











EMERGING RESEARCH

Diet and health inequalities: Connecting with vulnerable groups to address food insecurity—the DIO food project

Daniel R. Crabtree¹  | Emma Hunter²  | Victoria Jenneson^{3,4}  | Alison Fildes⁵  | Alice Kininmonth⁵  | Francesca Pontin^{3,6}  | Emily Ennis⁷ | Marta Lonnie¹  | Hannah Skeggs⁸ | Lizzy McHugh⁸  | Michelle A. Morris^{3,4}  | Flora Douglas² | Alexandra M. Johnstone¹  | on behalf of the DIO Food team

¹The Rowett Institute, School of Medicine, Medical Sciences and Nutrition, University of Aberdeen, Aberdeen, UK

²School of Nursing, Midwifery & Paramedic Practice, Robert Gordon University, Aberdeen, UK

³Leeds Institute for Data Analytics, University of Leeds, Leeds, UK

⁴School of Food Science and Nutrition, University of Leeds, Leeds, UK

⁵School of Psychology, University of Leeds, Leeds, UK

⁶School of Geography, University of Leeds, Leeds, UK

⁷Research and Innovation Service, University of Leeds, Leeds, UK

⁸IGD (Institute of Grocery Distribution), Watford, UK

Correspondence

Daniel R. Crabtree, The Rowett Institute, School of Medicine, Medical Sciences and Nutrition, University of Aberdeen, Aberdeen, UK.
Email: daniel.crabtree@abdn.ac.uk

Funding information

UK Research and Innovation, Grant/Award Number: BB/W018020/1; IGD (Institute of Grocery Distribution)

Abstract

The current cost-of-living crisis is disproportionately affecting families experiencing poverty and is likely to be amplifying existing dietary inequalities and challenges, such as food insecurity (FI). Government policies designed to address diet inequality in the UK have historically had minimal impact on population diet and health and may have even widened existing inequalities. Therefore, the effect of nutrition policies on those experiencing FI in the context of the current cost-of-living crisis needs to be better understood. The aim of the *Diet and Health Inequalities (DIO Food)* project is to work with early years, people living on a low income and retailers to generate opportune evidence-based research and commentary that will inform diet-related health inequalities policy and practice. *DIO Food* is related to the existing *Food Insecurity in people living with Obesity (FIO Food)* project, which consists of four interlinked work packages (WPs1-4). *DIO Food* consists of three interlinked work packages (WPs5-7), which enhance the scope of *FIO Food*, and are described in this article. WP5 addresses a paucity of research on maternal and infant food insecurity in the UK, by applying a qualitative research approach to capture parents' and carers' perceptions of the relationship between the food system and other influences impacting infant feeding practice, associated with the cost-of-living crisis. WP6 will conduct the first-ever cross-retailer independent evaluation of England's high fat, sugar and salt (HFSS) product placement legislation. Researchers will analyse store-level supermarket sales data provided by large UK retailers to produce sector-level insights into whether HFSS legislation reduced HFSS purchasing, improved the healthiness of retailer product portfolios, and was equitable across areas with different characteristics. WP7 will support WP5 and 6, by strengthening engagement with key stakeholders, including at-risk consumers and representatives of major supermarkets, and effectively translating research outcomes and stakeholder perspectives for policy and industry decision-makers.

KEYWORDS

diet inequality, health inequality, early years, products high in fat, sugar and salt (HFSS), food insecurity, food system

This is an open access article under the terms of the [Creative Commons Attribution](https://creativecommons.org/licenses/by/4.0/) License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited.

© 2024 The Author(s). *Nutrition Bulletin* published by John Wiley & Sons Ltd on behalf of British Nutrition Foundation.

