The £2 billion NHS windfall: Why meat reduction matters

January 2024

Conservative Animal Welfare Foundation

EXECUTIVE SUMMARY

In 2024 Britain faces key challenges in meeting our environmental targets and continually improving the health of the British people. At the same time, spiralling health costs and a tough economic climate mean that the government and the average family must do more with less.

We propose that modest reductions in how much meat British citizens eat can provide strong benefits in all of these areas. This report aims to educate both policymakers and the public alike on the personal and societal benefits to eating even a fraction less meat. In this way we hope individuals can be free to make informed choices about their diets.

We review the latest literature in public health, climate science, economics, and behavioural science and model the potential benefits to Britain of several meat-reduction scenarios. We estimate cost savings to the NHS from reductions in deaths from key lifestyle diseases worsened by high meat diets, such as cardiovascular disease, type 2 diabetes, obesity and cancer.

Our major findings include:

- If the British population ate meat-free lunches on weekdays, improved health could save the NHS as much as £2.2B annually.
- Reducing British meat consumption by 10% (e.g. eating 2 fewer packs of sausage per family per month) would offset the emissions of 16% of the cars on UK roads.
- Far from plant-forward diets being out of reach of everyday people, the average British household could replace 20% of their meat consumption while saving over £130 annually.
- Implementing meat-free defaults in public catering – a low cost and unobjectionable intervention – would save the NHS £74M a year.

1. BACKGROUND

In 2024, Britain faces a dual set of challenges: while many key global issues are getting worse, the country has less and less money to tackle them with.

It is no secret that NHS budgets are tight, and there is a pressing need to cut costs while maintaining a world-leading standard of care. Particularly, lifestyle diseases like cancer, diabetes, cardiovascular disease (CVD) and obesity are key problems. One in 10 Brits over the age of 40 now have type 2 diabetes, and the number of diabetes diagnoses is set to rise to 5.5 million people[1]. Cancer will claim 28% of British citizens[2]. Since 1993 the proportion of adults in England who are obese has risen from 14.9% to 28.0%[3].

Increases in these diseases have also brought rising costs. For example, cancer costs for the NHS have increased by an estimated 9% every year[4] for the last 10 years. Recently, it was estimated that each obese person costs the NHS as much as 1.5-2[5] people of a healthy weight. It is clear that new approaches are needed to drive new efficiencies and keep ballooning healthcare costs under control.

Additionally, progress on the UK's climate goals have been slower than desired[6], raising concerns around our targets of a 68% reduction of CO2e by 2030 and net 0 by 2050. To keep us on track, all practical, effective options must be explored.

[1] Diabetes UK. (2019, February 27). New figures show rise in diabetes rates across London. Available at https://www.diabetes.org.uk/in_your_area/london/london-region-news-/new- figures-rise-diabetes [2]Computed as 149,652 deaths out of 533,253 total. Data is from the 2017 dataset; cancer deaths listed as 'neoplasm'. See Office for National Statistics. (2018, Jult 18). Death registrations summary tables - England and Wales. Available at https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/datasets/deathregistrationssummarytablesenglandandwalesreferencetables

[3] Baker, C. (2023). Obesity statistics. House of Commons Library. See p4. Available at https://researchbriefings.files.parliament.uk/documents/SN03336/SN03336.pdf

[4] Cancer Research UK. Achieving world-class cancer outcomes: A strategy for England 2015–2020. See p76. Available at https://www.cancerresearchuk.org/sites/default/files/ achieving_world-class_cancer_outcomes_-_a_strategy_for_england_2015-2020.pdf

[5] The Guardian. (2023, May 18). Obese patients cost NHS twice as much as those with healthy weight, study says. Available at https://www.theguardian.com/society/2023/may/18/ obese-patients-cost-nhs-twice-much-healthy-weight-study

[6] UK Climate Change Commission. (2023). Progress in reducing emissions: 2023 report to Parliament. Available at https://www.theccc.org.uk/publication/2023-progress-report-to-parliament/

Lastly, the economic climate of the past few years means British families are feeling the pinch. Year-on-year inflation topped 9.6% in October 2022[7], and though it is falling, was still at 4.7%[8] a year later. The ONS reports[9] that last year, 35% of Brits were forced to reduce spending on essential items, some 14 million people.

This report argues that modest reductions in meat consumption can substantially help to alleviate all of these problems. If Britain consumes less meat, British citizens will be healthier and wealthier, British institutions will save money, and the country will be a big step closer to meeting its climate goals.

Our proposal is backed by the latest in scientific and economic research, which we detail below. Additionally, to demonstrate the potential benefits to Britain, we have constructed bespoke economic models to estimate savings for the NHS and British households, and the reductions in greenhouse gas emissions that could be achieved. We outline five feasible scenarios for meat reduction, from families eating two fewer packs of sausages per month, to changing the default food option in public catering to meat-free.

[7] Office for National Statistics. (2023, January 18). Consumer price inflation, UK: December 2022. Available at https://www.ons.gov.uk/economy/inflationandpriceindices/bulletins/consumerpriceinflation/december2022
[8] Office for National Statistics. (2023, November 15). Consumer price inflation, UK: October 2023. Available at https://www.ons.gov.uk/economy/inflationandpriceindices/bulletins/consumerpriceinflation/october2023
[9] Office for National Statistics. (2022, August 05). What actions are people taking because of the rising cost of living? Available at https://www.ons.gov.uk/peoplepopulationandcommunity/personalandhouseholdfinances/expenditure/articles/whatactionsarepeopletakingbecauseoftherisingcostofliving/2022-08-05

In this section, we review the evidence for our claims that meat reduction will reduce NHS costs by making the UK population healthier, reduce the UK's environmental impact, and save UK households money.

