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Making household food waste reduction easier

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Standfirst (330 characters): We waste huge amounts of food at a household level, leading to significant financial costs for individuals, and substantial contributions to CO_2 emissions. But this is a complex problem to address. In this Comment, Tapper and colleagues discuss how behavioral and systems science can help provide solutions.

It is estimated that 19% of our food is wasted, amounting to over 1 billion tones every year, with around 60% of this being generated by households. This has negative consequences for both climate and economy. For example, UK households generate around 6 million tonnes of food waste every year, resulting in 16 million tonnes of CO_2 emissions and an estimated financial loss of £17 billion. A key target for the United Nations sustainable development goals is to halve household food waste by 2030. However, this is proving hard to achieve. For example, the UK is considered a leader in food waste reduction but levels have only fallen by around 22% in 2021/2022 since 2007.

Why it's hard to reduce household food waste

From a behavioral perspective, we can immediately identify several reasons why reducing household food waste may be more challenging than changing other types of behaviors. First, it's hard because we need to keep at it. Unlike one-off behaviors such as insulating your house or getting a single-shot vaccine, reducing food waste requires daily effort.

Second, it's hard because you can't avoid the issue. We all need to eat. And therefore, we inevitably encounter the issue of potential food waste. Unlike quitting smoking or selling your car, we can't resolve to simply avoid the thing that causes the problem.

Third, it's hard because we're trying to reduce something. 'Approach' behaviors, such as taking public transport or eating more fruit and vegetables tend to be easier to promote than 'avoidance' behaviors. For example, whilst we might show a charismatic celebrity eating fruit, to make us feel good about eating more fruit, it's hard to imagine how we would even go about picturing that same celebrity 'wasting less food'.

This brings us onto our fourth point, that although we might view food waste – the physical act of throwing food into the bin – as a behavior, it is a behavior with a very large number of determinants[1]. Some of these determinants occur at the individual level, for example when someone views leftovers as unappetizing. However, others occur at the family level, for example where there is a need to accommodate the fickle appetite of a younger child. Still others may originate from the wider environment – an unexpected setback at work may impact on time available for food preparation in the evening. Added to the large number of determinants is the fact that they are interconnected. For example, a stressful day may lead someone to order a takeaway for dinner instead of preparing the meal they had planned, with the fresh ingredients already in their fridge. This will increase the potential for food waste. However, good food management skills, together with a desire to avoid food waste, could mean subsequent meals are adapted.

These types of interconnections are a feature of a complex system. A complex system is a set of elements interconnected in a way that produces a pattern of behavior over time[2]. These elements could be material (such as leftovers in your fridge) or non-material (such as your motivation to reduce food waste). The interconnections represent the flow or transfer of something; again, this could be something material (for example,

the unplanned takeaway increasing leftovers in your fridge) or something non-material (for example, stress at work reducing motivation to avoid food waste). Changing behavior within a complex system is challenging because the structure of the system can make it tricky to predict, resistant to change, or very slow to change.

Household food waste may be harder to change than obesity

Useful parallels can be drawn with obesity. Like food waste, obesity can be seen as an undesirable outcome of a food system that encourages us to buy more than we need. But, unlike food waste, governments have been working to address obesity for several decades, primarily through initiatives that emphasize individual responsibility. One consequence of these initiatives is that most of us probably have a reasonable idea of what is considered a healthy weight and what is considered an unhealthy weight. We may also be more likely to track our weight. For example, a key recommendation for anyone trying to manage their weight is to weigh themselves regularly. This is important because it provides feedback on weight management efforts[3]. Even those who avoid the weighing scales typically experience some form of feedback in terms of the tightness of their clothes. And although there is a lag between action and outcome - weight gain doesn't happen the instant that dessert passes your lips - we can still learn to associate certain behaviors with a change on the scales and the very personal implications for health and appearance. These feelings may lead us to think twice before selecting the more indulgent dessert.

This contrasts with food waste. First, food waste is much harder to track. For many of us, our food waste goes into a general waste bin leaving us in the dark about

whether we wasted more food this week compared to last week or today compared to yesterday. Second, our food waste is hidden. Not only do we not know what we are wasting, we don't know what others are wasting or what would be considered an acceptable amount of waste. In other words, we lack both descriptive norms (what others are doing) and injunctive norms (what others think we should be doing). Norms can be an important influence on behavior[4]. And third, compared to obesity, the impacts of food waste are more remote, less personal and less certain. Climate change doesn't happen the moment we throw food in the bin. And, unlike weight gain, it's hard to see and we're not sure about how exactly it will affect us.

How we can make household food waste reduction easier

Drawing on both behavioral and systems science, we have identified six key areas for action that we believe are promising for impact and which we discuss below. A wide range of specific food waste reduction actions have already been proposed by policymakers at subnational (e.g., Wales, Victoria), and national (e.g. Australia, EU, USA) levels; in Table 1 we highlight how some of these actions fit into our framework.

INSERT TABLE 1 HERE

1. Visibility

Food waste needs to be made more visible in households, for example via separate food waste disposal bins collected by councils. This would represent the introduction of an additional informational feedback loop into the system, helping people identify the factors that increase their waste as well as the effectiveness of any actions they take to reduce it. Visible reductions in food waste may also provide a sense of achievement, reinforcing effective actions. However, if used in isolation, there is a risk of separate food waste bins *increasing* food waste, for example if people feel their waste is now being repurposed rather than going to landfill[5]. As such, increased visibility needs to be coupled with other actions described below.

2. Comparison

We need to know what others do, what we're expected to do and what we're aiming for. This will help bring meaning to the number of caddies of food we throw away each week. Are two caddies good or bad for a family of four? How do I compare to my neighbors? What should I be aspiring to? As noted above, these types of descriptive and injunctive norms can be powerful motivators[4].

