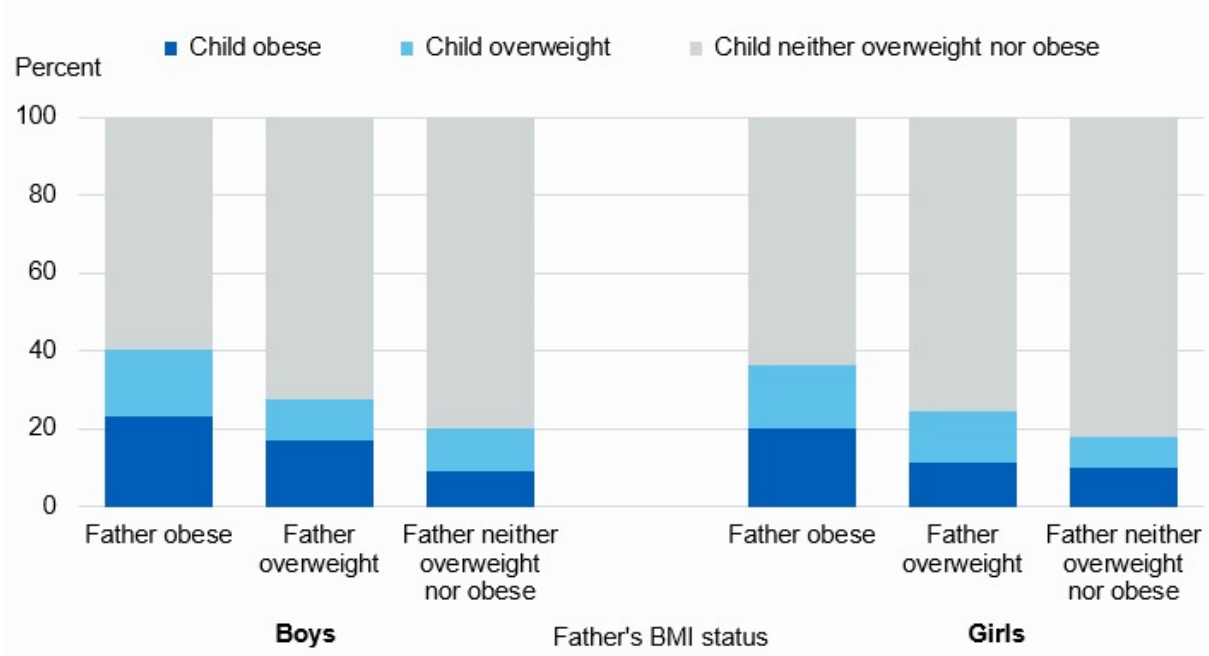
- At the extreme end the (v rare) Prader–Willi syndrome. Single chromosome (15). Constantly hungry.
- Multiple genes affect hunger and satiety.
- Polygenic control- a spectrum.
- Individual variation can largely be explained genetically.
- The multiple gut hormones and other feedback loops are drug targets.

- Several medical conditions, including hypothyroidism, cause weight gain.

Cortez F et al. PWS.

If mother or father are overweight or have obesity children more likely to as well. But many exceptions both ways. Genetic and social.





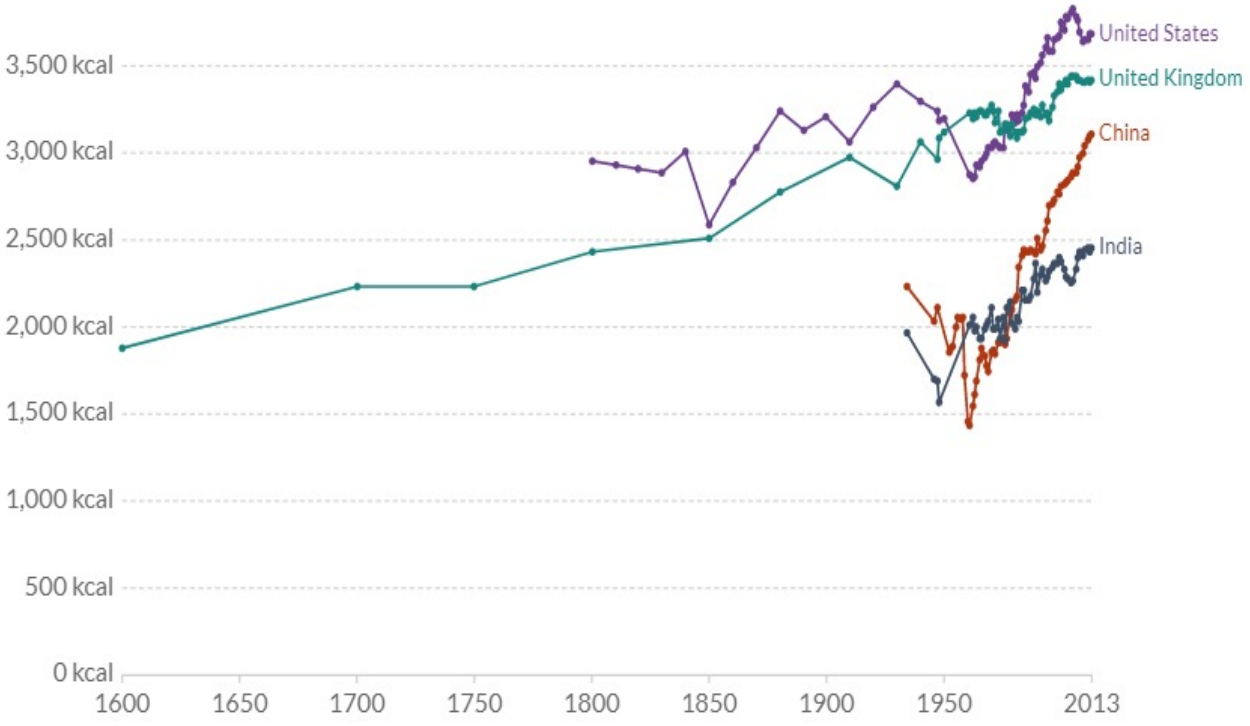
NHS Digital 2020

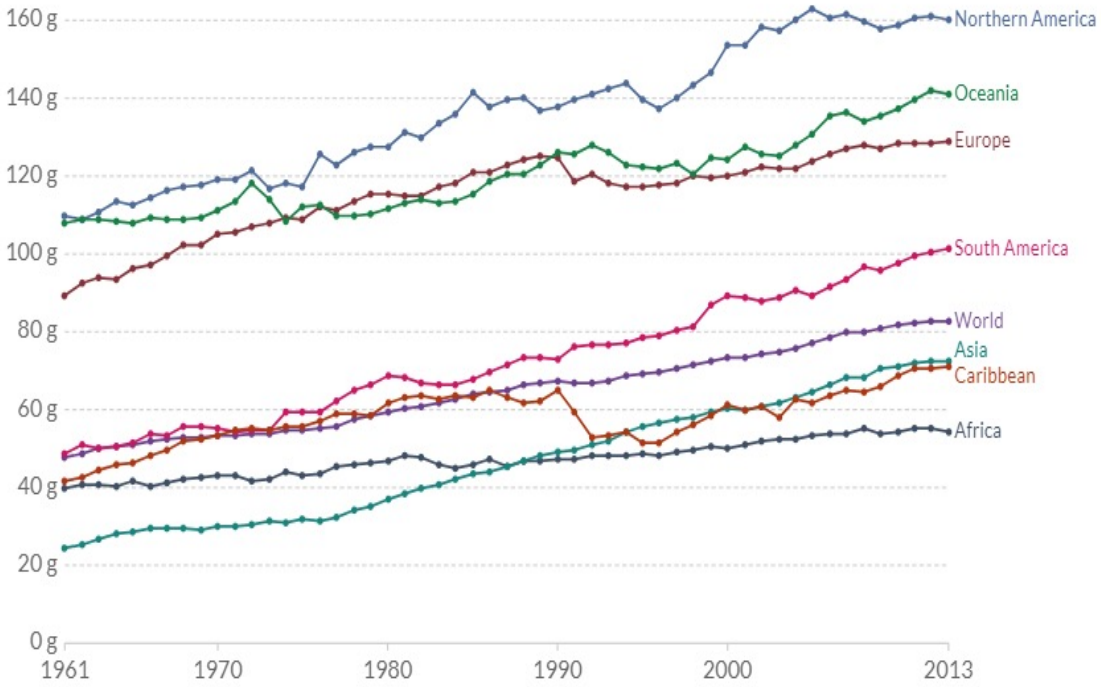
The body tries to hold on to weight gained.