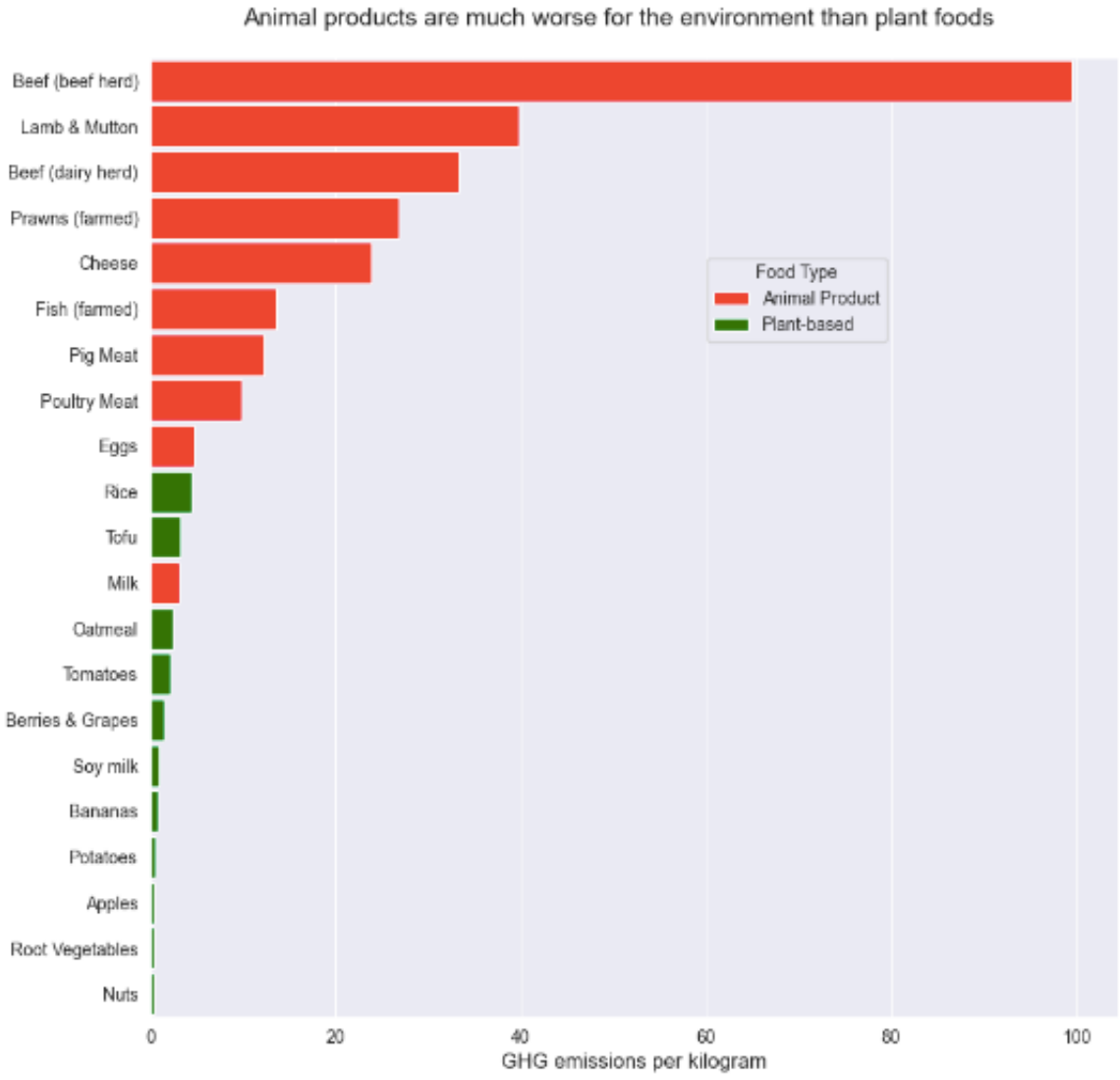
2.1 The Environment

Meat is one of the biggest sources of greenhouse gases in developed economies. The UN estimate that 30-40% of human-caused methane emissions come from our farm animals[10]. While meat and dairy provide just 18% of our calories and 37% of protein, it produces 60% of agriculture's greenhouse gas emissions[11]. A kilo of beef emits 216 times more CO2 equivalents than a kilo of potatoes, and even fish emit 30 times more[12]. While some have argued that better farming practices can reduce meat's environmental impact, the best meat for the environment still emits more Co2e per kilo than the least sustainable plant foods[13]. In 2019 The EAT-Lancet commission gathered 37 of the world's top experts in the health and environmental impact of food to identify an environmentally sustainable diet for our planet[14]. Their dietary guidelines, based on unassailable amounts of evidence, argue that we need to make strong cuts to our meat consumption[15].

The good news from this research is that it means even small reductions in meat consumption can help Britain make substantial progress towards its climate goals. In fact, British citizens do not have to completely give up meat in order to reduce the cost of addressing climate change by up to 50%[16].

[10] United Nations Environment Programme. (2021). Global Methane Assessment: Benefits and Costs of Mitigating Methane Emissions. See p25. Available at https://wedocs.unep.org/bitstream/handle/20.500.11822/35913/GMA.pdf
[11] Poore, J., & Nemecek, T. (2018). Reducing food's environmental impacts through producers and consumers. Science, 360(6392), 987-992.
[12] Our World In Data. (2022). Environmental Impacts of Food. Available at https://ourworldindata.org/environmental-impacts-of-food
[13] Poore & Nemecek (2018).
[14] EAT Forum. The EAT-Lancet Commission on Food, Planet, Health. Available at https://eatforum.org/eat-lancet-commission/
[15] Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., ... & Murray, C. J. (2019). Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. The lancet, 393(10170), 447-492.
[16] Stehfest, E., Bouwman, L., Van Vuuren, D. P., Den Elzen, M. G., Eickhout, B., & Kabat, P. (2009). Climate benefits of changing diet. Climatic change, 95(1-2), 83-102.

One recent review paper found that greenhouse gas emissions could be reduced by around a third through modest meat reduction[17]. Another review of 53 studies found that eliminating animal products from our diet was one of the most effective ways we could reduce our CO2e emissions, even beating eco-friendly home renovations[18].



Graph created by Bryant Research using data from Poore and Nemecek 2018[19] via Our World in Data[20]. All permissions obtained.

[17] Aleksandrowicz, L., Green, R., Joy, E. J., Smith, P., & Haines, A. (2016). The impacts of dietary change on greenhouse gas emissions, land use, water use, and health: a systematic review. PloS one, 11(11), e0165797.
[18] Ivanova, D., Barrett, J., Wiedenhofer, D., Macura, B., Callaghan, M., & Creutzig, F. (2020). Quantifying the potential for climate change mitigation of consumption options. Environmental Research Letters, 15(9), 093001.
[19] Poore & Nemecek (2018).
[20] Our World in Data (2022).

2.2 Health

It is well established among medical experts that reducing animal product consumption can improve health in most Western diets. There is now a mountain of evidence that red and processed meat contributes to a number of our worst lifestyle diseases, such as cancer, diabetes (Type 2), cardiovascular disease (CVD), and obesity[21]. So much evidence in fact that scholars now conduct reviews of reviews of evidence[22]. The WHO has officially classified processed meat as a Group 1, carcinogenic to humans, and red meat as Group 2A, probably carcinogenic to humans[23]. One review of 148 studies found that people who ate the most amount of red and processed meat in the population had higher rates of seven different cancers (breast, colon, colorectal, endometrial, lung, rectal, and hepatocellular carcinoma), compared to people who cut back on meat[24]. Another review of 43 reports found that eating less red meat can reduce weight gain by 12% and reduce risk of obesity by 9%[25]. The science could not be clearer that citizens of the UK need to eat less beef and pork.

While chicken and fish are often touted as healthier alternatives to red and processed meats, this is not always the case. For example, modern chickens (even free-range) are bred to have much higher levels of fat than in previous generations. This has made chicken less healthy than it once was. One review of eight studies found that people who ate chicken or fish did not have healthier cholesterol levels than people who also ate beef. Another study found that people who ate more meat than average had gained significant amounts of weight five years later, even compared to others who ate less meat but the same number of calories[26].

[21] Kwok, C. S., Gulati, M., Michos, E. D., Potts, J., Wu, P., Watson, L., ... & Mamas, M. A. (2019). Dietary components and risk of cardiovascular disease and all-cause mortality: a review of evidence from meta-analyses. European journal of preventive cardiology, 26(13), 1415-1429.
[22] Ibid.
[23] World Health Organization. (2015, October 26). Cancer: Carcinogenicity of the consumption of red meat and processed meat. Available at https://www.who.int/news-room/questions-and-answers/item/cancer-carcinogenicity-of-the-consumption-of-red-meat-and-processed-meat
[24] Farvid, M. S., Sidahmed, E., Spence, N. D., Mante Angua, K., Rosner, B. A., & Barnett, J. B. (2021). Consumption of red meat and processed meat and cancer incidence: a systematic review and meta-analysis of prospective studies. European journal of epidemiology, 36, 937-951.
[25] Schlesinger, S., Neuenschwander, M., Schwedhelm, C., Hoffmann, G., Bechthold, A., Boeing, H., & Schwingshackl, L. (2019). Food groups and risk of overweight, obesity, and weight gain: a systematic review and dose-response meta-analysis of prospective studies. Advances in Nutrition, 10(2), 205-218.
[26] Vergnaud, A. C., Norat, T., Romaguera, D., Mouw, T., May, A. M., Travier, N., ... & Peeters, P. H. (2010). Meat consumption and prospective weight change in participants of the EPIC-PANACEA study. The American journal of clinical nutrition, 92(2), 398-407.