INTRODUCTION

The current UK economic climate has led to a cost-of-living and energy crisis that has affected the affordability of goods and services for households. According to the Office of National Statistics (Office for National Statistics (ONS), [2024](#)), the overall price of UK food and non-alcoholic beverages rose approximately 25% between January 2022 and January 2024. It previously took over 13 years, from October 2008 to January 2022, for average food prices to rise by the same amount (ONS, [2024](#)). For families on a low income, the poorest fifth of the UK population need to spend 50% of their 'real' disposable income to consume a healthy diet in line with the Eatwell Guide, in contrast to 11% needed by the richest fifth in the UK (The Food Foundation, [2023a](#)). As recently as 2023, approximately one-quarter of low-income households 'ran up debt to pay for food' (Joseph Rowntree Foundation, [2023](#)). Therefore, this current cost-of-living crisis is disproportionately affecting households experiencing poverty and is likely to be amplifying existing dietary inequalities and challenges, such as food insecurity.

Food insecurity (FI) is defined as 'the state of being without reliable access to sufficient quantity of affordable, nutritious food' (USDA, [2022](#)). Food insecurity is an issue that is not confined to low-income countries but is increasingly found to affect households in high-income countries including the US and Canada, with evidence indicating that levels of FI in such countries have risen substantially in recent years (Gatton & Gallegos, [2023](#); Pollard & Booth, [2019](#); Pool & Dooris, [2022](#)). Even within high-income countries, the risk of experiencing FI can be highly variable according to where you live. The Priority Places for Food Index (PPFI) highlights that in the UK contributors to food insecurity risk at a neighbourhood level are highly context-specific and geographically dispersed. These include factors from seven domains—Proximity to supermarket retail facilities, Accessibility to supermarket retail facilities, Access to online deliveries, Proximity to non-supermarket food provision, Socio-demographic barriers, Need for family food support, Fuel Poverty—which broadly cover access to food provision and economic barriers to purchasing healthy nutritious foods, demonstrating an interplay between local food environments and economic circumstances (Consumer Data Research Centre [CDRC], [2022](#)). The PPFI serves to illustrate the complexity of tackling such an issue, which is likely to require localised solutions as well as a localised view on national solutions.

In the UK, community food provision usage has been used as a proxy for monitoring FI levels in the UK, with organisations such as the Trussell Trust and the Independent Food Aid Network reporting year-on-year increases in demand for help, including from families with children (Independent Food Aid Network (IFAN), [2023](#); The Trussell Trust, [2023](#)). The Trussell

Trust ([2023](#)) recently reported that 1.5 million emergency food parcels were distributed to UK citizens between April and September 2023 by food banks in the charity's network. This is the most parcels that the Trussell Trust network has distributed at this point in the year and represents a 16% increase from the same period in 2022 (The Trussell Trust, [2023](#)). Furthermore, between April and September 2023, 540 000 food parcels were distributed to more than 265 000 children living in families, a record for the charity and an 11% increase compared to 2022 (The Trussell Trust, [2023](#)). Indeed, recent UK survey data revealed 23.4% of households with children reported experiencing food insecurity compared to 14.8% of households without children (The Food Foundation, [2023b](#)).

Despite decades of activity in UK diet and obesity strategies and policies, their historic focus on behaviour change and information provision (e.g. voluntary food labelling guidelines) is thought to have contributed to a relative lack of impact on population diet and health (Theis & White, [2021](#)). Indeed, evidence suggests that such approaches are likely to widen existing inequalities. Wide-reaching food industry-facing policies which structurally alter the food environment and require less cognitive effort on behalf of individuals are therefore recommended instead (Theis & White, [2021](#)). With the majority of UK food purchasing occurring in supermarkets (Statista., [2023](#)), large grocery retailers are a promising policy target.

The National Food Strategy Independent Review ([2021](#)) advocated for a systems thinking approach and proposed 14 ambitious recommendations which spanned education and public welfare provision, agricultural and land-use reform, as well as industry legislation and mandatory data reporting by the food sector. While not all recommendations have been taken up by the UK Government (Department for Environment, Food, & Rural Affairs [DEFRA], [2022](#)), there is evidence of slowly changing political narratives. Adverse outcomes among people living with obesity (PLWO) observed during the COVID-19 pandemic sparked increased government commitment to introducing legislation aimed at 'making the healthy choice the easy choice' in retail and out-of-home food environments (Department of Health & Social Care [DHSC], [2020](#)). This includes the introduction of legislation to restrict product placement of HFSS (high in fat, sugar and salt) products in retail settings, an evaluation of which forms one of the work packages (WPs) of this project (DHSC, [2023](#)).