- By lifestyle changes it is possible to lose significant amounts of weight.
- The body however responds to weight loss by ‘trying’ to get back to the previous, maximum weight.
- Someone who has lost weight can have a prolonged physiological response like a leaner person who is starving.
- This can lead to yo-yoing between obesity and healthier weight.

Early yo-yo 1791.

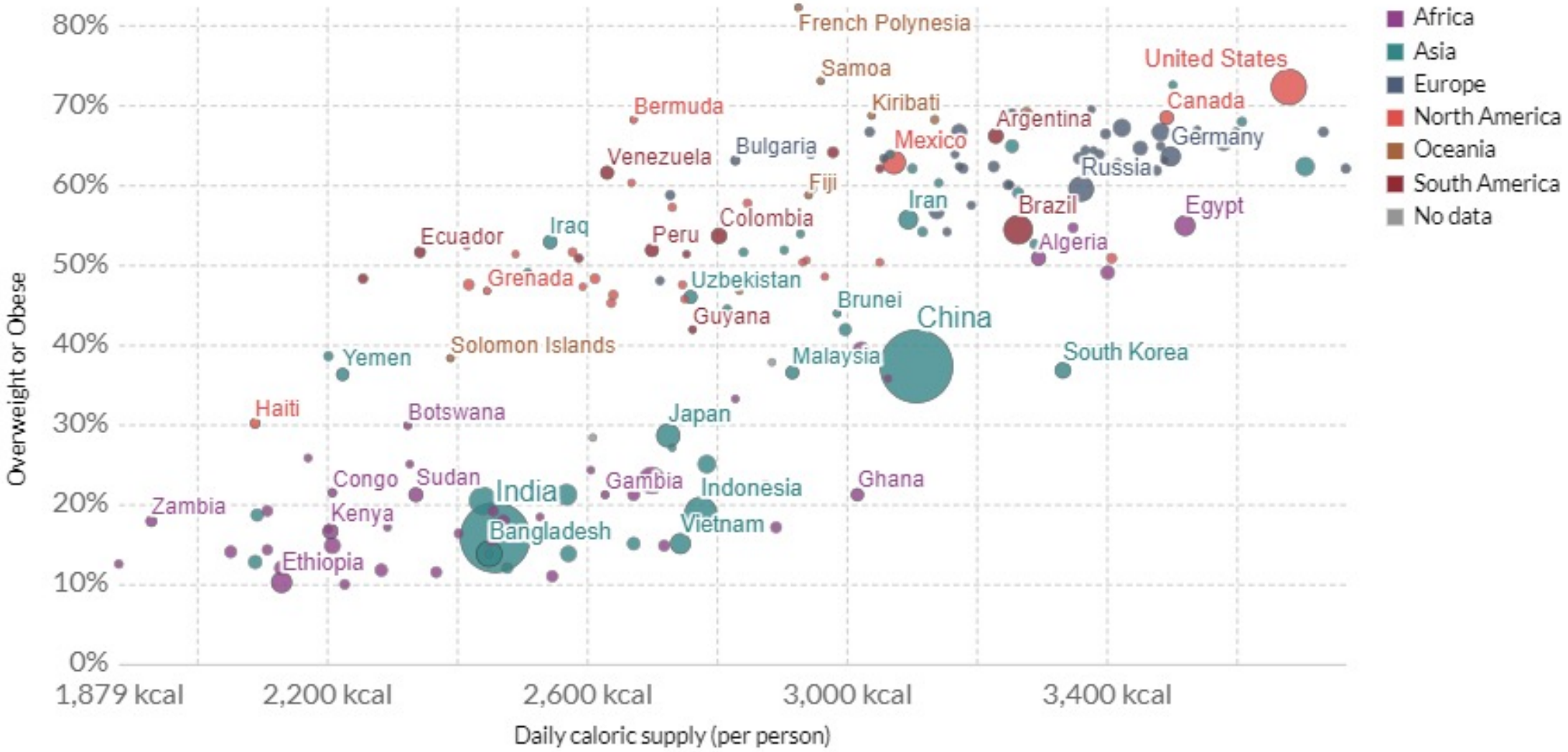
Total calories available (from 1600, L), and fat supply (from 1961) over time. Our World in Data / FAO





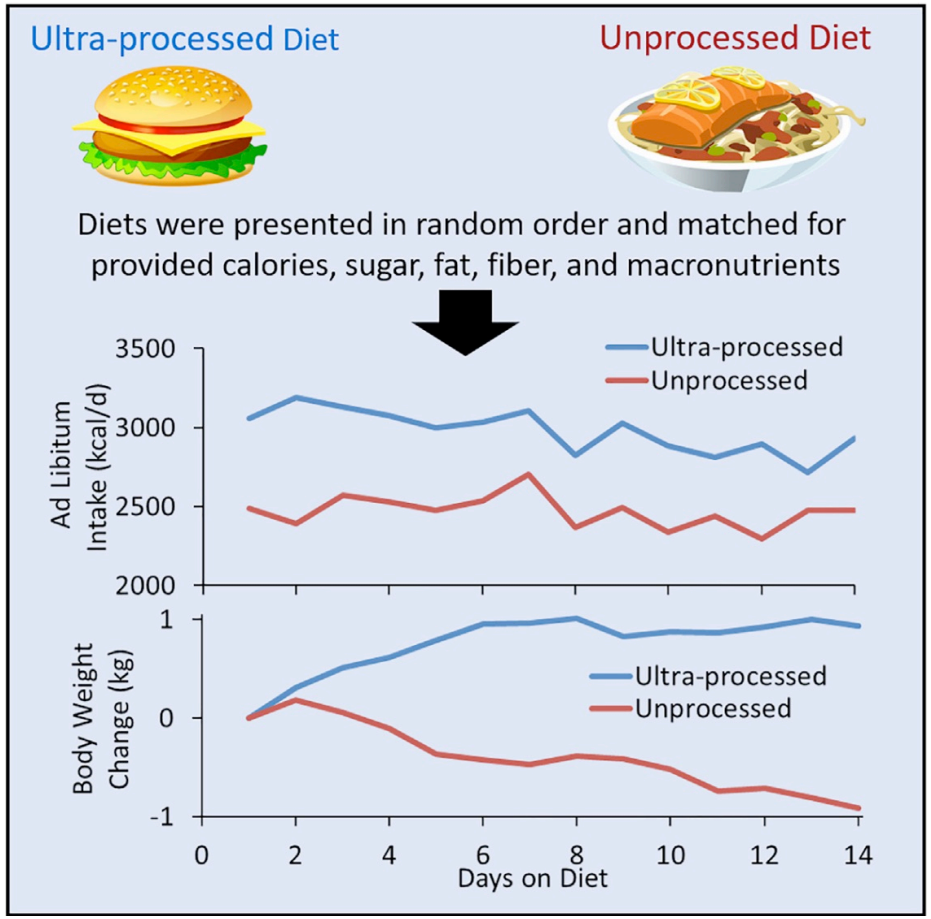
Share of men overweight/obesity v daily supply of calories.