This was true regardless of the type of meat. Lastly, in experiments where people adopted different diets, the only diets found to improve heart health are diets low in meat. The evidence suggests that reducing meat, not swapping for another kind of meat, is the surest way to better health.

There is also evidence that other animal products such as eggs and dairy can have negative health effects if not eaten in moderation. Eight studies of 30,000 deaths suggest that people who eat more than seven eggs a week die sooner[27], while another review of 13 studies and 17,000 cases suggests they increase diabetes risk[28]. Lastly, a recent review of 37 papers on the health effects of changing diets found that swapping butter for olive oil could reduce cardiovascular disease by 4%, and trading out one portion of dairy products per day with a portion of nuts could help us live longer. While dairy and eggs can be healthy under some circumstances, every month new evidence accumulates suggesting that reducing our intake of all animal products will leave us healthier.

2.3 Household Spending

Some have argued that cutting meat is just not practical for the average British household, because alternatives are too expensive. Having a healthy, climate friendly diet sounds good on paper, but is it affordable? Luckily, studies using a variety of methods show the answer is yes: In fact, reducing meat can make British families healthier, more climate friendly, and in many cases save them money.

One particularly thorough study created a hypothetical "mathematically optimal" British diet, that was both healthy and climate friendly. To ensure this would work in practice and not just theory, the diet could only include foods that most British people report eating regularly.

[27] Schwingshackl, L., Schwedhelm, C., Hoffmann, G., Lampousi, A. M., Knüppel, S., Iqbal, K., ... & Boeing, H. (2017). Food groups and risk of all-cause mortality: a systematic review and meta-analysis of prospective studies. The American journal of clinical nutrition, 105(6), 1462-1473.
[28] Schwingshackl, L., Hoffmann, G., Lampousi, A. M., Knüppel, S., Iqbal, K., Schwedhelm, C., ... & Boeing, H. (2017). Food groups and risk of type 2 diabetes mellitus: a systematic review and meta-analysis of prospective studies. European journal of epidemiology, 32, 363-375.
[29] See Fig 5. In Neuenschwander, M., Stadelmaier, J., Eble, J., Grummich, K., Szczerba, E., Kiesswetter, E., ... & Schwingshackl, L. (2023). Substitution of animal-based with plant-based foods on cardiometabolic health and all-cause mortality: a systematic review and meta-analysis of prospective studies. BMC medicine, 21(1), 404.
[30] Macdiarmid, J. I., Kyle, J., Horgan, G. W., Loe, J., Fyfe, C., Johnstone, A., & McNeill, G. (2012). Sustainable diets for the future: can we contribute to reducing greenhouse gas emissions by eating a healthy diet?. The American journal of clinical nutrition, 96(3), 632-639.

Additionally, the authors created and cooked an entire weekly menu from this optimal diet to verify that it was practical. This optimal diet involved cutting meat to four main meals a week, and eliminating dairy (except in hot drinks and cereal). Lastly, the authors calculated that purchasing the diet at a standard British supermarket would cost £29 per person in 2012, or about £39 in 2024. This is 11% cheaper than the average British food bill. This is a powerful illustration that a healthy, environmentally sustainable, practical diet is within reach of most families.

It seems that on average, reducing meat can save money. But does it depend on what we replace meat with? After all, someone who only eats whole plant foods is hardly the same as someone who replaces all meat with veggie burgers and chips. Interestingly, one study showed that going meat-free saves money in all scenarios they looked at. They found that the diet that replaced meat and dairy with all plant foods (including unhealthy ones) saved 8.8% on weekly grocery expenditures, while the diet which replaced meat and dairy with healthy plant foods only would save 12.2%[31]. Another study on American diets found that plant-based diets had lower greenhouse gas emissions and lower cost than alternative diets including low fat, low-carb and low grain[32]. No matter what we replace meat with, we're still likely to save money.

Lastly, it's revealing to study what happens to the food bills of groups of people after they adopt more plant-based diets. In these studies, we can be much more confident that reducing animal products directly causes them to save money. One such study exists: 244 overweight US adults were assigned to either a plant-based diet or their regular diet. Four months later the plant-based dieters were not only significantly healthier, but they reported their food bills were 16% lower[33]. Notably, this included diets where meat and dairy were substituted directly for plant-based versions.

[31] Berners-Lee, M., Hoolohan, C., Cammack, H., & Hewitt, C. N. (2012). The relative greenhouse gas impacts of realistic dietary choices. Energy policy, 43, 184-190.
[32] Conrad, Z., Drewnowski, A., & Love, D. C. (2023). Greater adherence to the Dietary Guidelines for Americans is associated with lower diet-related greenhouse gas emissions but higher costs. Frontiers in Nutrition, 10.
[33] Kahleova, H., Sutton, M., Maracine, C., Nichols, D., Monsivais, P., Holubkov, R., & Barnard, N. D. (2023). Vegan diet and food costs among adults with overweight: a secondary analysis of a randomized clinical trial. JAMA Network Open, 6(9), e2332106-e2332106.

2.4 Macroeconomic Effects

Evidence suggests that reducing meat consumption can save British citizens money, especially compared to other healthy or climate friendly diets. But can it benefit the macroeconomy, as well as the microeconomy?

Surprisingly, economic research suggests that Britain's meat eating habits may have slowed economic growth in the recent past. One study found that 1% higher meat consumption was associated with 0.125% lower economic growth for high income countries between 1995 and 2013[34]. This is because countries like the UK import a lot of meat. This can widen trade deficits and reduce medium-term economic growth as a result. Reducing meat consumption may thus reduce the UK's dependency on foreign imports.

Additionally, when it comes to British-grown meat, we needn't worry that eating less meat will harm the economy. A recent, first of its kind study of 11 high income countries, including the UK, found that any reductions in GDP from eating less meat can be almost entirely regained by increasing production of plant foods[35]. As for British meat farmers, adaptations will admittedly have to be made, but the research consistently projects an optimistic future for farmers. There are case studies in the literature of how livestock farmers can adapt to reduced demand for meat and maintain their livelihood, such as by changing their practices to favour margin over volume[36]. An analysis of the Scottish economy, known for its Aberdeen Angus beef, suggested the Scottish economy would benefit from eating less meat[37]. This is because meat is expensive, and the money saved is likely to be simply spent elsewhere in the economy, so it still provides stimulus. Even Northern Ireland, one of the top beef exporters in the world, could minimise potential economic slowdown by increasing fruit and vegetable exports, which it is well positioned to do[38].

[34] Marques, A. C., Fuinhas, J. A., & Pais, D. F. (2018). Economic growth, sustainable development and food consumption: Evidence across different income groups of countries. Journal of Cleaner Production, 196, 245-258.
[35] Pais, D. F., Marques, A. C., & Fuinhas, J. A. (2020). Reducing meat consumption to mitigate climate change and promote health: but is it good for the economy?. Environmental Modeling & Assessment, 25, 793-807.
[36] Duluins, O., Riera, A., Schuster, M., Baret, P. V., & Van den Broeck, G. (2022). Economic implications of a protein transition: evidence from Walloon beef and dairy farms. Frontiers in Sustainable Food Systems, 6, 96.
[37] Allan, G., Comerford, D., & McGregor, P. (2019). The system-wide impact of healthy eating: assessing emissions and economic impacts at the regional level. Food policy, 86, 101725.
[38] Greig, A., & Wu, Z. (2021). The impacts of a reduction in British meat and dairy consumption on Northern Ireland's agri-food sector. Local Economy, 36(2), 133-148.