As the cost-of-living crisis is a dynamic process, we need approaches to respond to the emerging 'crisis' in a timely manner. The *Diet and Health Inequalities (DIO Food)* project will combine lived experiences with population-level supermarket data, to highlight the effects of the cost-of-living crisis on young families and evaluate the impact of recent government legislation on the

shopping environment. The *DIO Food* project relates to the existing *Food Insecurity in people living with Obesity (FIO Food)* project, which aims to improve environmentally sustainable and healthier food choices in the UK food system and provide actionable evidence for policy on retail strategies to address dietary inequalities in PLWO and food insecurity, using four interlinked WPs (WPs1-4) (Johnstone et al., 2023; Johnstone & Lonnie, 2023; Lonnie et al., 2023, 2024; Stone et al., 2024). The *DIO Food* project enhances the scope of *FIO Food* by connecting not only with people living with obesity but also with vulnerable citizens who are facing diet-related health inequalities, using three additional interlinked WPs (WPs5-7; Figure 1) described in this emerging research article.

Similar to the *FIO Food* project, multilevel stakeholder engagement is central to the *DIO Food* research project. Our key stakeholders cover at-risk consumers and representatives of major supermarkets that they are likely to interact with, including parents and carers of infants (aged 0–6 months) living on a low income, along with retail partners and their customers. Research that has patient, community and/or stakeholder collaboration and dialogue as core principals is termed stakeholder-engaged research (Goodman et al., 2020). Enabling stakeholders to drive research shifts away from traditional power and knowledge hierarchies between academics and participants to equitable knowledge ownership and creation (Corbie-Smith et al., 2018). Stakeholder-engaged research is considered a powerful tool for improving the outcomes of research through the incorporation of a variety of different perspectives (Goodman et al., 2020; Ray & Miller, 2017). Insights from stakeholders can identify community health needs and priorities, inform decision-making about the study and intervention design and

contribute to project monitoring and evaluation, to ensure that research is acceptable and relevant to service users (INVOLVE, 2012; National Institute for Health Research [NIHR], 2014; McMillan et al., 2018; Harrison et al., 2019). Furthermore, involving stakeholders in the communication of findings can improve dissemination if they are fully engaged throughout all stages of the research process (Brett et al., 2014; Elwy et al., 2022). Translating research outcomes and the views of low-income consumers effectively for policy and industry decision-makers is critical to the sustained adoption and implementation of research evidence into equitable policy and practice (Elwy et al., 2022; Vallance et al., 2022). Authentic, meaningful engagement with our key stakeholders is intended to enhance the reach and significance of our research and ensure that we maximise the impact of the *DIO Food* project.

The *DIO Food* project aims to work with early years, people living on a low income and retailers to generate opportune evidence-based research and commentary that informs diet-related health inequalities policy and practice in the context of the cost-of-living crisis. The purpose of this emerging research article is to introduce the rationale, methodologies and objectives of the three *DIO Food* WPs (WPs5, 6 and 7).

DIO FOOD WORK PACKAGES

WP5: Early years—UK infant food insecurity

This WP will apply a qualitative research approach to address a policy data gap associated with maternal and infant food insecurity prevalence, experience

