A briefing report for the Food Standards Agency, September 2017

Food waste, food safety and kitchen practices: implications for policy and intervention

Reshaping the domestic nexus

engaging policy understandings of kitchen practices and how they change

The University Of Sheffield.

MANCHESTER 1824 The University of Manchester

THE NEXUS NETWORK

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

REPORT CONTENTS

Mike Foden, Ali Browne, David Evans, Liz Sharp and Matt Watson

This report is part of a research project bringing new ideas and evidence to bear on policy concerned with water, energy and food consumption. *Reshaping the Domestic Nexus* is a collaboration between research teams at the Universities of Sheffield and Manchester, in partnership with Defra, BEIS, Food Standards Agency and Waterwise. It is funded by the ESRC Nexus Network.

More on the project at nexusathome.wordpress.com

Contact: Matt Watson m.watson@sheffield.ac.uk

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REPORT SUMMARY

This report introduces a new approach to understanding the role of everyday household practices in domestic resource consumption and addressing the policy challenges this presents. To demonstrate this 'change points' approach we focus on one such topic: **household food waste and its relationship to food safety concerns.** Reducing food waste has been a major UK policy concern for a decade. It has an important role to play in meeting future food demand while minimising environmental impact. Households account for 70 per cent of post-farm-gate food waste; reducing household food waste is therefore a key challenge for food policy. Responses to this challenge can, however, sometimes sit in tension with food safety advice. This report synthesises evidence to help understand how householders negotiate these conflicting concerns on a daily basis and how food ends up being discarded in home kitchens.

Existing responses [p.6] seek to implement the waste hierarchy – prioritising prevention over other forms of waste management – primarily through a voluntary, partnership-based approach rather than through legislation. There is significant variation both at a local authority level (especially within England) and between the four countries of the UK. Typical interventions include:

- *Separate food waste collections* – diverting from landfill to composting or energy recovery; provision varies from half of all households in England to near-universal coverage in Wales
- *Brokering voluntary agreements* – Courtauld 2025 brings together businesses, NGOs and public agencies in working towards a 20 per cent reduction in food waste from 2015 to 2025
- *Campaigns focused on households and consumers* – the Love Food Hate Waste campaign provides online recipes and advice, supports local programmes of events and trains groups of volunteers to pass on waste reduction messages via their social networks

Here we present a new approach, tracing numerous 'change points' that occur in the process of carrying out routine household tasks (e.g. cooking, cleaning, laundry): moments in which resources are used up and waste is produced. In seeking to understand what influences these change points, and hence what successful intervention might entail, we draw on insights from **social practice theory**. This shifts attention from individual attitudes and behaviours to a systematic consideration of the multiple social, cultural and material factors that shape what people routinely do.

Our aim is to better mobilise this established body of academic work for practical use. In particular, we bring together evidence from what we term the **'home practices' literature**: recent empirical research applying social practice theory, and related social science approaches, to the study of household sustainability issues. This provides a distinctive but complementary addition to existing responses to domestic food waste, emphasising connections between everyday sequences of activity and wider cultural, political, technological and infrastructural factors.

Crucially, food waste does not just happen because of decisions at the kitchen bin. Rather, actions throughout the stages of food provisioning – including shopping, storage, food preparation, cooking, dealing with leftovers, and clearing up [p.8] – eventually lead to food being discarded, or otherwise. Insights into what shapes behaviour at these change points [p.10] lead to a range of implications and recommendations for policies and intervention [p.13]. Specifically they should seek to:

1. *Understand household routines and rhythms of everyday life,* ensuring interventions fit into those rhythms or look to take advantage of moments of change
2. *Think about kitchen design and the use of domestic technologies*, especially how these can complement and help bring about changes in routine practices
3. *Appreciate diversity within and between households*, learning from existing household responses to FOG, while anticipating any limits to transferability of successful initiatives
4. *Work with shared social norms* as well as individual knowledge and attitudes
5. *Recognise that kitchen practices are shaped by wider systems* – particularly systems of food provisioning (supply chains, retailers, etc.); and of food waste disposal.
6. *Collaborate across sectors*, recognising the interdependencies of interventions and their resource consequence.

THE ISSUE

Food waste has now been a major concern in both UK government policy and broader public debate for a decade.[1] Recent estimates suggest one third of 'the edible parts of food produced for human consumption' are wasted globally each year.[2] In the UK, 10 million tonnes of food and drink are wasted post-farm-gate, of which 60 per cent is considered avoidable.[*] UK food waste is associated with greenhouse gas emissions of over 20 million tonnes each year and, on average, costs each household £470.[3] The multiple economic, social and environmental implications of food waste are the subject of a major report published by the House of Commons Environment, Food and Rural Affairs (EFRA) Committee in 2017.[4]

Reducing food waste plays an important role in meeting the food needs of a growing world population, while minimising further environmental impact.[5] Households are a major contributor to overall levels of food waste, accounting for 70 per cent of the UK post-farm-gate total.[3] Reducing household food waste is therefore a key challenge for food policy. There are a range of possible approaches to this challenge; however, they can sometimes sit in tension with food safety advice, especially concerning how foods are stored and when they are deemed no longer fit for safe consumption. Research highlights how, on a day-to-day basis, people negotiate conflicting anxieties around eating fresh, healthy and varied food, avoiding waste and adhering to food safety guidance. Existing campaigns have begun to address these tensions by, for example, tackling confusion over the interpretation of 'use-by' and 'best before' dates and encouraging appropriate use of fridges and freezers to minimise food spoilage.