2.5 Nudges to Reduce Meat Consumption

The key challenge of being a policymaker is to implement laws that benefit society whilst also having broad support among voters. What can be done to reap the myriad benefits of reducing meat consumption in a way that is not unpalatable to the electorate?

Behavioural nudges offer a promising suite of solutions[39]. By restructuring the environment where individuals eat, we can influence them to make a positive choice. Crucially, and unlike restrictions or bans, nudges preserve individual autonomy: if someone has a strong desire to eat meat for a particular meal, they are not prevented from doing so. This makes them popular with the public[40]. Nudges are also typically fast, easy and cheap to implement.

One nudge strategy that has been shown in several studies to reduce meat consumption is to set the default meal choices in a restaurant to meat-free. For example, diners in a cafeteria may be given the meat-free menu when they sit down, but are made aware that they can request meals containing meat from their server. A review of 16 tests of meat-free defaults across restaurants, canteens and conferences, unanimously found that it was effective at increasing the number of meat-free meals purchased[41].

[39] Thaler, R. H., & Sunstein, C. R. (2008). Nudge: Improving decisions about health, wealth, and happiness. Yale University Press.
[40] Sunstein, C. R., Reisch, L. A., & Kaiser, M. (2019). Trusting nudges? Lessons from an international survey. Journal of European Public Policy, 26(10), 1417-1443.
[41] Meier, J., Andor, M. A., Doebbe, F. C., Haddaway, N. R., & Reisch, L. A. (2022). Do green defaults reduce meat consumption?. Food Policy, 110, 102298.

Here, we give a brief account of our approach. Further details of the methodology and model can be found in the Appendices, and our models can be found here[42].

We computed key outcomes variables for health, the environment, and the economy for a number of different meat reduction scenarios:

1. The UK population reduces meat consumption by 10% (equivalent to a family eating two fewer packs of sausages per month)
2. The UK population reduces meat consumption by 20% (equivalent to one person eating 3 fewer large chicken breasts per month)
3. The UK population adopts meat-free lunches during the week
4. The UK population adopts the EAT-Lancet recommended diet
5. The UK government implements meat-free defaults in all public catering

We gathered statistics from the latest and strongest academic research to estimate a number of potential benefits for the UK in each of the above scenarios, including:

1. **Health:** The % reduction in deaths from four key diseases:
    a. Cardiovascular disease
    b. Obesity
    c. Cancer
    d. Type 2 Diabetes
2. **Environment:**
    a. The kg of CO2e emissions averted
3. **Economy:**
    a. The money that could be saved by the NHS due to reductions in cases and deaths of the four diseases above.
    b. The money the average British family would save on their annual food bills.

It is worth noting that it would be possible to compute a range of outcomes associated with different types of meat reduction. We strictly based our model on realistic meat reduction practices by using statistics taken from studies of the recorded behaviour of vegetarians and vegans.

Environmental data is based on different levels of meat consumption and our modelling of the UK population with respect to those categories (see Appendix A). Health data is taken from retrospective cohort studies comparing diets which include/exclude meat – this reflects what meat-eaters or vegetarians in these samples actually ate in practice, on average (see Appendix B). Economic data estimates household spending based on an average scenario which entails replacing meat with all a variety of foods, rather than only healthy plant foods (see Appendix C).

All of these decisions were taken to ensure that our model outcomes reflect realistic dietary changes rather than an unfairly positive or negative version of a plant-based diet.

[42] http://tinyurl.com/CAWF-model

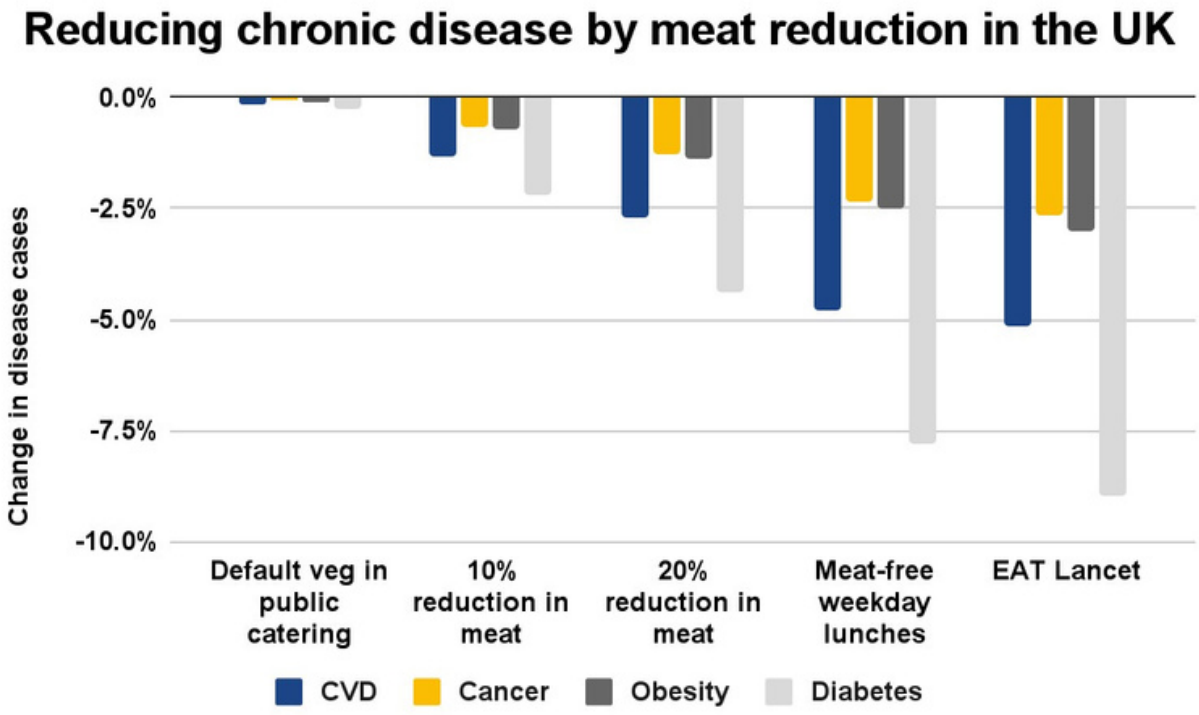
Here, we illustrate the major health, environmental, and economic outcomes for each scenario.

	Meat consumption		Environment		Health				Economy	
Scenario	Total meat (000s kg)	% change meat	GHGs (000s kg/day)	% change	CVD cases	Obesity cases	Cancer cases	Diabetes cases	NHS savings (£ millions)	Household savings (£)
Current diets	2,120,861	0%	450,418	0.00%	0.00%	0.00%	0.00%	0.00%	£0.00	£0.00
10% reduction in meat	1,908,775	-10.00%	432,046	-4.08%	-1.35%	-0.70%	-0.65%	-2.19%	£619.58	£65.19
20% reduction in meat	1,696,689	-20.00%	413,675	-8.16%	-2.69%	-1.41%	-1.30%	-4.38%	£1,239.16	£130.38
Meat-free weekday lunches	1,363,411	-35.71%	384,805	-14.57%	-4.81%	-2.51%	-2.32%	-7.82%	£2,212.78	£232.82
Default veg in public catering	2,095,411	-1.20%	448,299	-0.47%	-0.16%	-0.08%	-0.08%	-0.26%	£74.35	NA
EAT Lancet	1,866,358	-12.00%	328,175	-27.14%	-5.13%	-3.03%	-2.66%	-8.96%	£2,540.27	£276.50

As shown, reducing UK meat consumption would have considerable benefits for the environment, public health, and the economy.