Our World in Data / FAO / NCDRisk



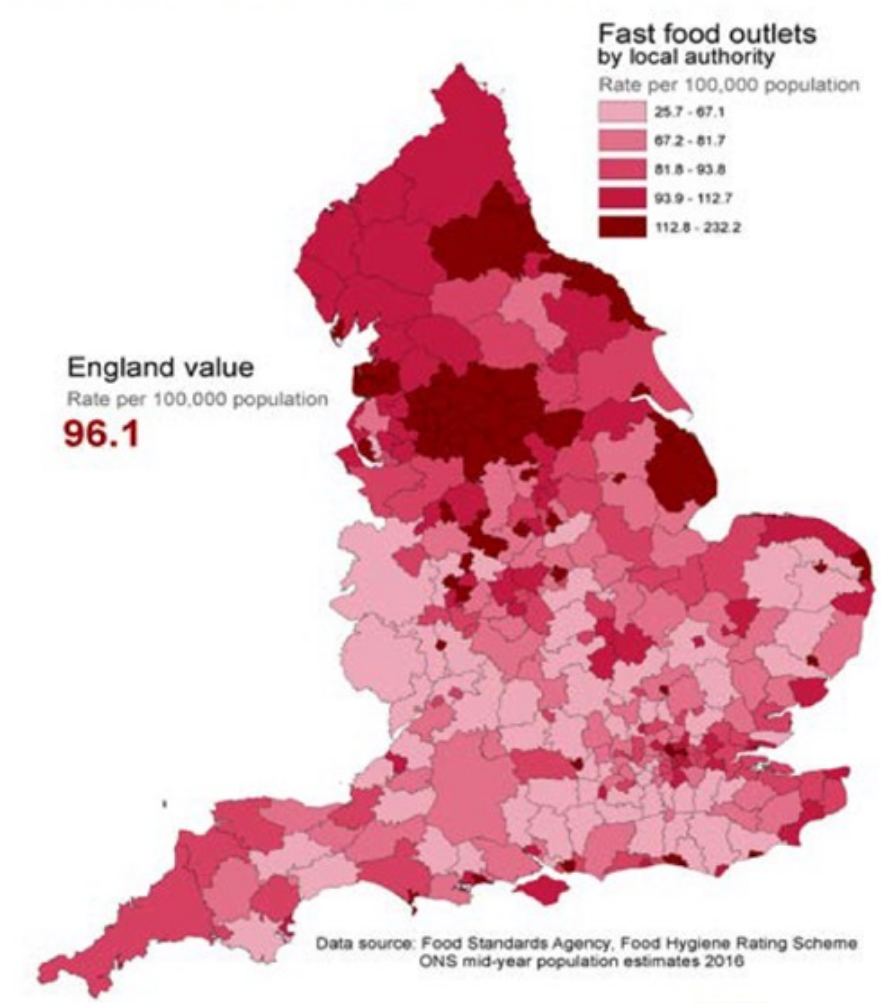
Ultra-processed foods lead to more weight gain per calorie ingested.

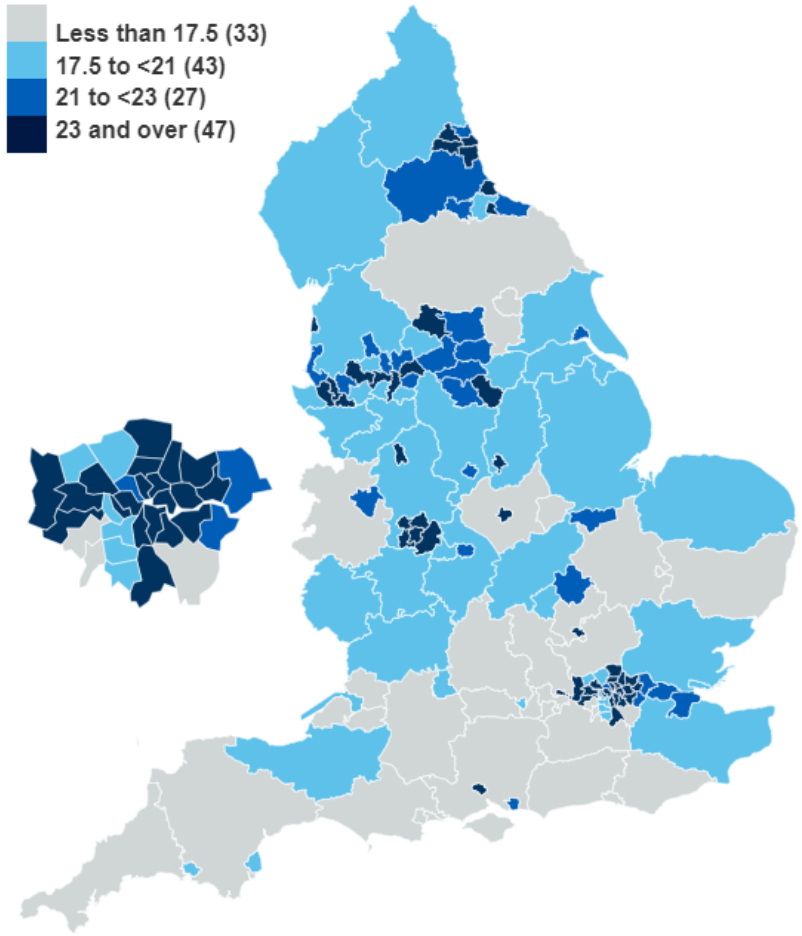
- It is possible to feel ‘full’ with the same number of calories, but ultra-processed food will lead to more weight gain.
- High calorie density.
- In unprocessed foods more calories simply pass through.



Hall K et al 2019

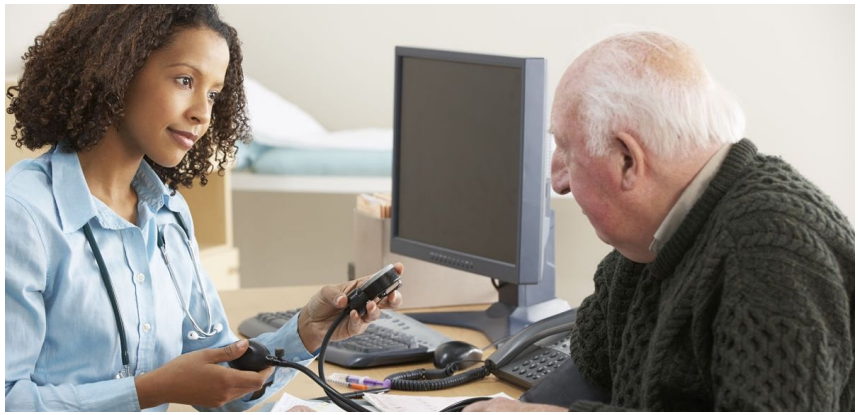
Child obesity prevalence Year 6 (R) and fast food outlets (L).





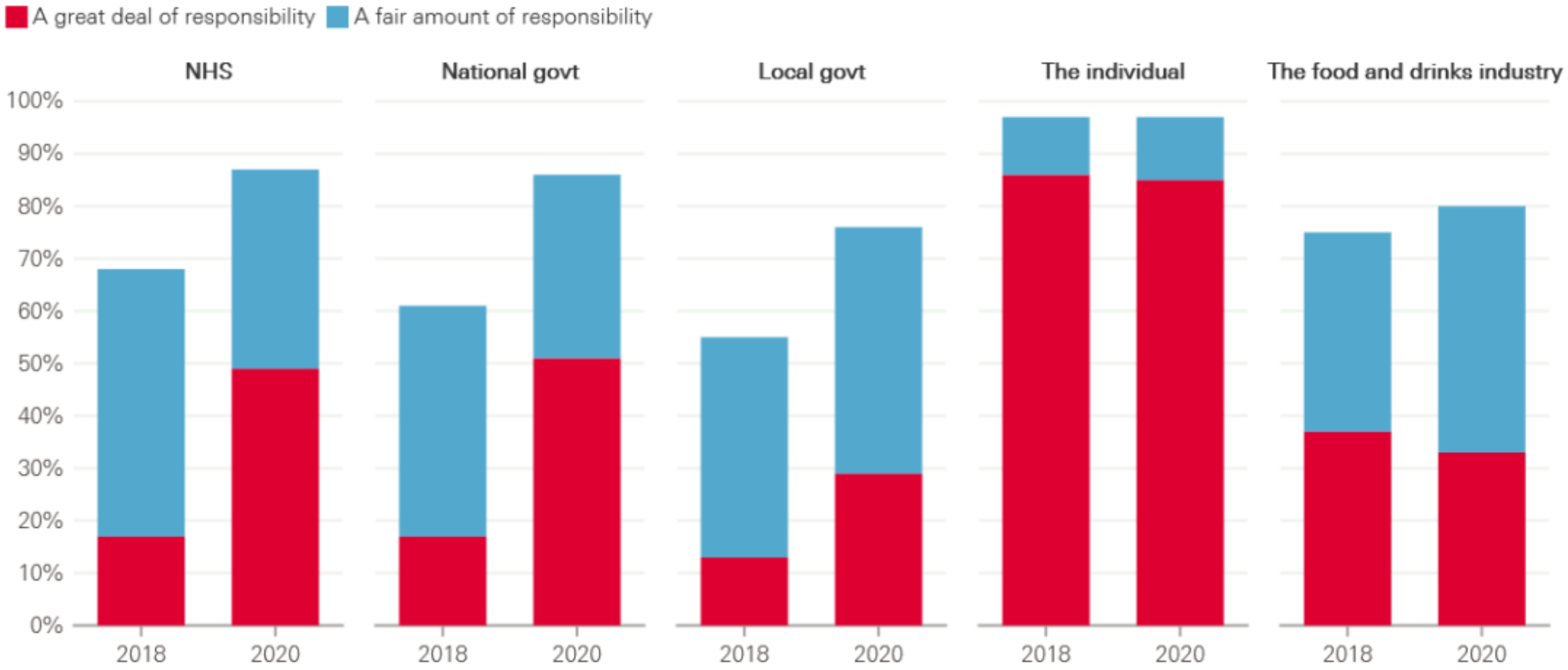
Individual medical practitioners- prevention and treatment.