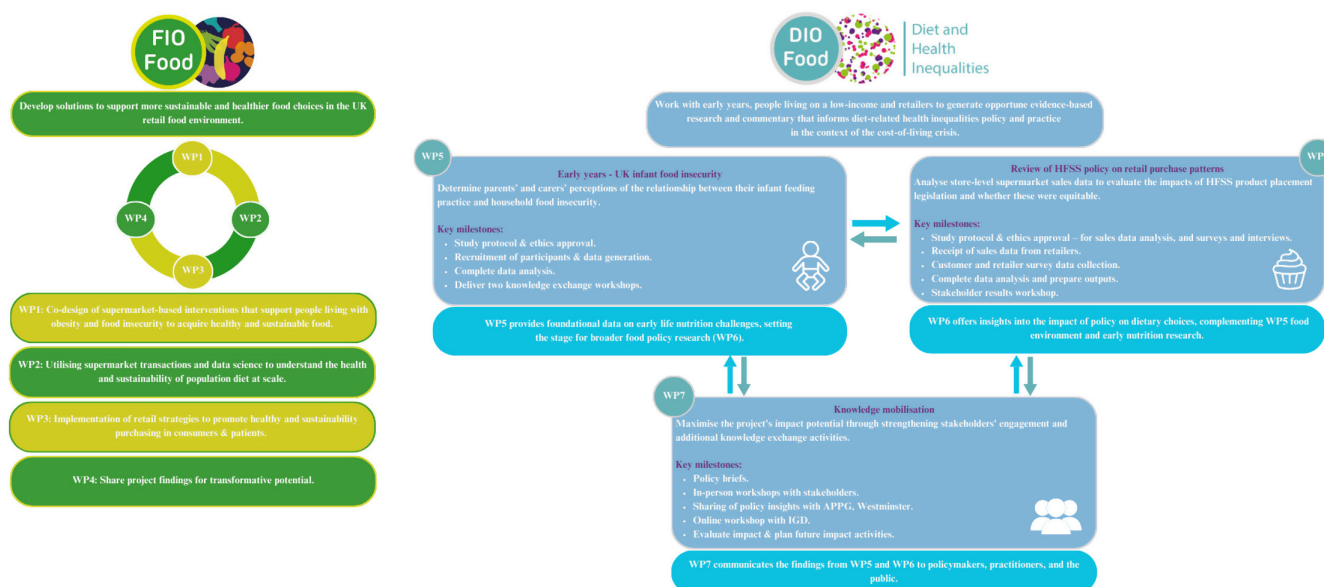


FIGURE 1 DIO Food project's structure, aims and key milestones, including related FIO Food work packages. APPG, All-Party Parliamentary Group; HFSS, high fat, sugar and salt; IGD, Institute of Grocery Distribution; WP, work package.

and ways in which families with very young children should be supported in the UK. This study targets early years for improving diet, including obesity prevention, and is consistent with the overall aims and underpinning rationale of the *DIO Food* study. Early years and more specifically, the first 1000 days of life have been recognised as a critical period in the development of childhood obesity that has consequences for children's future health and wellbeing (Baidal et al., 2016; Black et al., 2013). Much has been done to track household and later childhood food insecurity experience, and to secure the Right to Food for children in Scotland and the UK through policy development. But, there is a policy gap related to maternal and infant food insecurity in the UK. In the context of the current cost-of-living crisis, there is a desperate need to identify key priorities and policy actions concerning the impact of household food insecurity experience at this crucial early life stage.

Good nutrition is essential for promoting good health throughout the life course. Nutritional influences during early life, including in utero, can have an effect on health and wellbeing into adulthood (Langley-Evans, 2015; Wilkins et al., 2021) and there is growing recognition of the importance of epigenetic pathways in relation to in utero/early life stress exposures and metabolic disease and obesity. It is important to ensure individuals of all ages have access to good-quality, healthy food that meets their nutritional requirements. For infants aged 0–6 months, the World Health Organization and UNICEF recommend: 'Exclusive breastfeeding, without any additional food or fluids, not even water', with continued breastfeeding alongside complementary food for up to 2 years of age (UNICEF, 2023). However, infant feeding practices research from the Canadian context indicates that among women intending to breastfeed, some food-insecure mothers struggle to meet breastfeeding recommendations due to their experiences of insufficient breastmilk volume and personal concerns about the nutritional quality of their breastmilk, based on their lived experiences of the highly constrained quantity and quality of food they consume (Frank, 2020; Kay et al., 2020). Pressure to access infant formula impacts negatively on maternal mental health for families struggling with the costs of living (Feed, 2022; Scott, 2022). The cost of infant formula has grown exponentially in the last 18 months (First Steps Nutrition, 2022) which should be of significant public health concern given that many UK families continue to rely on infant formula to feed their babies during the first 6 months of life. Additionally, UNICEF guidelines recommend against the direct provision of infant formula through food and baby banks (UNICEF, 2022). There is emerging evidence that already food-insecure families struggle to afford infant formula in the UK (Feed, 2022) and formula milk has been reported as one of the most shoplifted items from retail and pharmacy stores (The Guardian, 2023). While efforts have been made to