In responding to these challenges and tensions, it is also important to distinguish between the cause and location of waste: there are many important factors outside the household which help shape the generation of waste within it.[6] As a result, there are numerous possible sites for intervention in domestic food waste, including but not limited to the behaviour of household members.

[*] WRAP distinguishes between avoidable, possibly avoidable and unavoidable food waste. Avoidable waste refers to all food 'considered edible by the vast majority of people' but that is 'no longer wanted or has been allowed to go past its best'. Possibly avoidable waste means material that 'some people eat and others do not', like potato skins. Unavoidable waste, like egg shells and tea bags, is not considered edible 'under normal circumstances'. See *Household Food Waste in the UK 2015*, p.7.

OUR APPROACH

This report provides new evidence and ideas for tackling food waste and encouraging food safety in home kitchens. It does so by presenting a new 'change points' approach. As will become clear in this section, the approach develops academic insights from social practice theory – and a broader body of empirical work that we term 'home practices' research – for practical application in policy settings. It is based on a synthesis of evidence from extensive existing research into everyday practices around food waste and other aspects of resource consumption in domestic kitchens. An emphasis on 'change points' provides a distinctive addition to existing understandings and approaches being applied to domestic food waste.

Focus on practices and change points

New evidence highlights that people seldom consciously 'demand' resources like energy and water but rather require those resources to do practices – such as cooking or cleaning. This project explores how evidence about these domestic practices can inform policy addressing water, energy and food consumption in homes. This report gathers together relevant ideas and evidence from this field of research in relation to tackling the relationships between food safety and waste, through a focus on the practices from which food ends up being discarded in UK home kitchens.

Our approach begins by charting the sequence of very ordinary things that people do in the course of buying, preparing, eating and disposing of food. We characterise the moments that these activities are carried out as **change points**, in two senses. First, they are moments in which multiple possible courses of action could be pursued, each with different direct or indirect consequences in terms of using up resources and producing different forms of waste. Second, they are moments in which an item of food changes state or status, such as being heated up, or being designated surplus to requirements. Change points are therefore potential targets for intervention to change prevailing food practices.

We then draw together existing research evidence on domestic practices, from across the domains of water, energy and food consumption, to explore the factors that shape change points: what makes currently prevalent courses of action more likely than others and how might this plausibly change?

Placing food waste and food safety in the Nexus of water, food and energy

The ways that resources like food, water and energy are used are closely linked. Intervening in how one resource is used is likely to impact on the others. Any attempt to change domestic eating practices is likely to affect all three. For example, the water 'embedded' in avoidable household food waste accounts for approximately 5 per cent of all UK water requirements.[7] Reducing household food waste therefore has the potential to reduce water consumption. Conversely, there are potential energy burdens associated with extending the 'shelf life' of food such that it remains edible for longer.

Recognising how food waste and food safety are situated in this nexus of resource relations – in home kitchens as well as throughout systems of food provision and disposal – is vital. Doing so helps to identify more holistic opportunities for intervention, anticipating trade-offs and synergies, both between food safety and food waste agendas and between different courses of action towards addressing these issues.

Work on the nexus of water, energy and food has typically focused on interdependencies in these resources' supply systems. This project focuses on practices performed in UK households' kitchens to explore the demand for these resources. As exemplified by the domestic kitchen, we argue that the water, energy, food nexus is present as much in people's homes and everyday lives as in sites of production.

The distinctiveness of the approach

Focusing on practices and change points, and paying attention to the interdependency of water, energy and food together allow our understanding of enduring policy problems – such as food waste – to be reframed, with important implications for intervention strategies.

Our approach is distinctive from other models of conceptualising and responding to such issues, in a number of ways:

1. Systematically tracing a sequence of distinct yet interrelated **change points** in the process of food provisioning – not just the point of disposal – broadens the view of the direct and indirect causes of food disposal, multiplying the possibilities for potential intervention.
2. Starting from the practices that take place at these change points immediately draws attention to connections and overlaps between different policy concerns relating to use of water, energy and food. Intervening in any of these change points is likely to have implications across policy domains and objectives.
3. The approach brings a distinctive understanding of what shapes the activities undertaken at these change points.
    - Conventional behaviour change approaches characteristically seek to provide better information or incentivise particular courses of action in order to allow individuals to make more appropriate decisions.
    - Behavioural insights approaches draw on recent developments in social psychology and behavioural economics, demonstrating that much of what people do on a daily basis is 'automatic', habitual and unthinking, rather than deliberative. They look to change behaviour by either capitalising on these automated responses to stimuli or targeting particular periods of disruption to instil new routine patterns of behaviour.
    - **Social practice approaches** go further, recognising the routinised nature of everyday practice but also looking outside the individual to the multiple social, cultural and material factors that shape what people do. These 'external' influences are continually reproduced in how people carry out everyday practices, but systemic change happens 'if enough people do enough things differently enough'.[8]

Thinking in terms of social practices implies a different, but complementary, approach to intervention, compared with those based on behavioural insights. Rather than focusing on small measurable changes to particular tightly defined behaviours, it emphasises connections between small-scale everyday activities and wider cultural, political, technological and infrastructural developments. The key imperative that follows is to think systematically about the different factors that can shape everyday kitchen practices, the interactions and interdependencies between these factors, and how intervening in one type of activity might have knock-on effects elsewhere.