- Primary care physicians (GPs) and specialists have the central role in secondary and tertiary prevention and treatment.
- Based on individual consent.
- Can give advice on not gaining weight, and losing it sustainably.
- Prescribe drugs and surgery in severe cases.
- Primary prevention mainly falls to the State.
- The role of the State in obesity is a contested area.



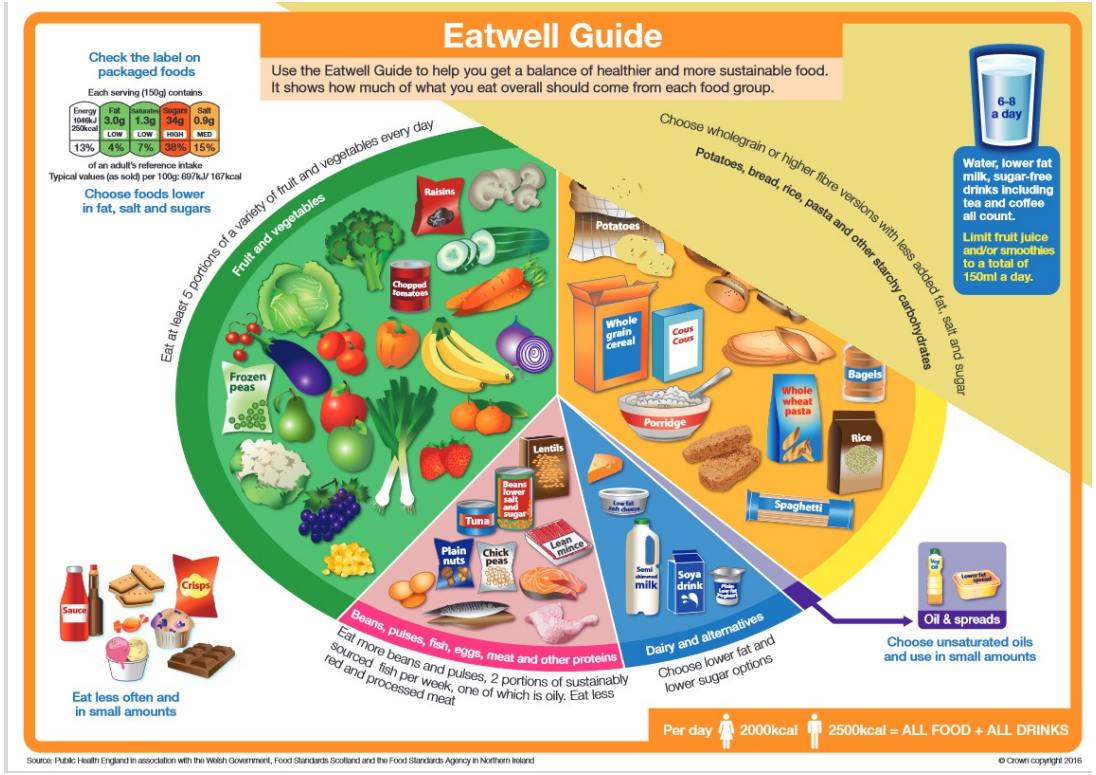
How much responsibility, if any, do you think that each of the following have for ensuring that people generally stay healthier?

Ipsos MORI poll for Health Foundation, May 2020.



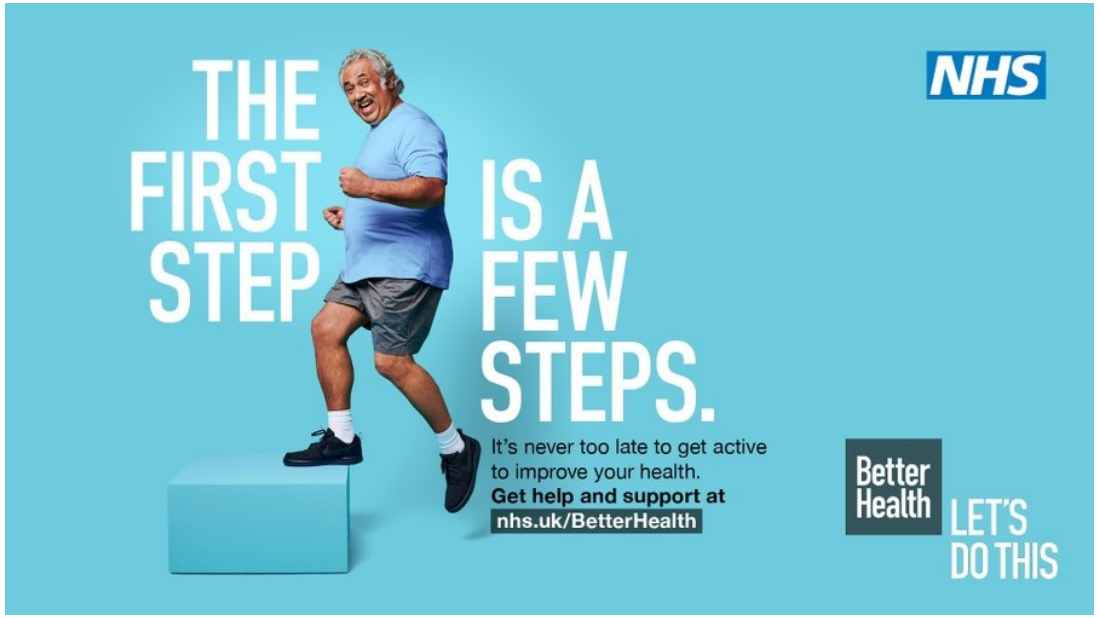
Helping individuals lose weight. Diet.

- Sustainable weight loss is possible, with substantial benefits.
- The key is to have calorie/fat intake lower than needed to maintain the current weight.
- 600 kcal/day deficit is ideal. Needs to be nutritionally balanced. And enjoyable.
- Usually better than ultra-low calorie diets.