monitor household and childhood food insecurity and to secure the Right to Food for children in the UK through policy development (The Food Foundation, 2022), a paucity of research on maternal and infant food insecurity in the UK remains. A recent scoping review of the factors associated with food insecurity among pregnant women and caregivers of children aged 0–6 months indicated a lack of qualitative evidence around the lived experience of maternal and infant food insecurity, required to deepen our understanding and help inform interventions and policy (Bastian et al., 2022).

To address this gap in the literature, after receiving all necessary approvals from the Robert Gordon University School Ethics Review Panel, WP5 will conduct a qualitative investigation of the lived experience of maternal and infant food insecurity, following a registered study protocol (Hunter et al., 2023). Interviews will be conducted with parents and caregivers ($n=25$) who are or have been responsible for feeding an infant aged 0–6 months. The final sample size will be dictated by data saturation; that is, recruitment will stop when no new information emerges from the interview data. Within the interviews, we will explore food-related challenges experienced by parents or caregivers during the first 6 months of their infant's life, their feeding intentions and whether these were realised as well as their perceptions of what has helped or hindered their ability to feed their infant the way they would like or intended during the cost-of-living crisis and with the UNICEF guidelines, outlined above, in mind.

Conscious of the sensitivities and challenges to personal identity associated with being a parent, particularly for women who are living with low income and caring for a young family (Douglas, 2023) our approach to the research is underpinned by consideration and humility in the face of the significant challenges that many families with young children and babies are experiencing at the current time due to the ongoing cost-of-living crisis in the UK. To ensure that we are conducting the research sensitised to those concerns, a short-life expert advisory group drawn from parent groups, public health professionals and academic stakeholder groups, with expertise in family and infant food insecurity has been convened to help us ensure the study approach enables and encourages parents to participate in the study in a dignified and meaningful manner. Study documents and details will be shared and discussed with the advisory group to ensure all materials (i.e. recruitment leaflets, information sheets, interview topic guides) are appropriate and acceptable, that the research is conducted sensitively, and that participants are treated with respect and dignity throughout the project. Additionally, the advisory group will be consulted on plans around reporting and documenting researcher concerns (i.e. disclosed or suspected harm or abuse, including timelines for reporting and escalation procedures).

We believe this approach will help ensure that we include appropriate safeguards to protect vulnerable participants. Advisory group members will be able to provide their thoughts on the findings as they emerge and provide advice to guide our dissemination of the results to those stakeholders who need to be aware of the findings.

The last survey on maternal nutrition and infant feeding in Scotland was conducted in 2017 (Scottish Government, 2017). This research focused solely on feeding practices but did not explore the impact of food insecurity on feeding decisions and behaviours. The key objective of our research is to capture parents' and carers' perceptions of the relationship between the food system and other influences impacting infant feeding practice, associated with the current cost-of-living crisis. Our impact will be to produce a research briefing to feed into at least one knowledge exchange event with key stakeholders from food industry, social and health policy and practice, and third sector domains.

WP6: Review of HFSS policy on retail purchase patterns

In October 2022, legislation came into effect in England that restricts promotion of HFSS products by in-store and online location (DHSC, 2023). The legislation employs choice architecture nudge theory (Münscher et al., 2016) to reduce impulse purchases and subsequent overconsumption of HFSS foods by limiting their prominence in retail environments. Pre-packaged products in 13 categories (DHSC, 2023) can no longer be placed at store entrances, at the ends of supermarket aisles, or at the checkouts (and online retail equivalent spaces) in larger retail stores (with a retail floor area greater than 185.8m²) unless they pass the UK's Nutrient Profiling Model (NPM) (Department of Health (DoH), 2011), a composite score accounting for less favourable (calories, saturated fat, sugar and sodium) and more favourable nutritive elements (fibre, protein and fruit, vegetable and nut content). Although not the overt intention of the policy, recent insight from IGD (Institute of Grocery Distribution) suggests that food businesses have also responded to the legislation by reformulating products to become 'healthier' and pass the NPM, incentivised by exemption from the restrictions (The Institute of Grocery Distribution [IGD], 2023). Despite an apparent lack of consumer awareness of the policy (IGD, 2023), cited commitments to reformulation suggest that the legislation could have led to positive dietary shifts, without conscious behaviour change efforts by consumers.