Synthesising evidence

Progress has already been made in reducing household food waste. It decreased markedly between 2007 and 2012, from 8.3 to 7.0 million tonnes.[9] In 2015, the total rose to 7.3 million tonnes, which represents a small increase even after allowing for population growth.[1] One possible explanation is that a substantial proportion of the initial improvements reflected macroeconomic circumstances, chiefly the expense of food relative to pay. While similar circumstances may return and could plausibly have further (albeit unpredictable) impacts on waste, policy measures to intentionally make food more expensive are unlikely. Instead, this report looks at other factors that influence food waste generation and tries to identify other points of traction for intervention.

This report – and our 'change points' approach – is based on a thorough critical review of the burgeoning body of literature providing insight into domestic practices and their consequences for resource consumption. Several key fields of work are brought together in our review, especially those concerned with the dynamics of social practices[10] and household sustainability.[11,12] What makes this 'home practices' literature distinctive is its shift of attention from purely economic drivers or individual attitudes and behaviours to examining socially, culturally and materially constituted practices. This shift in emphasis informs the development of our 'change points' approach.

By emphasising the importance of social norms, meanings, rhythms, routines, materials and technologies, as well as inter-personal relations within the home, contributions to this literature together provide new framings of how resources are consumed and wastes produced as part of accomplishing the practices that make up everyday life. The 'home practices' literature has been influential in the development of social scientific accounts of household food waste.[13–16] It has also been taken up by policy and delivery bodies, notably WRAP[17] and the FSA.[18]

EXISTING RESPONSES

Policy principles and responsibilities

The principles underlying waste policy in the UK have arisen from EU Directives and been incorporated into national policy in each of the four constituent countries. Recent developments include the House of Commons EFRA committee's report on waste food in April 2017. Key principles include:

1. ***Implementation of the waste hierarchy***
   Under the EU Waste Framework Directive, the UK is required to prioritise waste prevention, followed by reuse, recycling, energy recovery, and finally – as a last resort – disposal to landfill.[19] This suggests that household food waste interventions should focus greatest attention on the overprovisioning of food, and helping people make fuller use of the food they buy. As highlighted in point 3 below, exactly how this is implemented varies.

2. ***Voluntary and partnership-based approaches***
   The management of waste food involves a complex mixture of stakeholders including the devolved administrations, local authorities and their contractors who undertake waste management, as well as supermarkets and their suppliers. Voluntary approaches are generally used in preference to legislation,[20] usually overseen by the arm's length delivery agency, the Waste and Resources Action Programme (WRAP). This is a charity which receives funding from Defra, the devolved governments and the EU that works to prevent waste including food waste. In addition to delivery of interventions, WRAP has played a leading role in establishing a robust evidence base on the extent, causes and management of food waste.[1,8,21]

3. ***Local variation***
   Local authorities operate under different legislative requirements for waste collection in each of the four countries of the UK.[22] In Scotland all local authorities are, as of 2016, required to provide separate food waste collections, except in rural areas.[23] In Wales local authorities have mandatory targets for reusing and recycling municipal waste; all 22 authorities offer some form of separate food waste collection, covering 99 per cent of households.[24] In England and Northern Ireland local authorities are responsible for choosing whether or not to offer separate food waste collection, based on local circumstances.[25] Among the factors influencing this choice are concerns about the costs and practicalities of collection and processing, especially where uptake by households is low; restrictions resulting from existing long term waste management contracts; and the priorities and preferences of local people and politicians.[4,26]

Meanwhile, responsibility for the governance of food safety falls to the Food Standards Agency (FSA) and Food Standards Scotland (FSS). Recently, as part of their broader commitment to understanding the role of consumers in relation to sustainable food futures, research commissioned by the FSA revealed food waste and its impact on future food security to be a major concern among consumers.[27] The FSA and FSS have become increasingly engaged in campaigning on food waste and in how this fits alongside the promotion of food safety. Waste reduction is identified as a key area in which the FSA can support and complement the work of other agencies.[28]

Food waste initiatives

Where a separate collection exists, food waste is diverted from landfill and put to numerous uses, from large-scale composting to energy recovery via anaerobic digestion. However, only 12 per cent of domestic food waste collected by UK local authorities is recycled in these ways, with the remainder going to residual waste streams.[23]

Further up the waste hierarchy, most food waste reduction initiatives in the UK are co-ordinated by WRAP. Actions fall into two main categories:

Brokering voluntary agreements involving multi-stakeholder coalitions

The Courtauld Commitment 2025, for example, brings together businesses in food production, retail and hospitality with, among others, local authorities and national government agencies, in working towards a 20 per cent reduction in food waste from 2015 to 2025. The FSA is a founding signatory. Central to the rationale for the Courtauld Commitment is a concern with meeting future food demand with minimal environmental impact. Recent changes made by producers and retailers, but with a focus on household food waste, have included removing promotional offers (e.g. BOGOFs) and improvements in packaging design to help keep food fresher for longer.