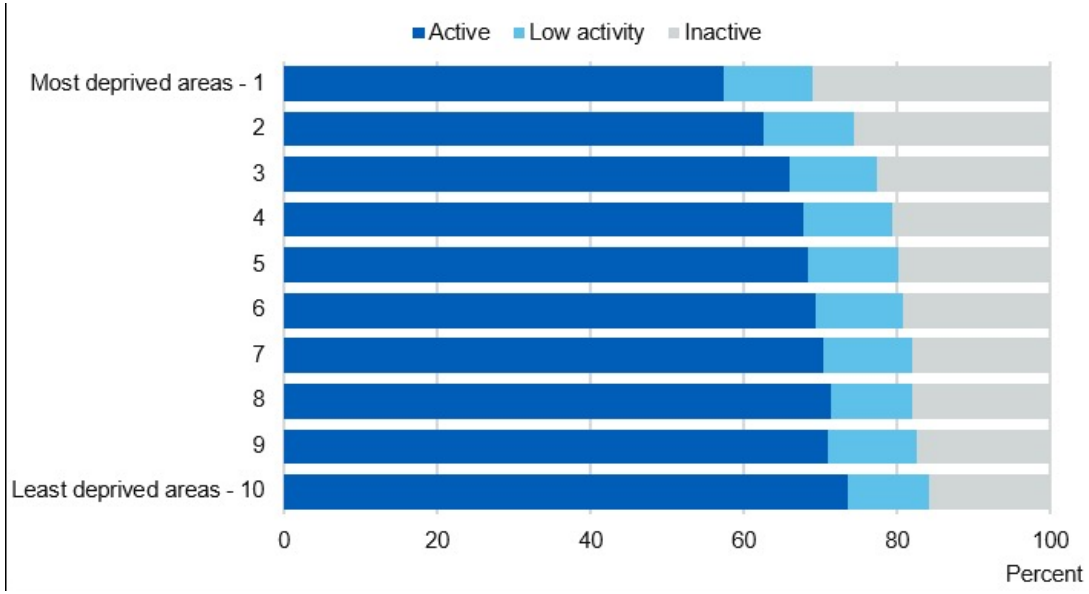


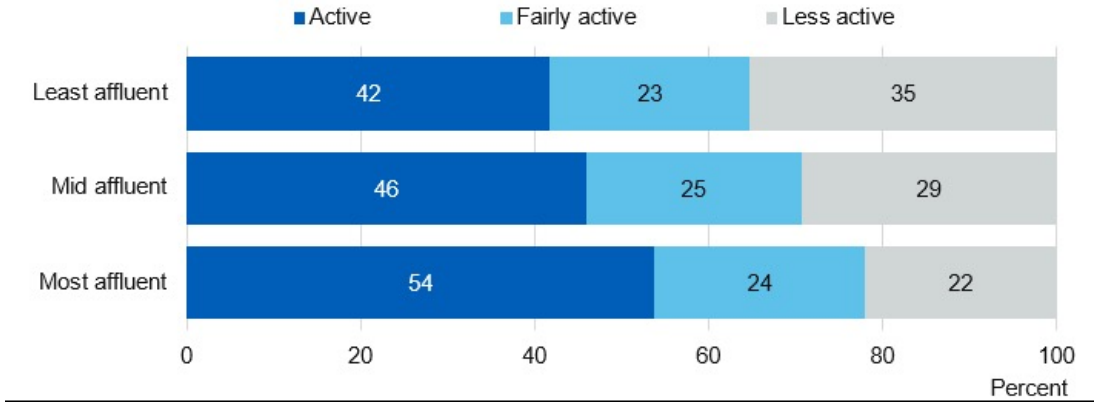
Reducing weight. Exercise.

- Exercise has an important role- but it is very difficult to lose weight once a person has developed obesity without reducing calories.
- To prevent obesity, most people may need to do 45–60 minutes of moderate-intensity activity a day.
- Exercise is however essential to wider health benefits, and can help keep weight down.



Physical activity and affluence.





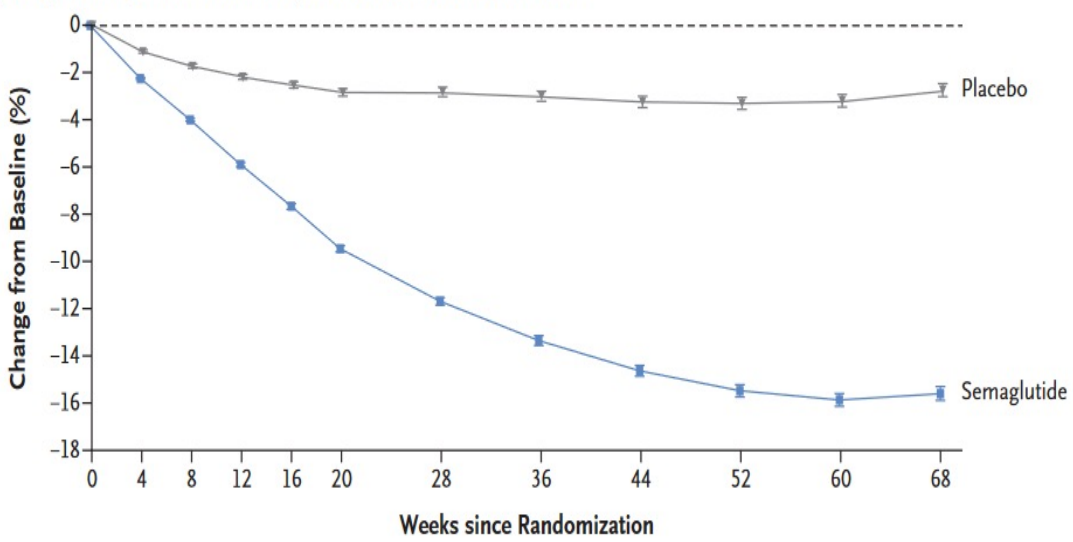
Adults. 73% active in the least deprived areas, to 57% in the most deprived areas. NHS Digital 2020

35% of children in the least affluent families do fewer than 30 minutes of activity a day, compared to 22% of children from the most affluent families. NHS Digital 2020

Drug treatments are advancing.

- Drug treatments exist, but many currently have limited efficacy or unacceptable side effects.
- Orlistat- stops around 1/3rd of fat being absorbed.
- This field is advancing rapidly. Example:
- Semaglutide, a glucagon-like peptide-1 (GLP-1) analogue used in type 2 diabetes has recently shown benefit. Reduces appetite.

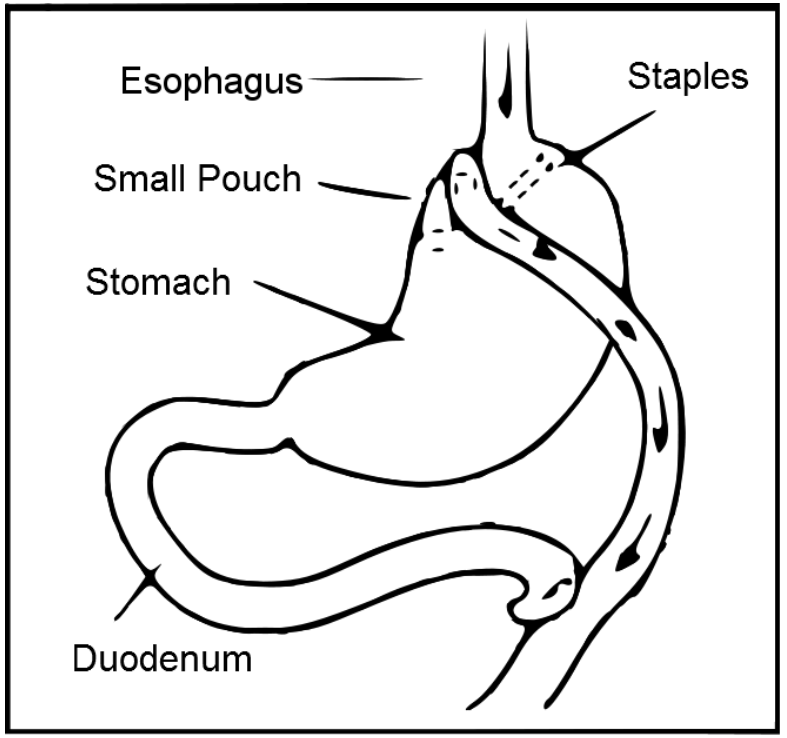
Body weight change from baseline. Semaglutide v placebo.



Wilding J et al. NEJM 2021

The most invasive treatment is bariatric surgery.

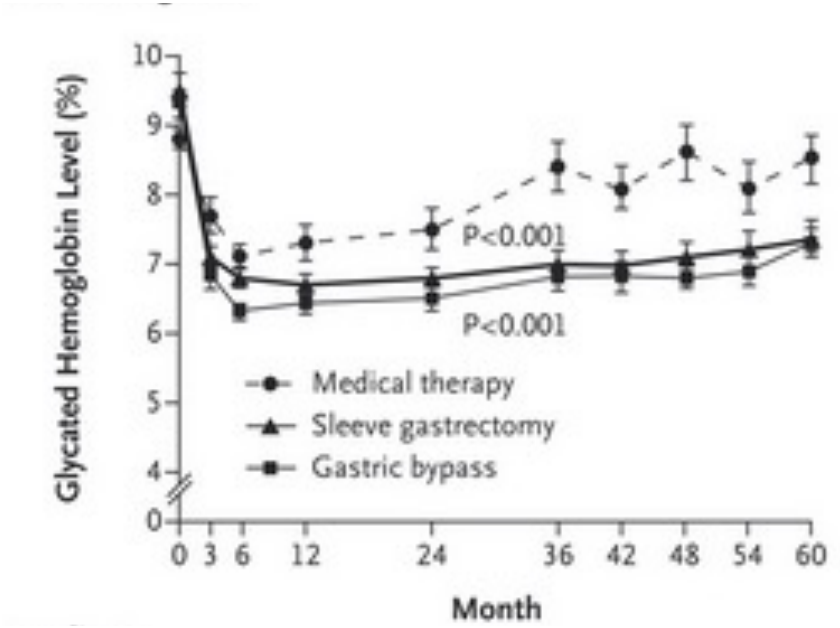
- Gastric band – a band placed around your stomach, so you do not need to eat as much to feel full
- Gastric bypass – the top part of your stomach is joined to the small intestine.
- Sleeve gastrectomy – some of your stomach is removed,.
- Change signals from gut that regulate appetite and glucose.