Supermarket purchase records can offer a reasonable proxy for dietary intake among loyal customers

(Jenneson et al., 2023). Evidence suggests that retail product placement strategies can impact shopper dietary quality (2023Jenneson et al., 2023; Shaw et al., 2020) and body mass index (Cohen et al., 2015). Those experiencing FI are often 'nudged' by economic constraints to buy calorie dense foods (Morales & Berkowitz, 2016); however, budgetary constraints for those experiencing food insecurity may also preclude them from being able to make impulse purchases. The impact of a policy aimed at reducing impulse purchasing by restricting placement of HFSS products on those experiencing FI needs to be better understood. It is important that evaluations of England's HFSS product placement legislation consider intervention effectiveness across different socio-economic groups. Described as a 'good first step' (Muir et al., 2023), the HFSS product placement legislation is set to underpin future HFSS policy, including proposed implementation in the UK's devolved nations of Scotland (Scottish Government, 2024) and Wales, and planned volume-based price promotion restrictions for England (DHSC, 2023). But implementation and enforcement of the legislation are not without their practical challenges, including the need for detailed implementation guidance and tools for automated, consistent implementation, such as an online dashboard, which would apply the rules in an identical way for each product and that does not rely on human interpretation (Jenneson et al., 2020; Jenneson & Morris, 2021; Muir et al., 2023). Without these, there is a risk that the policy will not achieve its full potential for impact.

Beginning a year on from the legislation's implementation, WP6 will conduct the first-ever cross-retailer independent evaluation of England's HFSS product placement legislation. Researchers will follow an a-priori protocol (Jenneson et al., 2024a, 2024b) to analyse store-level supermarket sales data provided by multiple large UK retailers to evaluate the HFSS product placement legislation (University of Aberdeen, 2024). We will answer the following research questions:

1. What happened to HFSS product sales after introduction of the policy?
2. What happened to the retail product portfolios after introduction of the policy?
3. Has the HFSS legislation lead to healthier overall purchasing using the Eatwell Guide as metric?
4. Were impacts of the HFSS legislation, determined by product sales (Research question 1) and purchasing in line with the Eatwell Guide (Research question 3), equitable across different sociodemographic groups across the country? These questions will be answered using store-level sales data, supplemented by contextual information collected during interviews and surveys with the retailers and customers (Jenneson et al., 2024a, 2024b).

The team will employ controlled interrupted time-series methodology to compare HFSS product sales in stores in England with a no-intervention counterfactual, and against sales from control stores in Scotland and Wales where the legislation was not introduced. Sales data will be assessed against a range of outcome measures, including HFSS status, nutrient metrics, and, with additional financial support from the IGD, the Eatwell Guide (GOV.UK, 2016) (as a marker of a healthy and sustainable diet). By sampling stores from areas across all tenths of the PPFI (a composite index for neighbourhood-level risk of food insecurity) (CDRC, 2022), in addition to profiling results according to the Index of Multiple Deprivation (GOV.UK, 2019), we will provide insight into the policy's equitability across different segments of the population. Product data will also be examined pre- and post-legislation to understand how different nutritional quality of available foods in different categories may have changed following the rules.

Insights from supermarket sales data will be further contextualised with findings from primary data collected via customer surveys, and surveys and interviews with retailer employees (Fildes et al., 2024; Jenneson et al., 2024a, 2024b). Customer survey data will be utilised to explore whether self-reported changes in shopping behaviours following the introduction of the HFSS legislation differ between customer groups (i.e. those experiencing food insecurity or families with young children) and to ascertain public perceptions of in-store changes following the legislation. Specifically, we will answer the following research questions: How frequently do customers report purchasing of HFSS products following the introduction of the HFSS legislation? Does this vary by customer demographics?; Does self-reported susceptibility to retailer strategies (product placement and price promotions) for the sales of HFSS products vary based on customer demographic characteristics?; Does awareness of changes to supermarkets following HFSS legislation vary by customer demographics (i.e. those experiencing food insecurity, households with children, those experiencing overweight or obesity)?; To what extent are customers in favour of the HFSS legislation?