Similarly, the FSA are currently working with Defra, WRAP and representatives of the food industry to review current guidance on date marking and storage advice on packaging, with a view to reducing avoidable food waste.[29]

Campaigns focused on households and consumers

The Love Food Hate Waste campaign (LFHW) seeks to give 'individuals the information they need to recognise and tackle food waste'.[30] This is provided primarily through the LFHW website and social media, as well as through provision of resources for other organisations to use in local campaigning. Online materials include recipes, searchable by leftover ingredients, and articles highlighting practical strategies for reducing waste, such as avoiding overprovisioning when shopping, storing food correctly and interpreting date labels. Other notable LFHW initiatives include supporting localised programmes of events and hands-on activities[31] and providing 'cascade training', whereby a group of volunteers – usually members or employees of a given organisation – are trained to pass on food waste reduction messages to those around them, formally or informally.[32]

Again, the FSA has collaborated with partner organisations on consumer-facing campaigns, for example promoting better use of freezers and using leftover food during the Christmas period.[33]

Lessons from food waste: the power of social networks

WRAP's consumer-facing campaign, Love Food Hate Waste (LFHW) seeks to engage with householders to raise awareness of food waste and encourage related changes in how people buy, store, prepare and eat food. LFHW's 'cascade training' model of delivery recognises that:

1) Householders are embedded in networks of social relations within and outside the home; and
2) Learning often results from these social connections and occurs in the process of personal interactions, especially in practical settings when new ways of carrying out practices can be demonstrated first hand.

Cascade training works on the assumption that 'everything we say or do tends to ripple through our network, having an impact on our friends (one degree), friends' friends (two degrees) and our friends' friends' friends (three degrees)'.[25] Volunteers attend a training session to learn more about food waste and how to play a part in reducing it. They are then expected to pass the learning on to their friends, family, colleagues and neighbours, who are then encouraged to do the same within their own social networks.

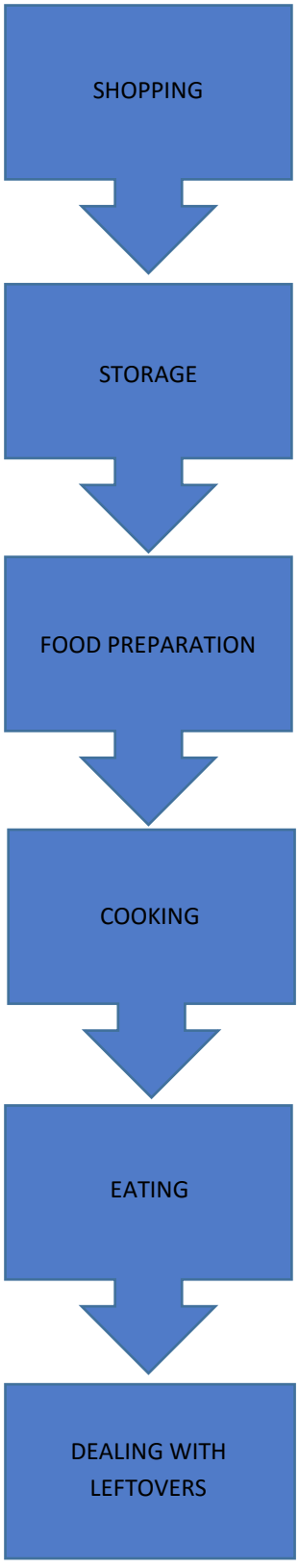
The cascade model was found to be successful in passing on information, especially at the first 'degree' of connection, with over 90 per cent of volunteers 'cascading'. On average they each shared their learning with between 16 and 38 people (depending on the method of estimation used), who in turn each passed it on to two further people. Also important was the method of communication. In the majority of cases this happened informally – in the course of ordinary conversation – and often took place 'in the kitchen, around food and in very practical situations'[25] involving not only dialogue but allowing friends and family to observe changed practices.

FOOD WASTE, FOOD SAFETY AND KITCHEN PRACTICES

This section of the report articulates what is distinctive about a 'change points' approach to food waste and food safety.

In the course of acquiring, using and disposing of food, households engage in a series of different activities: shopping, storage and managing stock, food preparation, eating, dealing with leftovers, and cleaning up. Waste is produced, directly or indirectly, through each of these activities; at the same time, other resources such as water and energy are used. Each stage can be seen as a key ***change point***, a moment where numerous possible courses of action could plausibly be pursued. Different courses of action have different implications for what ends up in waste streams, as well as for other policy concerns relating to food (e.g. healthy eating, food safety) and the conservation of water and energy.

In general, activities aimed at minimising the oversupply of food, expediting its use or slowing its deterioration are mutually beneficial for promoting food safety and minimising food waste: they help prevent the situation arising where an assessment has to be made about whether or not food is still edible. Once this situation is reached, however, concerns with safety and waste can come into tension (although much of this 'assessment' and 'tension' might not manifest itself in conscious deliberation, instead being negotiated into routine practice).



STAGES IN THE FLOW OF FOOD

Understanding where food waste comes from

Shopping

Decisions made when buying food can ultimately impact on food safety and waste within the home.