Roux-en-Y gastric bypass. NIH

Gastric surgery (bariatric surgery) effects.

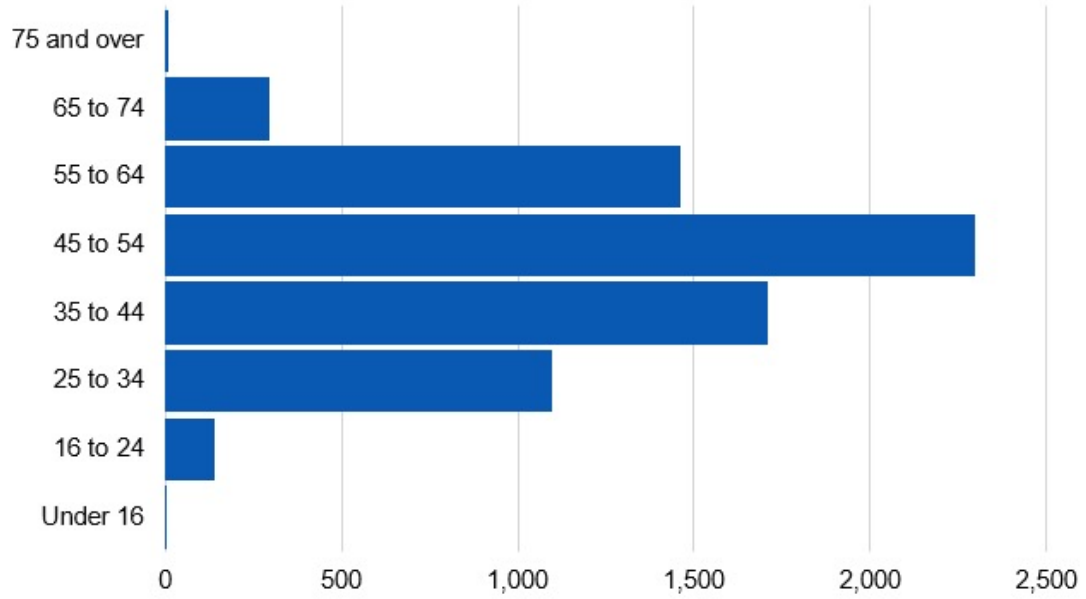
- In people with severe obesity bariatric surgery leads to weight loss.
- If they have Type 2 diabetes this often resolves, and the reduction in blood sugar is maintained.

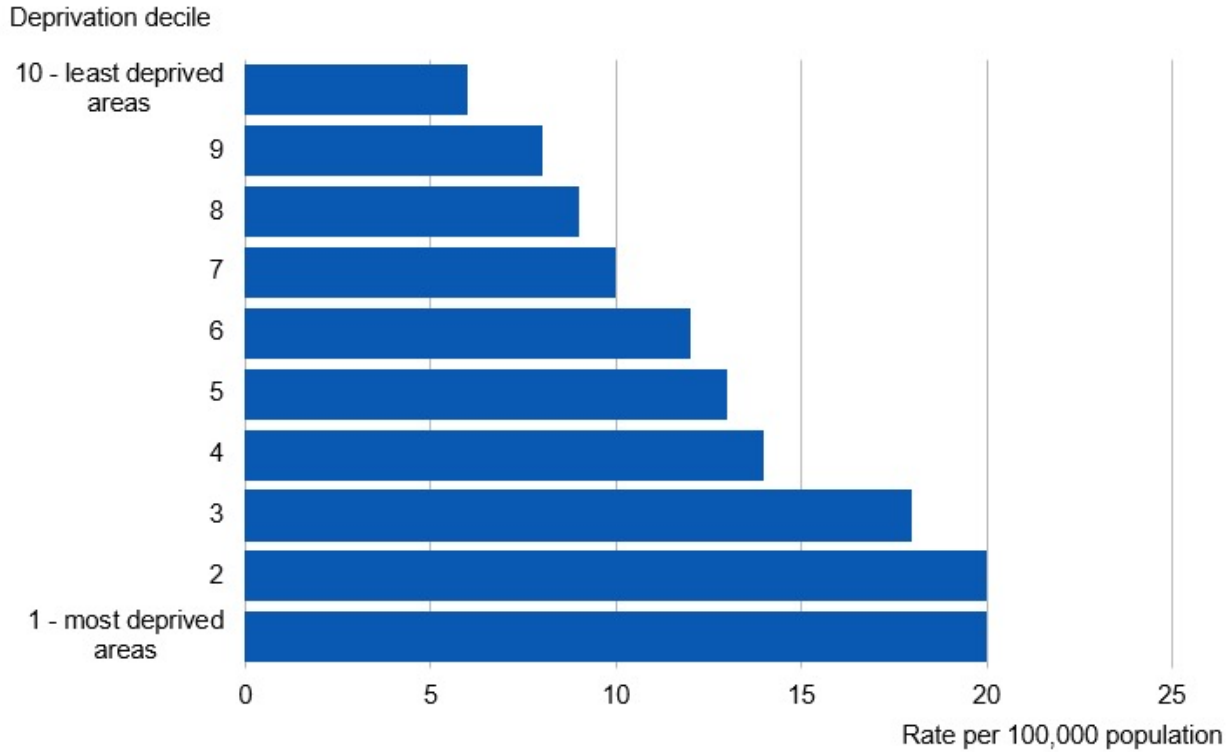


Schauer et al, NEJM 2017

Bariatric surgery by age and deprivation. NHS Digital 2020.

Over 3x more likely in most deprived areas.