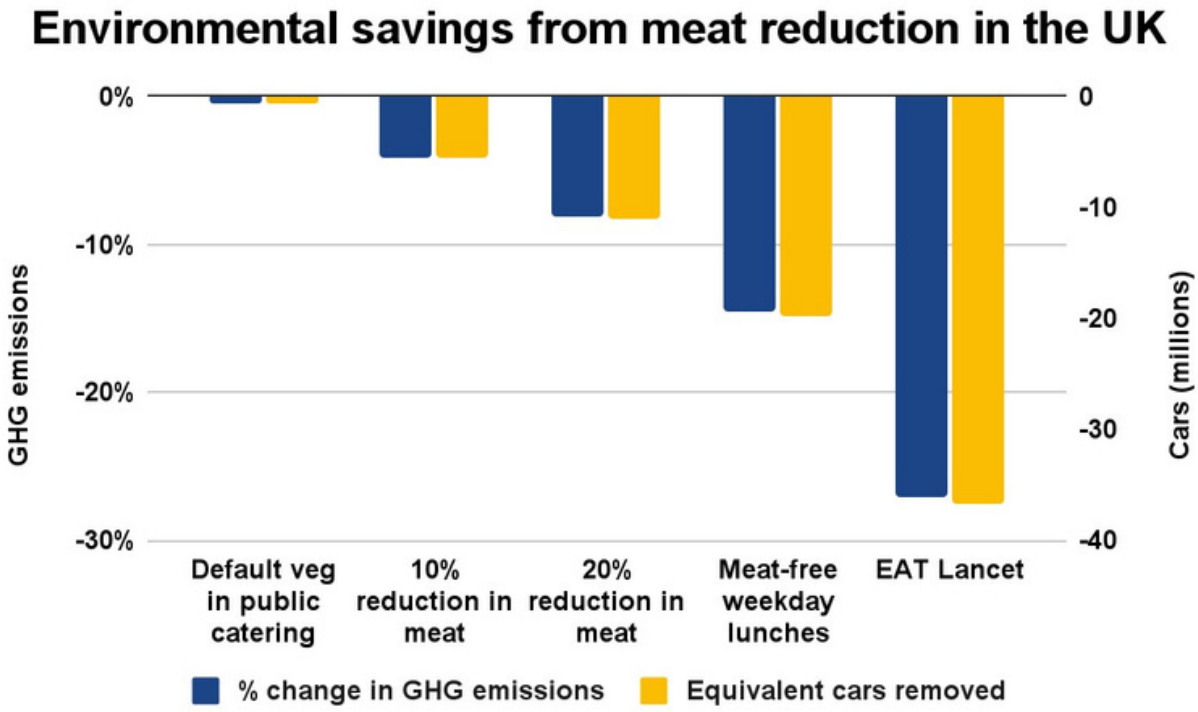
Highlights

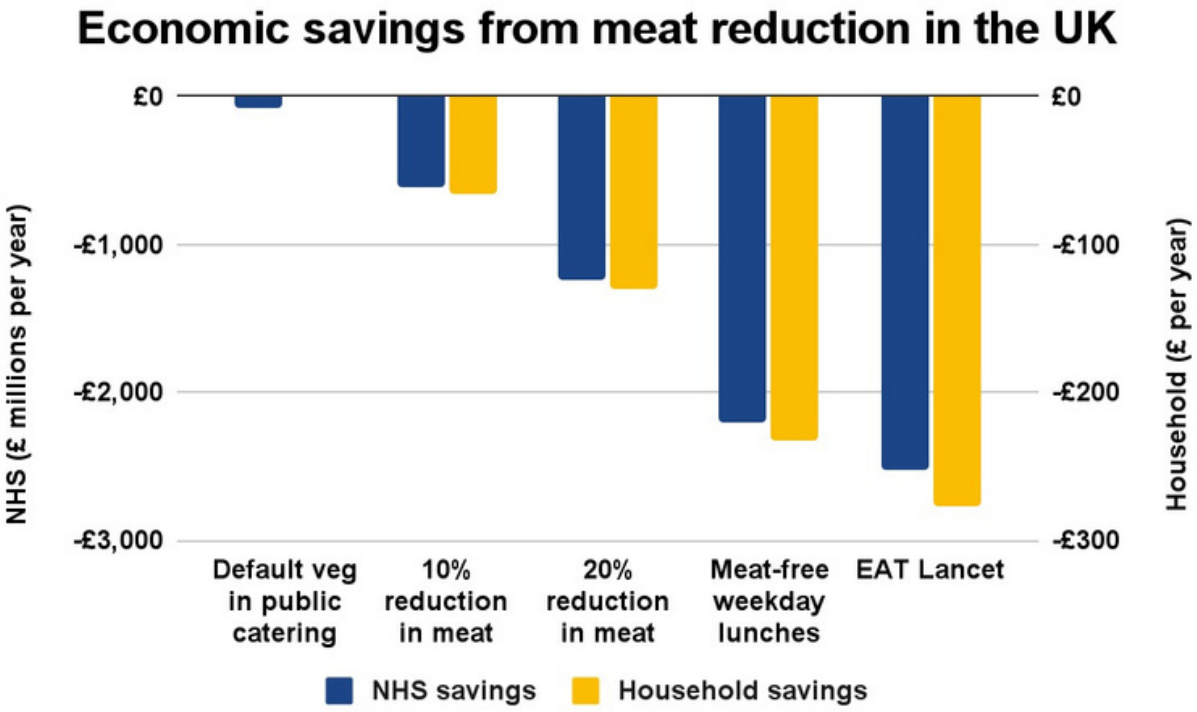
1. A 10% reduction in meat consumption would be the CO2 equivalent of taking over 5 million cars off the road[43].
2. If everybody were to adopt meat-free lunches during the week, it would prevent over 7,000 CVD deaths a year[44].
3. Adopting meat-free default options in public catering could save the NHS over £74 million a year
4. Reducing meat consumption by 20% would save the average UK household over £130 a year on their grocery bills.



[43] Based on an average of 164 g of CO2e per mile driven (see https://www.statista.com/statistics/1233337/carbon-footprint-of-travel-per-kilometer-by-mode-of-transport-uk/) and an average UK annual mileage per car of 7,400 (see https://www.britanniacarleasing.co.uk/news/annual-uk-car-milage/)

[44] Based on a 4.8% reduction of 160,000 UK annual deaths. See British Heart Foundation (2023). UK Factsheet. Available at https://www.bhf.org.uk/-/media/files/for-professionals/ research/heart-statistics/bhf-cvd-statistics-uk-factsheet.pdf


Environmental savings from meat reduction in the UK
0%
-10%
-20%
-30%
0
-10
-20
-30
-40
GHG emissions
Cars (millions)
Default veg in public catering
10% reduction in meat
20% reduction in meat
Meat-free weekday lunches
EAT Lancet
% change in GHG emissions
Equivalent cars removed


Economic savings from meat reduction in the UK
£0
-£1,000
-£2,000
-£3,000
£0
-£100
-£200
-£300
NHS (£ millions per year)
Household (£ per year)
Default veg in public catering
10% reduction in meat
20% reduction in meat
Meat-free weekday lunches
EAT Lancet
NHS savings
Household savings

SUMMARY & RECOMMENDATIONS

As this report has made clear, modest reductions in meat consumption can boost the health of the British people, benefit the environment, ease household budgets, and positively influence the British economy. This is supported by the weight of the science, as well as our own modelling, presented here for the first time.