- Quantities are important: many households routinely buy more food than they end up using for reasons beyond their control.
- The types of food bought can also be influential. While healthy eating agendas have tended to promote the use of fresh produce, these items typically deteriorate more quickly and are more commonly discarded than processed foods. This makes them both more likely to be discarded and more likely to present a food safety risk.
- The condition of the food when bought, including how close it is to use-by or best before dates, will affect how quickly it needs to be eaten after purchase. Although promoting the sale of short dated food makes sense to reduce retail waste, this is only beneficial if consumers go on to safely use it.

Storage and household management

How food is stored impacts on both safety and waste. In most cases keeping fresh produce in a fridge or freezer helps to prolong its shelf life while slowing the growth of harmful bacteria, although for some items (such as tomatoes) this is considered to have a detrimental effect on taste and texture. However, research also highlights how food in fridges can become forgotten. Despite substantial improvements in their efficiency, these appliances remain among the most demanding users of electricity in the home. Using smaller appliances (in turn meaning buying food more frequently and/or storing it in other ways) could reduce domestic energy consumption, while also mitigating the tendency for food to be forgotten about. Setting fridges and freezers to a higher temperature would reduce their energy use, but may pose a food safety risk and/or lead to more waste. The FSA recommends fridges are kept below 5°C.

Food preparation

Washing and peeling are recommended from a food safety perspective, particularly for fruit and vegetables that are to be eaten raw. There are, however, risks that edible food (from a nutritional perspective) is routinely thrown away because it is not considered 'food' in a given social context, for example broccoli stalks. Choosing between washing and peeling can involve a trade-off between food waste, food safety and the use of other resources. Washing might have nutritional benefits over peeling, and may reduce solid waste, but it is likely to use more water and energy.

Cooking

Often cooking leaves unused ingredients, for example the remaining contents of a multipack of vegetables. Sometimes these simply become the ingredients for future meals, but on other occasions there is no obvious use for them. Another source of surplus food is when more food is cooked than can be eaten at a given meal occasion: leftovers. While unused ingredients and leftovers are not automatically equivalent to waste, a closer correspondence between what is bought and cooked, and between what is cooked and eaten, would reduce the amount of surplus created. A further question concerns the energy and water used in preparing and cooking food. In some cases, for example, it may represent a more economical use of household resources (time, labour, money) and wider resources (water, energy and food) to 'batch' cook enough for multiple meals and then subsequently reheat the remaining portions, than to cook the equivalent number of meals from scratch.

Eating

Whereas surplus food from cooking is often saved for potential future use, this is rarely true of food left on plates after eating. As well as food going to waste, the energy and water used in producing, storing, preparing and cooking it is effectively wasted. It remains a possibility, however, that these leftovers be saved and reused. Alternatively, serving less – with optional 'seconds' remaining in the pan or dish – might mean that more is kept for future meals; this could also help with 'portion control', overlapping virtuously with healthy eating concerns.

Dealing with leftovers

Both surplus ingredients and cooked leftovers are commonly stored in a fridge or freezer, awaiting future use. A number of different outcomes for surplus food can then potentially arise. It might be:

- Reused in future meals within the home.
- Gifted to family members, friends or neighbours outside the home.
- Not put to use before it deteriorates.

Research suggests that while each of these three outcomes occurs in practice, some are more likely than others. Specifically, giving food to others outside the home is extremely rare, while eventually disposing of

surplus is a common outcome. An important part of dealing with leftovers is the assessment of whether or not the surplus food is still fit to eat. Food safety concerns can often come into tension with efforts to minimise waste.

What shapes what happens at change points?

This section presents understanding of why some courses of action at key change points tend to be more likely than others, and where attempts to intervene might find some traction. The key message is that although food is assessed and discarded in these change points, the causes may well be elsewhere: in the complexities of daily routines, in relationships and the division of labour within the home, in social norms and cultural conventions, in the configuration of kitchens and the material properties of food, in the systems of provision and of disposal.

Unconscious routines

Much of what people do on a day-to-day basis is a matter of routine. What are often understood as rational consumer decisions – e.g. what people buy and cook, or how they decide if food is still good to eat – tend to follow stable patterns and in normal circumstances involve little conscious reflection. Campaigns that aim to encourage behaviour change through providing information and advice may only have limited success, especially if this is the only method pursued. However engaged someone is by the campaign, translating their new knowledge into practical action will always be difficult. Targeting moments of disruption to routine behaviour (such as moving house) or seeking to 'nudge' people may yield some success but a number of other factors also need to be considered.

Time and convenience

In the context of busy lives, often with competing employment and caring responsibilities, householders find ways of managing domestic life that *work* for them and minimise disruption elsewhere. Grocery shopping is particularly routinized, as exemplified by 'the big shop' that takes place at fixed intervals. Food preparation, cooking and eating follow similarly routine patterns. Many have a repertoire of 'tried and tested' meals that suit the needs and tastes of household members and fit well into the normal rhythms of daily life. Sometimes, however, other commitments (e.g. work, school or social activities) or events (e.g. illness, traffic problems or an unexpected visit) disrupt the usual routine, increasing the risk of food being wasted. There is emerging evidence that routine ways of shopping are currently in the process of shifting (home delivery, buying little and often at 'convenience stores'). These emerging patterns might represent a site of traction for encouraging further changes in how people go about household provisioning.