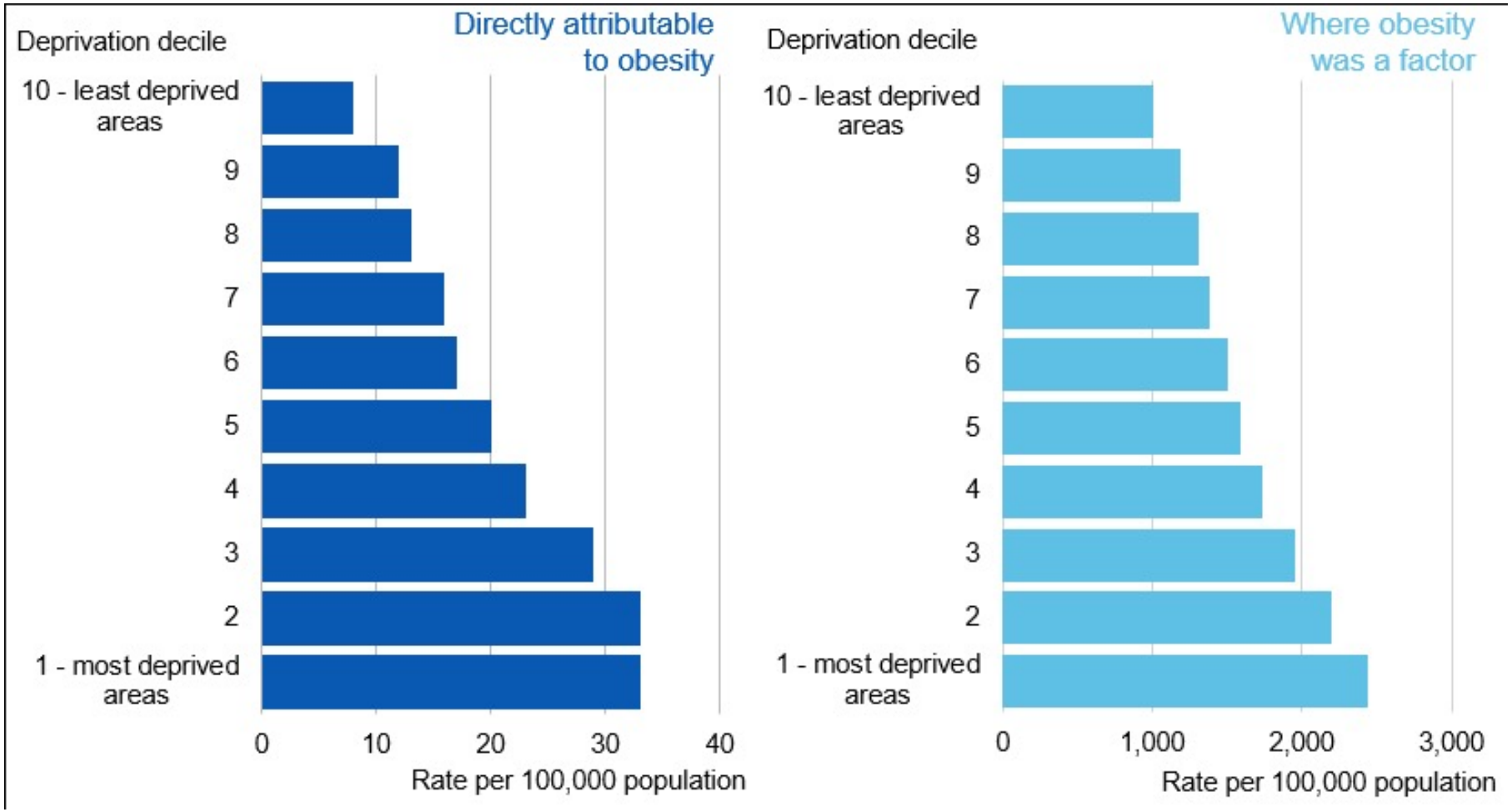




The ladder of possible State intervention.

- Make individual citizens subject to civil or criminal law.
- Ban.
- Tax heavily.
- Regulate.
- ‘Nudge’ tax or intervention.
- Mass voluntary programme (vaccination, screening).
- Engage with industry.
- Inform the public.
- Support science to test possibilities.

Hospital admissions directly attributable to obesity, or where it was a factor, by deprivation decile.



We, the public, need to engage with the food industry on this.
Pleasure, profits and health are not mutually incompatible.
But it needs a different approach.

My local supermarket.

Sponsorship in UK sport includes….

- Football Association: *McDonald's, Walkers, Snickers, Coca-Cola*
- English Football League: *Carabao, Papa John's, Ferrero*
- Champions League: *Walkers*
- British Olympic Association: *Coca-Cola, McVitie's*
- Rugby Football Union: *Red Bull, Britvic*
- Premiership Rugby: *Greggs*
- England & Wales Cricket Board: *KP Snacks*
- Wimbledon: *Haagen Dazs*
- Arsenal, Aston Villa, Chelsea, Leeds United, Liverpool, Manchester City and United, Sheffield etc. *Cadbury*.

The aim should be not to reduce enjoyment, but to reduce unnecessary energy (esp. sugar and fat) intake.

And ultraprocessed foods can increase weight with the same calories.

0g fat

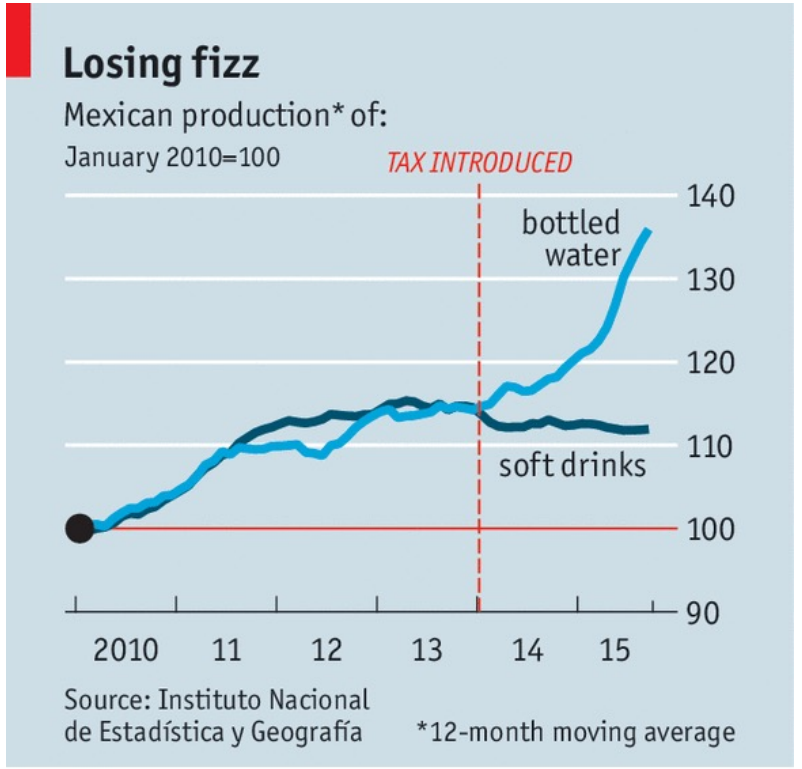
8.5g fat

Diabetes.co.uk. 2015

We need multiple interventions, each with modest incremental impact. We do not yet know the optimal mix.

Examples of *possible* State interventions include:

- Traffic light labelling of high calorie foods.
- Restricting direct advertising to children.
- Restricting sports advertising of high calorie low nutritional value food.
- Restricting fast food outlets near schools.
- Sugar levy on highest calorie soft drinks.
- Lower taxes on lower calories.

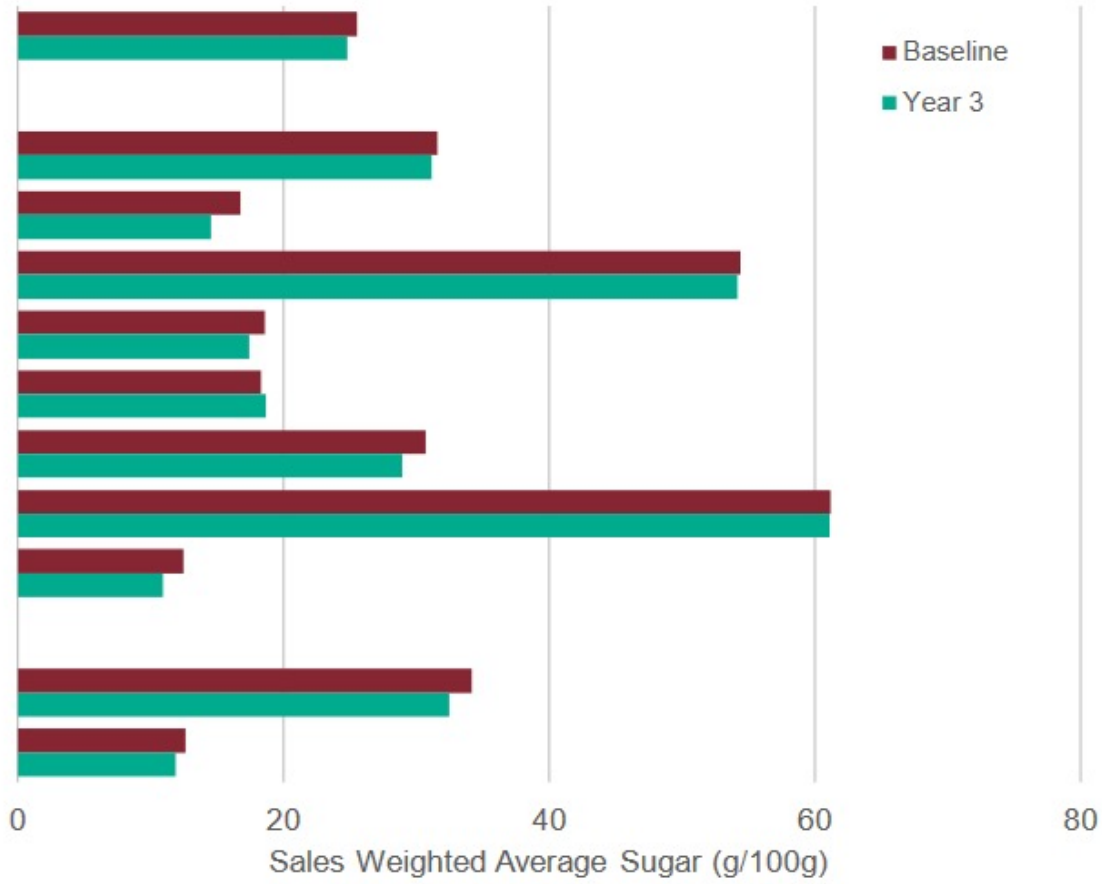


Use of State powers is *always* a political question.