In addition, retailer surveys and interviews will explore business-level responses to the HFSS legislation, specifically: What are the barriers to implementation? What are the resources required for implementation? What are the range of interpretations and implementation approaches applied by the UK retail sector?

These data will be used to inform and provide contextual information to aid the interpretation of the sales data.

By working closely with the project's retail partners and work package co-funder IGD, we aim to produce sector-level insights into whether the HFSS product placement legislation worked to reduce HFSS

purchasing, improve the healthiness of retailer product portfolios, and was equitable across areas with different characteristics.

WP7: Knowledge mobilisation, stakeholder engagement and impact

Knowledge mobilisation, also referred to as knowledge translation, knowledge exchange or knowledge transfer, is integral to the generation of research impact (described later in this section) (Bayley et al., 2017; NIHR, 2023). Knowledge mobilisation enables researchers to demonstrate the value of their data, engage stakeholders in the relevance of the research and appeal to a variety of audiences, to maximise impact on society, the economy, quality of life and public policy (Chandler et al., 2015; Phipps et al., 2016). The sharing of research knowledge was once considered to be a one-way process: however, knowledge mobilisation is now recognised as an evolving, bi-directional process that requires multiple perspectives and efforts from a variety of stakeholders (Gabbay et al., 2020; Phipps et al., 2016). According to NIHR (2023), 'Knowledge mobilisation is more than dissemination. It involves a two-way dialogue between researchers and research users so that knowledge can be shared to create new knowledge to catalyse change'. Equitable, participatory knowledge building that contributes to social transformation requires engagement with stakeholders affected by the social, environmental and economic impacts of the research (Buchanan, 2013; Vienni Baptista & Rojas-Castro, 2019). Knowledge mobilisation should narrow any inequalities, not exacerbate them and therefore *DIO Food* will co-create an inclusive, equitable knowledge mobilisation strategy that responds to the needs of citizens living with diet-related health inequalities.

Stakeholder engagement is defined by Deverka et al. (2012) as 'an iterative process of actively soliciting the knowledge, experience, judgment, and values of individuals selected to represent a broad range of direct interests in a particular issue, for the dual purposes of creating a shared understanding [and] making relevant, transparent and effective decisions'. Meaningful stakeholder engagement requires a communication strategy that is developed with consideration for the diverse needs of the recipients (Bessette, 2004). Effective communication planning is best achieved through co-production with the stakeholders at all stages of the process, including the identification of additional stakeholders and subsequent stakeholder mapping (Elwy et al., 2022). Engaging stakeholders in research communication amplifies research outputs and enhances end-user implementation, as outcomes are perceived as more trustworthy, and behaviour change recommendations

are deemed more feasible (NIHR, 2019; Goodman et al., 2020). Therefore, the *DIO Food* project stakeholder communication plan will be co-designed in collaboration with key stakeholders, such as IGD, charitable organisations and people living with FI, utilising their experiences, knowledge and communities to potentially increase the reach and impact of the project on diet-related health inequalities. Furthermore, food industry project partners will be integral to the design and delivery of a *DIO Food* industry-focused webinar, which will share results on the impact of HFSS legislations and whether impacts were equitable. The results will additionally include the customer and retailer perspective on the legislation. As regards online presence, the *DIO Food* project has a dedicated website (<https://www.abdn.ac.uk/rowett/research/dio-food-1857.php>) and we have created a space for digital sharing and engagement via our X profile (<https://twitter.com/FIOFood>—a profile representing both the *FIO Food* and *DIO Food* projects). Social media engagement can facilitate relationship building with a diverse range of potential stakeholders, promote project activities and provide a platform for co-creation (Trunfio & Rossi, 2021). Stakeholder engagement with the project will be further facilitated through the delivery of knowledge exchange activities, bi-annual meetings with project partners and stakeholders and scientific conferences, which will support shared knowledge generation and pathways to research impact.