Diversity within and between households

Often, households are not singular units, but are comprised of relationships between different people, sometimes with differing needs, priorities and roles. Moreover, responsibilities for negotiating multiple competing demands within and outside the home fall disproportionately on women. The work of feeding the household exemplifies this imbalance. Repertoires of meals are often constrained by the frequently narrow range of foods that some family members are willing to eat, as well as by the complex scheduling of many family lives. The requirement to balance the conflicting needs of different household members represents a potential barrier to changing what is bought, cooked and eaten. Similarly, this highlights a need to recognise diversity between households: they are composed in many different ways, with different combinations of people at different life stages, and with different characteristics and preferences. Interventions that have traction in one household type might not work in others.

Social norms and cultural conventions

How people go about domestic activities is not merely a matter of personal preferences or individual habits. Instead, kitchen practices are shaped by shared understandings – and associated anxieties – around food. In today's UK context 'proper food' tends to mean serving a variety of *home cooked meals*, using *fresh* and *healthy* ingredients, prepared *from scratch* and eaten *together*. The persistence of this view creates the conditions in which food is at risk of going to waste. For example, fresh food is perishable and the imperative to eat 'as a family' often involves the overprovisioning of 'back up' meals and ingredients. These conventions also impact on attempts to put surplus food to use insofar as batch cooking might risk providing insufficient variety; or giving away leftovers to other households risks opening up mundane meals to outside scrutiny. Shared understandings are difficult to shift; however, sustained campaigning on multiple fronts – including the influence of high profile intermediaries (e.g. celebrity chefs) – could yield results.

Materials and technologies

The material properties of food and the kitchen also play an instrumental role in shaping kitchen practices. Evidence suggests that when food begins to deteriorate, its material properties – and the bodily reactions caused by its appearance, smell and feel in the people handling it – play an important role in how it is discarded. Furthermore, the sizes and quantities in which food is available to buy can often mean surplus ingredients are left over from meal preparation. This can be particularly problematic in single person households, which are historically on the rise.[17] Other relevant material factors include the technologies and infrastructures used for storing and disposing of food.

- ***Storage spaces.*** Although keeping food in a fridge or freezer can help prolong the life of food, fridges and freezers can also be places where food becomes hidden and forgotten about while it quietly decays, meaning that good intentions to use up leftovers are not fulfilled. Other storage spaces, such as cupboards, can similarly lead to items of food being forgotten about, but these typically have a long shelf life and account for a very small proportion of the total food thrown away.
- ***The kitchen bin*** and its associated waste management infrastructure is very effective and reliable at dealing with decaying excess food. Little effort is required from throwing something away to it being collected by waste disposal services. Alternative means of disposal, are comparatively ineffective or unreliable at allowing households to distance themselves from their unwanted materials.

Knowledge, know-how and competence

There is little evidence that food waste is caused by a decline of culinary knowledge or household management skills. Households are, on the whole, highly organised in their routine purchasing of food for a given period, but their plans are often disrupted by unanticipated circumstances. Similarly, difficulties in using up surplus food reflect what is typically a fixed repertoire of 'tried and tested' meals. This repertoire is based not primarily on limitations of cooking ability but on a limited set of recipes that all household members will eat. Multiple types of formal and practical knowledge are put to use in assessing the safety and edibility of food. For many, the information provided by labels and date codes is combined with sensory judgements based on smell, taste, appearance and feel.

Lessons from food waste collections

Evidence[36] from separate food waste collections in many UK local authority areas provide some valuable lessons. These relate not only for the treatment of discarded food but also for interventions higher up the waste hierarchy, i.e. in seeking to reduce the amount thrown away, by shedding light on how food comes to be discarded. Specifically these experiences highlight how a combination of routine practices, daily rhythms, interactions with problematic materials, cultural conventions and interpersonal dynamics within the home together help to produce wasted food.

Further evidence suggests more direct links between households participating in food waste *separation* and taking subsequent measures to *prevent* or *reduce* waste. The survey element of the WRAP (2009) trials found that a small proportion of households (4 to 8 per cent) reported changing their attitudes or habits around buying and eating food as a result of taking part. The literature review (WRAP, 2011), meanwhile, highlights a number of trials and other studies reporting reductions over time in the overall amount of food waste produced, including the amount going to residual waste collections. While some of this may be accounted for by increases in home composting, this gives some credibility to the argument that participating in a food waste collection scheme has an impact on shopping, storage, cooking and/or eating practices in a manner that helps reduce overall levels of waste.

IMPLICATIONS FOR INTERVENTIONS TO REDUCE FOOD WASTE

As discussed in the *Existing Responses* section, there are a range of existing initiatives that address the challenge of food waste reduction. Some of these seek to reduce household food waste following a *service provision* model, requiring no change in what householders do. Examples include changes to packaging design to help food stay fresh longer or changing the way municipal waste is treated after collection. Another prevalent response is to appeal to *consumer decision making* through information campaigns that draw attention to the issue and/or suggest tips for changing behaviours in response.