Health Benefits: The report highlights the substantial health advantages of reducing meat consumption, alleviating the burden on the NHS. Reducing intake of red and processed meats is linked to lower rates of major lifestyle diseases such as cancer, type 2 diabetes, cardiovascular disease (CVD), and obesity. We estimate that if the UK population swapped our meat for their weekday lunches, cases of over 11,000 cases of Type 2 Diabetes could be prevented a year[45], and 366k fewer people would be living with cardiovascular disease[46]. The health benefits of this change would have similar health effects to adopting the EAT Lancet diet, which arguably requires far more lifestyle change. These health benefits could save the NHS over £2B annually.

Climate benefits: Meat production is a major contributor to greenhouse gas emissions, but even modest meat reduction can help the UK meet its climate goals. A 10% reduction in meat consumption, which is two packs of sausage per family per month, could offset the emissions of 15.7% of the cars on UK roads.

Household savings: Healthier, plant-based diets are not only more climate-friendly, but they are affordable too. Far from plant-based diets being more expensive, the average British household could replace 20% of their meat consumption while saving £132 a year.

The power of nudges: We also found that implementing meat-free default menus in public catering could generate significant benefits. Nudges are proven to work, are easy and cheap to implement, and enjoy public support as they preserve individual choice.

In conclusion, we recommend implementing plant-based defaults in public catering and educating the public around the benefits of modest reductions in meat consumption. This strategy is realistic and evidence-based, and addresses multiple national priorities simultaneously. Doing so can generate a triple dividend: benefiting health, wealth and environment.

[45] https://www.diabetes.org.uk/about-us/about-the-charity/our-strategy/statistics
[46] https://www.bhf.org.uk/-/media/files/for-professionals/research/heart-statistics/bhf-cvd-statistics-uk-factsheet.pdf

APPENDICES

Appendix A: Environmental benefit model

For each scenario, we estimated the total UK greenhouse gas emissions in kg of CO2 equivalents (GHG) per day across the entire population. We did this by dividing the UK population into six groups based on meat consumption, estimating the total daily GHG emissions from each group, estimating reductions for a given scenario, then summing them.

We found the average daily GHG emissions for the average UK citizen in each of six categories:

1. Heavy meat eaters (>100g day)
2. Medium meat eaters (50-99 g/day)
3. Light meat eaters (<50g/day)
4. Pescetarians
5. Meat-free
6. Completely plant-based

This was taken from two sources: Nature Food[47] and Scarborough et al., 2014[48]. As these sources differ slightly, but are both respected and reliable, we computed the geometric mean of the estimates. We then estimated the CO2e in each category's diet that is due to meat they consume by subtracting their GHG emissions from that of the meat-free category.

To model the GHG of the average member of a particular group if they reduced meat consumption by 1%, we took the GHG of the average member of the meat-free group, and added 99% of the GHG from meat for that group. Once we had established the reductions in GHG emissions from a 1% reduction for the average group member, this could be multiplied by the number of people in that group in the UK to get the total GHG emission reduction for that group. This could be scaled to 10%, 20% or other percentages based on the specific scenario.

[47] Scarborough, P., Clark, M., Cobiac, L., Papier, K., Knuppel, A., Lynch, J., ... & Springmann, M. (2023). Vegans, vegetarians, fish-eaters and meat-eaters in the UK show discrepant environmental impacts. Nature Food, 4(7), 565-574. See Table 3.
[48] Scarborough, P., Appleby, P. N., Mizdrak, A., Briggs, A. D., Travis, R. C., Bradbury, K. E., & Key, T. J. (2014). Dietary greenhouse gas emissions of meat-eaters, fish-eaters, vegetarians and vegans in the UK. Climatic change, 125(2), 179-192. Stt Table 3.

APPENDICES

Estimation of dietary categories

Whereas the health and environmental outcomes associated with meat reduction are likely to have a direct relationship to the quantity of meat, the literature on environmental impacts generally gives impacts for a range of types of diet, i.e. low-, medium- and high-meat consumption.

Estimates of the number of people in each meat consumption category were based on 2019 UK figures from Stewart et al. (2021)[49]. The data indicated that 4.5% were meat-free or entirely plant-based, and another 2.5% were pescatarian, leaving 93% as meat consumers. Between them, they consume an average of 86.3g of meat per day.

To derive the population's distribution across the meat consumption categories, we made specific assumptions about consumption variability. We considered a daily meat consumption range from a minimum of 20g/day to a maximum of 300g/day. Given this span, and presuming it represented six standard deviations (99.7% of the population in a Gaussian distribution), we estimated a standard deviation of 46.67g/day. We note that this is similar to the distribution observed in other comparable data[50]. Using this derived standard deviation and the Gaussian distribution model based on data from Stewart et al. (2021) the estimated population distribution is as follows:

- Heavy meat eaters (100+g/day): 36.6%
- Medium meat eaters (50-99 g/day): 35.7%
- Light meat eaters (<50g/day): 20.6%
- Pescatarians: 2.5%
- Meat-free: 3.1%
- Completely plant-based: 1.5%

It should be noted that these estimations hinge on multiple assumptions, particularly the Gaussian distribution and the derived standard deviation, which may introduce variability to the results. That said, these estimates are congruent with a mean consumption of 86.3g/day and our derived estimates appear to be congruent with other sources.

[49] Scarborough, P., Clark, M., Cobiac, L., Papier, K., Knuppel, A., Lynch, J., ... & Springmann, M. (2023). Vegans, vegetarians, fish-eaters and meat-eaters in the UK show discrepant environmental impacts. Nature Food, 4(7), 565-574. See Table 3.

[50] Mejborn, H., Møller, S. P., Thygesen, L. C., & Biltoft-Jensen, A. (2020). Dietary intake of red meat, processed meat, and poultry and risk of colorectal cancer and all-cause mortality in the context of dietary guideline compliance. Nutrients, 13(1), 32. **See Table 2**

APPENDICES

Appendix B: NHS savings model

We estimated the potential savings to the NHS in 2024 from various initiatives that reduce meat consumption. We estimated savings from reduced cases of four diseases that represent large portions of the overall health burden of the UK (we estimate 30% of the NHS budget in 2024):

1. Cardiovascular disease (CVD)
2. Obesity
3. Type 2 Diabetes
4. Cancer

First, we estimated the cost of each disease to the NHS in 2024. We gathered the most recent, reliable costs in the literature; for example, The Independent Cancer Taskforce Report (ICTR) estimated that in 2012, cancer cost the NHS £6.7 Billion in 2012[51].

We then scaled these costs with inflation to 2024. We assumed that healthcare costs inflated at 2.5% each year, based on estimates from the Nuffield Foundation[52]. One exception was cancer, where treatment cost inflation was directly available at the considerably higher 9%[53]. If the cost to treat type 2 diabetes, cardiovascular disease or obesity increases faster than this average, we would be underestimating the costs to the NHS in 2024 and as a result the savings from meat reduction. We also scaled costs to take into account population increases; if the country's population increases by 5%, it is reasonable to expect healthcare costs for a given disease to also increase by around 5%.