Economist

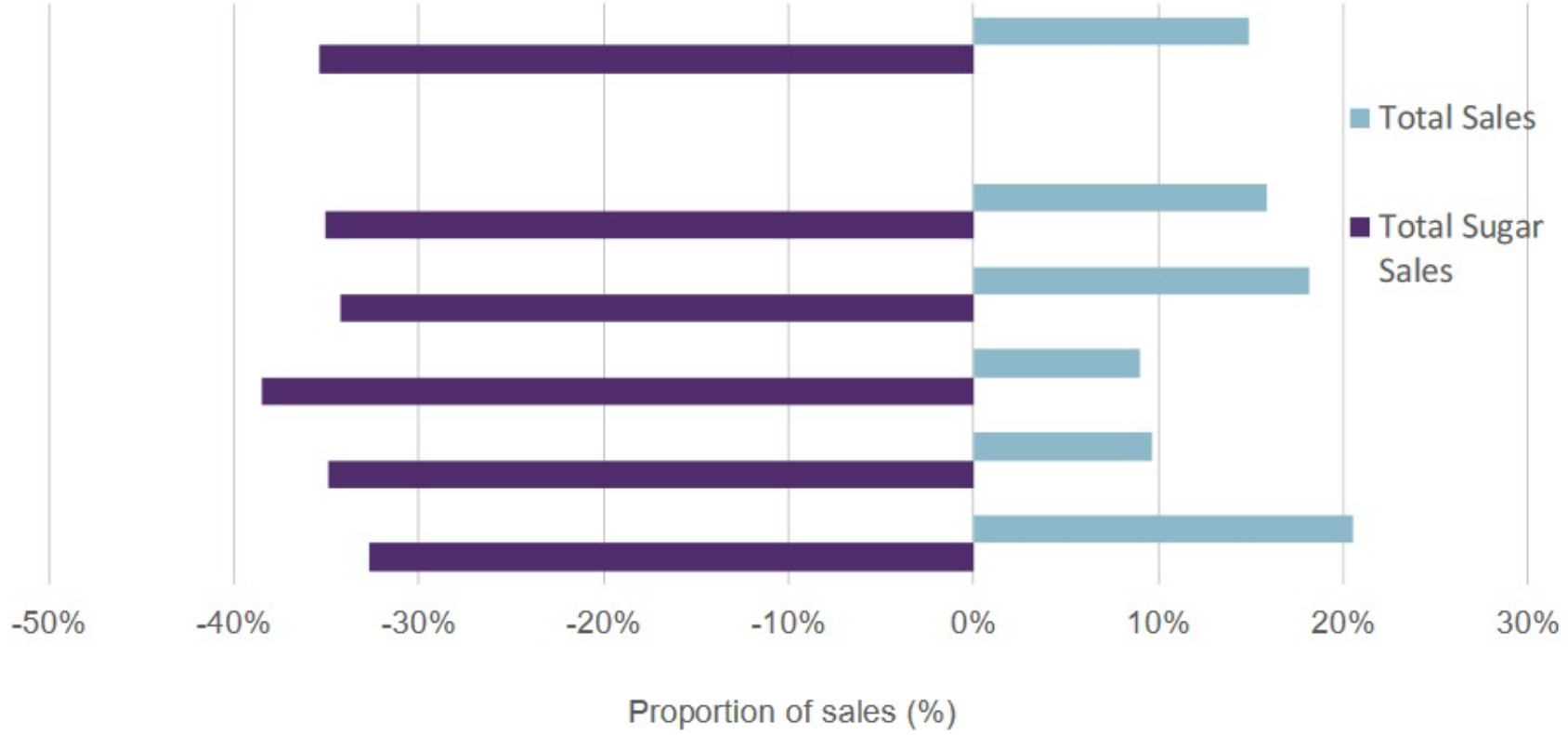
Voluntary agreements have some effects, but should not be exaggerated. Sales-weighted average total sugar g/100g 2015-19. Breakfast cereals, yoghurts and spreads saw significant falls.

	Baseline	Year 3
Overall	**25.6**	**24.8**
Biscuits	31.6	31.1
Breakfast Cereals	16.7	14.5
Chocolate Confectionery	54.4	54.2
Ice Cream, Lollies and Sorbets	18.6	17.4
Puddings	18.3	18.7
Sweet Spreads and Sauces	30.7	29.0
Sweet Confectionery	61.2	61.1
Yogurts and Fromage Frais	12.5	10.9
Cakes	34.1	32.5
Morning Goods	12.6	11.9



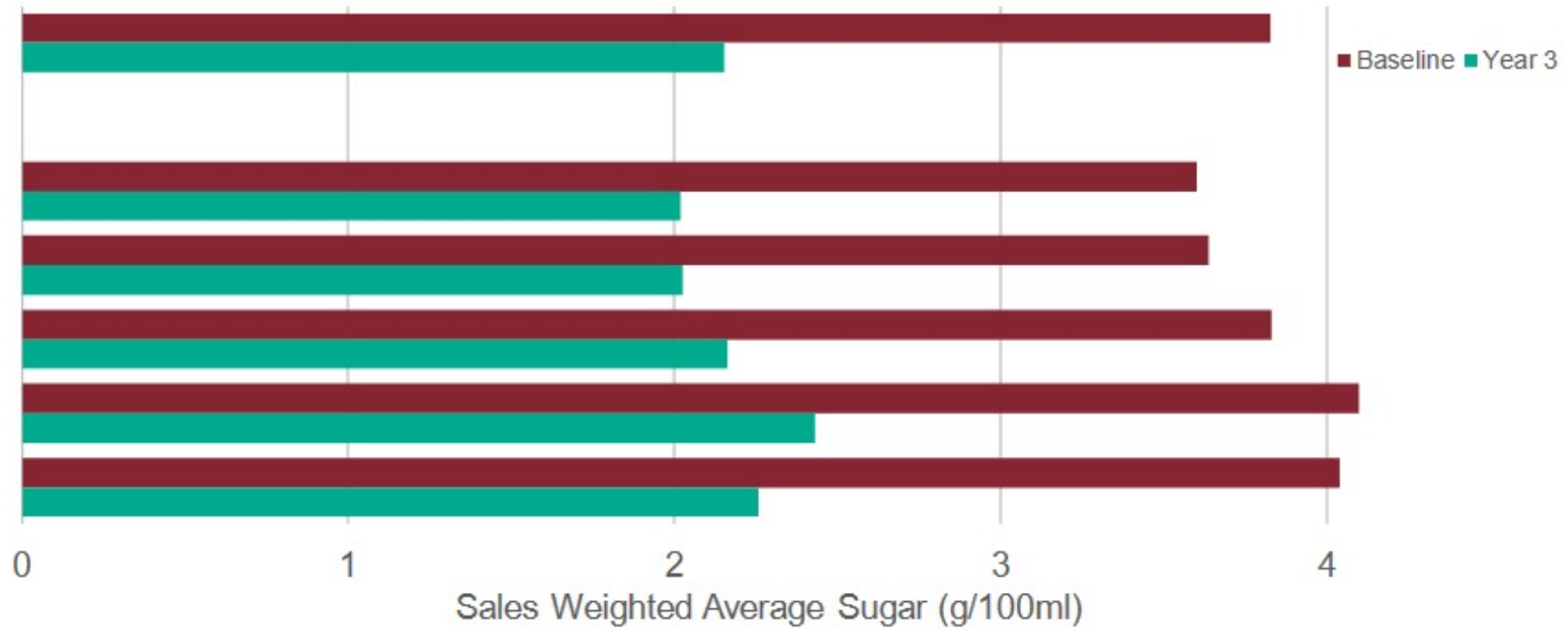
Soft drink sugar levy on higher sugar drinks. Sales increased 15%, total sugar decreased by 35% (135,501 2015 to 87,600 tonnes 2019).

	Total Sugar Sales	Total Sales
All	-35.4%	14.9%
AB	-35.1%	15.9%
C1	-34.2%	18.1%
C2	-38.5%	9.0%
D	-34.9%	9.6%
E	-32.7%	20.5%



Sales weighted average total sugar, 2015 v 2019.

	Baseline	Year 3
All	3.8	2.2
AB	3.6	2.0
C1	3.6	2.0
C2	3.8	2.2
D	4.1	2.4
E	4.0	2.3



Obesity has increased and is increasing.

This lecture has covered:

- Epidemiology of obesity.
- Health impacts.
- Interventions at an individual level.
- Interventions at a societal level.

Balzac by A. Rodin, 1893.
Sailko