Food waste initiatives have progressed considerably over the years to embrace more sophisticated understandings of what can influence householders' behaviour. Responses to food waste often include a mixture of the two above models – service provision and targeting consumer decision making – for example labelling to assist consumers in using packaging correctly. Finally consumer campaigns such as Love Food Hate Waste have rolled out a programme of 'cascade training', using volunteers' existing social networks to disseminate information, share their own learning and encourage others to do the same.

On the basis of the evidence we present above, we argue that initiatives like these could be further advanced by an approach rooted in understandings of everyday activities in a given household as enactments of wider social practices. The key imperative that follows is to **think systematically** about the different factors that can shape everyday kitchen practices, the interactions and interdependencies between these factors, and how intervening in one type of activity might have knock-on effects elsewhere. Traditional approaches often focus on a particular policy problem, assuming that broader contexts stay largely the same, whereas the 'change points' approach assumes that all aspects are potentially able to change.

An important point to reiterate is that many existing responses to food waste and food safety are already, at least in part, implementing interventions that are consistent with the practice approach. From the synthesis of work above, we can identify a number of additional recommendations. Below these are differentiated between those that focus on change directly to practices in the kitchen, and those that target intervention elsewhere in the broader systems (e.g. of food provision, waste disposal) that could have influence on household food waste and food safety.

Changing practices in the kitchen directly

A focus on practices taking place at key change points enables a holistic understanding of the situations that lead to food waste, and appreciation of the range of factors influencing those situations. In so doing, it shows different potential targets for intervention, as well as a fuller basis for anticipating challenges and trade-offs.

Alongside disrupting and intervening in individual routines, which some of the more developed behaviour change programmes in this field already seek to do, there is a need to intervene in the multiple other factors that shape what people do in their kitchens. This means **distinguishing between the cause and location of waste**, recognising the important factors outside the household which help shape the generation of waste within it.[6]

Key implications for intervention that follow from the discussion above include:

- **Understanding household routines and rhythms of everyday life,** paying attention to the ways in which people achieve balance between competing priorities. Interventions need to fit into those rhythms, but might also exploit moments of change. For example, buying too much food can be seen (in part) as a function of prevailing patterns of working and shopping that have remained relatively stable in recent decades. Emerging changes – flexible working, buying less food more frequently, ordering online for

home delivery – can be seen as an opportunity to innovate, promote and normalise new patterns of food provisioning.

- **Thinking about kitchen design and the use of domestic technologies:** A complementary change to buying 'little and often' – having a smaller fridge – might mean surplus food is less likely to become hidden and subsequently forgotten, reducing the amount of food that eventually becomes unsafe or goes to waste, as well as the energy used in powering the fridge. Ultimately the adoption of smaller fridges would be encouraged by corresponding changes to kitchen layouts.
- **Appreciating diversity within and between households** can enable:
    - Anticipation of the challenges of transplanting initiatives that have been successful in one situation to another.
    - Identification of specific opportunities for targeted intervention, for example reflecting the particular cooking practices and conventions within subgroups of the population.
    - Recognition of, and sensitivity to, the dynamics within households and the disproportionate burden on particular household members (especially female partners and mothers). There are risks that the pursuit of good environmental outcomes may inadvertently exacerbate existing inequalities such as gendered divisions of labour.
- **Working with shared social norms** as well as individual knowledge and attitudes:
    - Cultural conventions around 'proper' food – being fresh, varied and prepared from scratch – help cause waste. Working with retailers to promote good quality, healthy versions of convenience food, including mixed packs of pre-prepared vegetables, sauces and even well-designed ready meals, could help minimise waste (as well as reducing burdens of domestic labour). Cultural intermediaries (such as celebrity chefs) and other organisations (NGOs, consumer groups) could actively help in shifting understandings of what it means to cook and eat ‘properly’.
    - Changing date labels and storage instructions might not directly prompt individual consumers to shift behaviours, given that many food items are routinely used by busy householders, with little conscious reflection. However, it can be seen as a small step in changing a broader conversation, challenging food safety 'myths' and, over time, become negotiated into the routine ways people act in their own kitchens.
    - Opportunities to work with community groups or social media can be means to effect change to collective social norms.

Changing systems to shift kitchen practices

What people do in kitchens is shaped by wider systems. For example, when people buy, prepare and cook food these activities are part of a wider complex of interdependent practices together making up the 'food provisioning system', including farming practices, retail practices and so on. Changing the way that food is supplied will impact on how people eat, and vice versa. Similarly, how people dispose of food waste is part of a complex of interdependent practices making up the 'food disposal system', including waste management practices, governance and the operation of all associated infrastructure.

Opportunities for intervention in kitchen practices and their consequences in terms of food waste and food safety may therefore be found elsewhere.

- **In the food supply system.**
    - The way food is sold means some of it is likely to become surplus. The sizes and quantities that goods are available in from a typical supermarket, *in interaction with* shared understandings about cooking 'properly' with fresh and varied ingredients, leads to routine overprovision of food. Making food more readily available (and cost effective) in a variety of sizes, designed specifically to be appropriate to people’s aspirations and contemporary culinary ideals, could reduce generation of surplus food.