An example of our calculations is as follows: one study estimated the direct costs of Type 2 Diabetes to the NHS in 2010 to be £8.8 billion[54]. Assuming this cost increases 2.5% each year, by 2024 the cost would be £12.43B annually. The population grew approximately 7.9% in this time, so we further inflated the cost by 8.2%. This gives a final cost of £13.47B.

[51] UK Health Security Agency. (2016, November 01). Understanding the costs and benefits of investing in cancer. Available at https://ukhsa.blog.gov.uk/2016/11/01/understanding-the- costs-and-benefits-of-investing-in-cancer/
[52] Charlesworth, A. (2014). Why is health care inflation greater than general inflation?. Journal of health services research & policy, 19(3), 129-130.
[53] UK Health Security Agency (2016).
[54] Hex, N., Bartlett, C., Wright, D., Taylor, M., & Varley, D. J. D. M. (2012). Estimating the current and future costs of Type 1 and Type 2 diabetes in the UK, including direct health costs and indirect societal and productivity costs. Diabetic medicine, 29(7), 855-862.

Next, we calculated the disease risk reductions from reducing meat consumption. We restricted our analysis to the health benefits of reducing red and processed meat consumption by 10%. This is because red and processed meat have the largest and most well studied negative health effects. As shown in section 2.2, there are also potential positive health effects of swapping out chicken and other animal products for plant foods.

We first identified recent, high quality studies that provided relative risks for meat consumption of each of these diseases. In each case we use large scale meta analyses that summarise many studies, as these are widely considered to be higher quality evidence.

All studies presented their results as the increase in risk of a negative health outcome from an increase in meat consumption. To instead find the reduction in risk from reducing meat, we took the inverse of the relative risk and subtracted the result from 1. For example, if the relative risk of 50g/day of processed meat on developing Type 2 Diabetes is 1.15, then reducing processed meat by 50g/day should reduce risk by around 1-(1/1.15) = 13% reduction.

Nearly all source papers gave their relative risks as from 100g/day of red meat or 50g/day processed meat. Our meat reduction scenarios are considerably lower than this, so risk reductions had to be scaled down appropriately. For example, a 10% reduction in red meat consumption for the average UK citizen is around 2.37g.

Our model makes several assumptions worth noting. We assume:

- That the savings to the NHS are entirely captured by reductions in cases of obesity, cancer, CVD and Type 2 diabetes. It is likely that reducing meat will have positive health effects far beyond these four, which may mean we underestimate NHS cost savings. However, the NHS could also save less than we estimate if reducing meat incurs greater health costs elsewhere. For example, if someone reduces meat and so avoids CVD, but instead lives long enough to develop dementia, their overall cost to the NHS might be higher if their dementia costs the NHS more than their CVD would have.
- That reductions in meat consumption have linear effects on health. We believe this is justified, as the literature we reviewed did not show strong evidence of non-linear effects. Additionally, we are considering small reductions in meat consumption, and small changes are nearly always linear in practice (the distance between two points on any curve is approximately linear if the 2 points are very close together). If non-linear effects were present, it is likely that they would be of the form that meat reduction brings larger health effects for people who eat more meat. If this is true, we will be underestimating the health benefits of modest meat reduction and as such underestimating NHS savings.
- That a reduction in cases and deaths has a linear effect on costs. I.e. that reducing cancer cases by 10% means reducing the cost of treating cancer by 10%.

APPENDICES

Appendix C: Household spend model

We used data from the Office of National Statistics (ONS) report "Family spending in the UK", which representatively samples the UK population and records how much they spend on various household goods[55]. We extracted how much the average person spends on food in a year, inside and outside the house.

The latest data was March 2022, so needed to be inflation-scaled to 2023. As inflation is typically recorded as year-on-year changes, we inflation-scaled the average food expenditure to April 2023. This gave us £2323.20 per person, per year. Then, we multiplied this number by 2.36 as this is the average size of a British household[56]. This gave us an average British household food spend of £5,482.75 per year.

To establish how much a household's grocery spending would change by reducing meat, we first estimated the change in household spending by going meat-free. Our model estimates that the savings from meat reduction are equivalent to a percentage of the savings that someone would make by going meat-free. For example, a 10% reduction in meat would result in a family gaining 10% of the savings of going meat-free. This assumes that reductions in meat have a linear relationship with money saved.

Our estimates for the change in grocery spend are based on three estimates given in the 2012 paper 'The relative greenhouse gas impacts of realistic dietary choices'[57]. Compared to the baseline UK diet, the paper gives the following estimates for a range of diets:

[55] Office for National Statistics. (2023, May 31). Family spending in the UK: April 2021 to March 2022. Available at https://www.ons.gov.uk/peoplepopulationandcommunity/personalandhouseholdfinances/expenditure/bulletins/familyspendingintheuk/latest

[56] Office for National Statistics. (2023, May 18). Families and households in the UK: 2022. Available at https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/families/bulletins/familiesandhouseholds/2022

[57] Berners-Lee, M., Hoolohan, C., Cammack, H., & Hewitt, C. N. (2012). The relative greenhouse gas impacts of realistic dietary choices. Energy policy, 43, 184-190.

Diet	Daily cost per person	% cost of baseline	% change from baseline
UK baseline	**£ 6.59**	**100.0%**	**0.0%**
Vegetarian (based on replacing meat with equal calories of dairy	£ 5.63	85.4%	-14.6%
Vegetarian (based on replacing meat with equal calories of healthy foods that do not include dairy)	£ 5.78	87.7%	-12.3%
Vegetarian (based on average real US vegetarian diet rescaled to average UK caloric intake)	£ 6.01	91.2%	-8.8%
Vegetarian average	**£ 5.81**	**88.1%**	**-11.9%**

Cost estimates are given for a range of possible meat-free diets: replacing meat with dairy, replacing meat with healthy (non-dairy) foods, and replacing meat with foods typical of actual vegetarians. Each of these three estimates, though imperfect representations of a realistic UK vegetarian diet, are complementary in that they draw from (a) hypothetical meat-free diets in the UK, and (b) actual meat-free diets in the US. Noting that each estimate yields a cost within 6 percentage points (85%–91% of the baseline), we proceeded based on the average of the three, which represented a cost saving of 11.89% for replacing all meat.

To estimate the annual food bill savings for a British household, we multiplied the average annual bill of £5,482.75 by (11.89%x) where x is the meat reduction percentage. Note that we did not compute household savings for scenario 5 (meat-free defaults in all public catering), as it is not relevant.

One further cost saving not accounted for is in money saved due to lower food wastage. Meat spoils more quickly than pulses, nuts and legumes, and so is more likely to be wasted. However, given the modest changes in diet we are considering, we believe money saved due to reduced waste to be negligible.

APPENDICES

Appendix D: How we adjusted our models for each scenario

To reiterate, our 5 scenarios were:

1. The UK population reduces meat consumption by 10%
2. The UK population reduces meat consumption by 20%,
3. The UK population adopts meat-free lunches during the week
4. The UK population adopts the EAT-Lancet recommended diet
5. The UK government implements meat-free defaults in all public catering

To estimate the effects of scenarios 1 and 2, we generally followed a strategy of estimating the effects (environmental, health or financial) of giving up meat entirely, then assumed that a 10% or 20% meat reduction would capture 10% or 20% of these benefits, respectively.