3. Understanding and opportunity

We also need to understand how to reduce food waste. Some of this we may figure out ourselves simply by noticing what influences the amount of waste we produce. But other things may be less obvious. For example, there may be misunderstandings around use by and best before dates, or optimal storage methods[6]. And even where people do know what to do, they may lack equipment (such as freezer space) to allow them to put

recommendations into practice. Initiatives that increase both food knowledge, and the resources we need, could help us reach our food waste reduction targets.

4. Motivation

Although comparison will provide some motivation for waste reduction it will not always be sufficient, especially where a person feels a comparison doesn't apply to them or where they feel they are already doing 'better than others'[4]. It is therefore important to explore additional strategies for influencing how people feel about food waste[1]. These strategies could relate to environmental impacts but could also draw on other motivations such as social justice or financial considerations. Emotions can be one of the most powerful drivers of behaviour[7]; making people feel uncomfortable about wasting food (or proud of their food waste reduction efforts), could help address its otherwise remote impacts. However, such an approach needs care as eliciting negative emotions can have negative consequences[8]. There is also the potential for backlash when people feel they are being manipulated[4]. More research is needed to identify the types of communications that are most persuasive, and how we might elicit emotional responses that motivate change whilst avoiding guilt, shame or disengagement.

5. Regulation

Regulation is also likely essential. In relation to obesity, we have arguably already done much to increase visibility, comparison, understanding and motivation. And yet obesity remains a problem. Of course, it is unclear how much more of a problem it might be in the absence of our efforts. Nevertheless, given rates of obesity continue to rise, it is clear these efforts have not been sufficient. Many have argued that governments place too much emphasis on obesity as an issue of individual responsibility, ignoring the

structural and environmental determinants that have co-occurred with global increases in obesity. This has led to calls for regulation designed to change our food environment. The same argument may be made in relation to food waste. Food systems that are dominated by profit-driven corporations serve to promote both over purchasing and over consumption. More research is needed to identify the types of regulatory strategies that are effective at reducing these, for the purposes of both health and sustainability[9].

6. System goals

Ultimately, however, we need more than just regulation: we need coherent systems level governance. Because even if we are successful at reducing food waste, this will not necessarily translate into emissions reductions; people may simply spend the money they saved on food on other high emissions purchases[10]. To avoid this, we need to change higher-level system goals[2]. We can do this by urging governments measure and prioritize more of the things that are important to us, like health, happiness and sustainability. Not just economic growth. This type of overarching goal change would make all the other changes a whole lot easier.

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Image

https://www.gettyimages.co.uk/detail/photo/close-up-compost-royalty-free-image/1173220535

Competing interests

The authors declare no competing interests.

Table 1. Calls to action for household food waste reduction.

Actions	Actors	Examples
Visibility		
Introduce schemes that prompt households to separate out their food waste.	Local and national government, community organisations, businesses, researchers.	• Provide food waste caddies and a food waste collection service. • Provide bins for, and guidance around, home composting. • Research and invest in community and municipal composting and valorisation schemes.
Develop and test technologies to help households better track their food waste.	Businesses, researchers.	• Smart bins which estimate food waste amount and type.
Comparison		
Identify appropriate household level food waste targets.	Local government, researchers, third sector organisations.	• Weight or volume per person per week
Investigate then deploy the most effective means of communicating these targets.	Researchers, creative industries, local government, third sector organisations, businesses, supermarkets.	• Leaflets to homes showing example household types (e.g., family of four) and their target number of caddies of waste per week.
Understanding and opportunity		
Introduce and further develop initiatives that increase citizens' food management knowledge and skills, and enable action.	Local and national government, food industry, businesses, supermarkets, creative industries, third sector	• Educational campaigns around best before and use by dates, food storage, food safety and meal planning. • Changes to products and packaging to help citizens optimize food storage and

	organisations, housing associations, schools, researchers.	use. • Tools and equipment to help citizens with meal planning, shopping, and food storage and use. • School curriculum that places more emphasis on food management.
Introduce and further develop initiatives aimed at increasing citizens' ability to cook appetising meals that use leftovers and/or limit food waste.	Chefs, businesses, supermarkets, national government, schools, researchers.	• Promotion of recipes that use leftover ingredients. • Promotion of flexible recipes that can be adapted to incorporate different types of ingredients and leftovers. • Promotion of root-to-tip recipes. • Evaluation of meal kits. • School curriculum that places more emphasis on flexible cooking skills that can be used to cook meals with leftovers / limit food waste.
Motivation		
Investigate then deploy communication approaches that help motivate food waste reduction whilst avoiding backlash and/or unintended outcomes.	Researchers, creative industries, local government, third sector organisations, businesses, supermarkets.	• Imagery, infographics, facts and statistics that highlight the consequences of household food waste.
Regulation		
Investigate then deploy regulatory strategies that are effective at reducing household food waste (and the wider systemic drivers of household food waste) whilst avoiding other unintended negative outcomes.	Researchers, supermarkets, restaurants, local and national government.	• Mandate clear and consistent use and storage labels on packaging. • Restrict practices (such as buy-one-get-one-free offers) that promote over purchasing. • Require retailers to stock smaller pack sizes of perishable goods, at

		equivalent prices. • Require restaurants to provide appropriate portion sizes as the standard option. • Set legal targets for household food waste reduction.
System goals		
Develop, track, communicate and prioritise metrics that incorporate health, happiness and sustainability.	Intergovernmental organisations, national government, researchers.	• Build international consensus around and support for alternative metrics to gross domestic product. • Use surveys and dashboards to track and communicate these metrics. • Use these metrics to guide policy decisions. • Evaluate the effects of different policy initiatives on these metrics.