- Where and how people shop is connected to buying too much food. Ensuring that premises selling good quality food are located conveniently for where people live and work, as well as encouraging the use of public transport or cycling to the shops, would help to normalise the idea of buying 'little and often'. This infrastructural change might help shift conventional understandings of being a good provider from having a well-stocked home to being able to easily access new supplies of food outside the home when needed. More responsive, real time home delivery services could be another way to achieve a similar end.

Retailer engagement in tackling household food waste

Food directly discarded by retailers accounts for a very small proportion of overall levels of food waste. However, their supply chain management and sales practices – especially those of large supermarkets – have a powerful impact on the larger quantities of waste generated elsewhere in both production and consumption. Focusing on the latter, research[37,38] conducted with a range of policy, NGO and commercial stakeholders charts a growing and widespread acknowledgement of this 'distributed responsibility' for household food waste and observes the emergence of a broad, multi-stakeholder coalition for change, with retailers occupying a prominent position. Their pivotal role between producers and consumers makes them especially well placed to effect change.

The research suggests that retailer engagement with household food waste is prompted by a recognition that food waste *matters* to their customers, whose loyalty is highly prized in the present food retail market. In turn this recognition stems from an increasing awareness that the formerly common sense image of careless, irresponsible consumers casually discarding food is deeply at odds with social science evidence on people's provisioning and disposal practices. Positive action to date has included substantially reducing the use of once-ubiquitous promotional offers, discouraging customers from buying too much, and innovative use of packaging and labelling to reduce the amount subsequently thrown away.

Importantly, a consensus around the multiple and complex causes of household food waste has emerged not primarily through contestation but in a process of co-production between the various stakeholders. WRAP has played a vital mediating role in this process, reflecting its credibility within the public, private and voluntary sectors alike; its trustworthiness, stemming from its commitment to using evidence; and its neutrality.

- **In the food disposal system**. A crucial factor in managing excess food is the provision of alternative waste disposal infrastructure that – from a user perspective – is effective and reliable at ejecting unwanted materials from the home. This is likely to include some means of collecting and storing waste food in the home with minimal mess, without being an obtrusive presence in the kitchen, combined with a reliable service for recovering the waste food and directing it to where it can be processed for reuse in energy production.

- **Understanding unintended consequences.** Domestic kitchens are meeting points of multiple 'supply systems'. In preparing and cooking food, eating, cleaning up and disposal, systems of provision of water, energy and food are brought together, as are systems for disposal of liquid and solid waste. Again kitchen practices shape, and are shaped by, each of these systems. Intervening in what people do in kitchens can have intended and unintended consequences in each of these interdependent domains, hence working collaboratively is essential.

Lessons from food waste: providing appropriate infrastructure

Evidence from separate food waste collections in many UK local authority areas provide some valuable lessons for thinking about alternative disposal of FOG:

- Participating households go to considerable lengths to accommodate food waste collection caddies into the size, shape and layout of their kitchen and into their everyday routines of food preparation and cleaning. Flexibility, convenience and reliability of provision are therefore key important features of successful collection schemes.
- Many participating householders are wary of having to handle unpleasant material or of keeping a food waste caddy on their kitchen worktop, associating them with uncleanliness and a potential to contaminate food preparation areas. This emphasises how strongly the messy nature of decomposing food impacts on disposal decisions. The same is likely to apply to handling FOG.
- Those not participating in collection schemes commonly cite concerns with hygiene, odours or vermin; interestingly, relatively few participating households reported experiencing these problems in reality. This suggests an important role for peer advocacy of such schemes, making use of existing social networks and relationships of trust.

Collaboration and locating responses in the Nexus

Designing and implementing interventions that consider multiple infrastructural and resource implications requires collaborative working across policy domains.

- There is a particular need for messages around food waste and food safety to be coordinated. WRAP, Defra and the FSA have already collaborated on information campaigns. Where interventions focus on preventing surplus food arising, or prolonging the shelf life of food, these concerns are likely to be complementary and campaigns can be mutually reinforcing. Tensions are more likely to arise where interventions focus on the assessment over whether or not food is still edible. Here, partners with different emphases in their interests should continue to work together, helping negotiate the tension between these competing social anxieties at a societal level, rather than leaving householders responsible for doing so in their daily lives.
- Policy actors responsible for water, energy, food and waste – together with relevant academics, NGOs and business representatives – could usefully collaborate to negotiate various resource-related trade-offs and synergies. For example, those in the waste management sector might not be best placed to lead on developing interventions relating to how food is sold or to kitchen design, but their support and input might be valuable alongside others.
- The above implications for intervention suggest numerous productive collaborations:
  - Working in partnership with supermarkets, manufacturers and retailers of white goods, interior designers, and suppliers of fitted kitchens to promote shopping 'little and often' and the use of smaller fridges, as complementary changes.
  - Engaging nutritionists, celebrity chefs, retailers and other stakeholders in promoting healthy, good quality convenience foods.
  - A coordinated, multifaceted campaign to challenge food safety 'myths', building on existing collaboration between WRAP, Defra and the FSA, for example around the use of freezers, involving manufacturers and retailers in the redesign of labelling, but also communicating via social media, cookery programmes and publications, community groups and so on.

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The team

Principal Investigator	Matt Watson
Researcher	Mike Foden
Co-investigators	Alison Browne
	David Evans
	Liz Sharp

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