Option 3 was defined as a 35.7% decrease in meat consumption. This is because weekday meals represent five of a person's 14 non breakfast meals. We assumed the average UK citizen eats a negligible amount of meat for breakfast over the week. We also assumed that equal amounts of meat are consumed at lunch and dinner. Furthermore, we also assume that there are no compensation effects, such that eating no meat during weekday lunches does not result in eating more meat on other meals. If the average UK citizen eats more meat at dinner time, or less meat on weekday lunches compared to weekend lunches, then the true meat reduction from this scenario would be lower.

Option 4 (EAT-Lancet) required special consideration as it recommends changing different meats by different amounts (high red meat reduction, low poultry reduction and eating more fish). This is covered in Appendix E

Likewise, Option 5 (meat-free defaults in all public catering) is covered in Appendix F, but to summarise, would likely result in the UK's meat intake dropping by 1.2%.

Appendix E: How we adjusted our models for The EAT-Lancet scenario

Adjusting our scenarios EAT-Lancet was more complicated than modelling a simple 10 or 20% reduction in all meat, because it advocates reducing different meat types by different amounts. EAT-Lancet recommends that people should limit their consumption to 98g/week (14g/day) of red meat and 203g/week (29g/day) of poultry[58]. Current average consumption in the UK according to Stewart et al. (2021) is 23.7g/day of red meat and 35.3g/day of poultry[59]. This implies that adopting the EAT-Lancet recommendations would entail an average 41% reduction in red meat consumption and an 18% reduction in poultry consumption.

We note that EAT-Lancet does not make specific recommendations for reduction of processed meat, but believe that it would be in the spirit of the diet to do so. For example, for the health model, EAT-Lancet scenario, we model reductions in processed meat. Specifically, as EAT-Lancet recommends a 41% reduction in red meat, we also model a 41% reduction in processed meat. The EAT-Lancet commission is on "Food, Planet and Health" (emphasis ours). With health considered a core part of the diet's mission, and the overwhelming evidence of negative health effects of processed meat (see the section 2.2 of this report) we believe this assumption is more justified than assuming that to adopt the EAT-Lancet means not reducing processed meat at all, which is taking the recommendations as read.

In the environmental model, we used estimated kg CO2e emissions per kg of different foods to compute UK emissions associated with current red meat, poultry, and fish consumption[60]. We then applied the appropriate multipliers to reflect the changes in consumption of each outlined above to calculate the total change in dietary emissions.

In the economic model, we approximated the cost savings of the EAT Lancet as the savings of the optimal vegetarian diet (12.3%) rather than a typical vegetarian diet (11.9%).

[58] Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., ... & Murray, C. J. (2019). Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. The lancet, 393(10170), 447-492.

[59] Stewart, C., Piernas, C., Cook, B., & Jebb, S. A. (2021). Trends in UK meat consumption: analysis of data from years 1–11 (2008–09 to 2018–19) of the National Diet and Nutrition Survey rolling programme. The Lancet Planetary Health, 5(10), e699-e708.

[60] Clune, S., Crossin, E., & Verghese, K. (2017). Systematic review of greenhouse gas emissions for different fresh food categories. Journal of Cleaner Production, 140, 766-783.

APPENDICES

Appendix F: Estimating the impact of veg defaults in public catering

In order to estimate the impact of changing menus to a meat-free default, we consulted a recent review[61] of studies that have estimated these impacts. We also found three newer studies which have been published since the review (study 1[62], study 2[63], study 3[64]).

For each study, we recorded the percentage point increase in ordering of meat-free meals (commonly called "the effect size" of the study). Then we averaged these effect sizes together, giving a higher weight to studies with more participants. The weighted average was +30.35 percentage points, which is the increase in meat-free orders we can expect to see by adopting meat-free defaults.

To estimate the potential meat reductions from implementing the default nudge in public sector catering, we start with the estimate that the public sector serves 1.5 billion main meals[65]. We assumed that meat was an option in 80% of these meals (1.2 billion), excluding some breakfasts and other meals which may not have meat options. Public Sector Catering estimates that 690 million public sector meals contain meat, which would imply that 510 million meals are meat-free out of 1.2 billion meal choices (42.5%). If this could be increased by 30.35 percentage points to 72.9% of meals, that would represent an additional 365 million meat-free meals. Given the average meat portion size of 67g per meal[66], this would equate to 24,455,000 kg of meat reduced – 1.2% of the UK's total consumption. As such, we estimated the population wide effects of plant-based defaults in public sector catering as a 1.2% reduction in meat consumption.

[61] Meier, J., Andor, M. A., Doebbe, F. C., Haddaway, N. R., & Reisch, L. A. (2022). Do green defaults reduce meat consumption?. Food Policy, 110, 102298.
[62] Taufik, D., Bouwman, E. P., Reinders, M. J., & Dagevos, H. (2022). A reversal of defaults: Implementing a menu-based default nudge to promote out-of-home consumer adoption of plant-based meat alternatives. Appetite, 175, 106049.
[63] Radnitz, C., Beezhold, B., Pilato, I., Drury, C. R., Fruchter, S., Murphy, B. D., & Loeb, K. L. (2023). Application of optimal defaults to increase selection of sustainable menu choices. Food Quality and Preference, 110, 104954.
[64] Hielkema, M. H., Onwezen, M. C., & Reinders, M. J. (2022). Veg on the menu? Differences in menu design interventions to increase vegetarian food choice between meat-reducers and non-reducers. Food Quality and Preference, 102, 104675.
[65] Public Sector Catering. (2020, April). Size of the public sector. Available at https://www.publicsectorcatering.co.uk/in-depth/size-public-sector
[66] Ibid.

APPENDICES

Experiments on plant-based defaults

Study	Sample size	% of all subjects	% before	% after	PP change	Weighted PP Change
Hansen et al. (2019)	108	1.6%	2	87	85	1.34
Hansen et al. (2019)	112	1.6%	6	86	80	1.31
Hansen et al. (2019)	110	1.6%	12.5	89	76.5	1.23
Taufik et al. (2022)	800	11.7%	8.6	80	71.4	8.33
Taufik et al. (2022)	127	1.9%	16.1	58.3	42.2	0.78
Radnitz et al. (2023)	209	3.0%	22.8	92.8	70	2.13
Hielkema et al. (2022)	1,489	21.7%	19.4	39.8	20.4	4.43
Campbell Arvai et al. (2014)	319	4.7%	10.3	60	49.7	2.31
Campbell Arvai et al. (2014)	319	4.7%	7.5	73.2	65.7	3.06
Gravert & Kurz (2019)	3,195	46.6%	3.4	15	11.6	5.41
Stewart et al. (2016)	66	1.0%	14.3	16.1	1.8	0.02
TOTAL	**6,854**	**100.0%**	-	-	-	**30.35**

[67] Hansen, P. G., Schilling, M., & Malthesen, M. S. (2021). Nudging healthy and sustainable food choices: three randomized controlled field experiments using a vegetarian lunch-default as a normative signal. Journal of Public Health, 43(2), 392-397.
[68] Taufik et al. (2022).
[69] Radnitz et al. (2023).
[70] Hielkema et al. (2022).
[71] Campbell-Arvai, V., Arvai, J., & Kalof, L. (2014). Motivating sustainable food choices: The role of nudges, value orientation, and information provision. Environment and Behavior, 46(4), 453-475.
[72] Gravert, C., & Kurz, V. (2021). Nudging à la carte: a field experiment on climate-friendly food choice. Behavioural Public Policy, 5(3), 378-395.
[73] Stewart, G., Patel, R., Sucharitakul, G., 2016. Can Simple Nudges Reduce Meat Consumption? The Cambridge Green Challenge.