In the past, the impact of research was considered only within the context of academia and the advancement of scientific knowledge (Bornmann, 2013). However, during the last 20–30 years, as the growth of research has outstripped public resources, the wider impact of research receiving public investment has been further scrutinised (Martin, 2011; Reed et al., 2021). Funding organisations and governments are increasingly seeking evidence to demonstrate that the research they support is making a tangible real-world difference beyond academia, including to society, the economy, policy, health and the environment (Bornmann, 2012; Watermeyer, 2016; NIHR, 2020). Therefore, researchers must capture impact to demonstrate the value of their work to stakeholders and the wider public (Penfield et al., 2014). However, the relationship between research outcomes and corresponding societal benefit is complex and non-linear; therefore, capturing impact is challenging (Bornmann, 2012; Greenhalgh & Fahy, 2015; Martin, 2011). Indeed, impact can develop through formal and informal networks and processes, including knowledge mobilisation and the co-production of research, creating the potential for multiple pathways to impact (Boulding et al., 2020).

Given the increasing requirement for academic researchers to capture and communicate impact, roles such as knowledge brokers, research impact

officers (RIOs) and public engagement officers, collectively referred to as ‘research impact practitioners’ by Bayley et al. (2017), have been created to support researchers. Research impact practitioners are commonly appointed by academic institutions in a central role, covering multiple projects; however, *DIO Food* project funding has been allocated to the employment of a dedicated RIO, to help facilitate pathways to impact and maximise: (1) the significance—importance and relevance of research findings in advancing knowledge, addressing societal challenges, and making a meaningful difference (Newell, 2023a); and (2) the reach—the extent, spread, breadth and/or diversity of the beneficiaries of the research outcomes (Newell, 2023b)—of the project.

The aim of WP7 is to optimise the impact potential of the *DIO Food* project and to ensure that impact is equitable across our society, through the social mobilisation of knowledge and inclusive engagement with stakeholders, including those living with FI.

CONCLUSIONS

We need evidence-based solutions to support the National Food Strategy Independent Review approach to, ‘deliver safe, healthy, affordable food, regardless of where people live or how much they earn’ (National Food Strategy Independent Review, 2021). The *DIO Food* project directly addresses the pressing issue of diet and health inequalities by engaging a variety of stakeholders to highlight the importance of the early years and evaluate the impact of current HFSS legislation. This new project has the capacity to inform policy directives targeting inequalities in the UK food system.

ACKNOWLEDGEMENTS

Funded through supplemental funding for the *DIO Food* grant (Diet and Health Inequalities) from the Transforming the UK Food System for Healthy People and a Healthy Environment SPF Programme, delivered by UKRI, in partnership with the Global Food Security Programme, BBSRC, ESRC, MRC, NERC, Defra, DHSC, OHID, Innovate UK and FSA. Grant Award BB/W018020/1, for *FIO Food: Food Insecurity in people living with Obesity—improving sustainable and healthier food choices in the retail FOOD environment*. WP6 received additional support from IGD (Institute of Grocery Distribution) through their Social Impact programmes on healthy and sustainable diets. Thanks to Ms. Mia Fuery for assisting in the design of Figure 1.

CONFLICT OF INTEREST STATEMENT

Victoria Jenneson and Michelle Morris declare their work in partnership with national UK retailers.

DATA AVAILABILITY STATEMENT


Data sharing not applicable to this article as no datasets were generated or analysed during the current study.

ORCID

Daniel R. Crabtree  <https://orcid.org/0000-0003-2013-9109>

Emma Hunter  <https://orcid.org/0000-0002-4858-5445>

Victoria Jenneson  <https://orcid.org/0000-0003-2468-8009>

Alison Fildes  <https://orcid.org/0000-0002-5452-2512>

Alice Kininmonth  <https://orcid.org/0000-0002-1145-525X>

Francesca Pontin  <https://orcid.org/0000-0002-7143-8718>

Marta Lonnie  <https://orcid.org/0000-0002-7257-165X>

Lizzy McHugh  <https://orcid.org/0009-0007-4840-9218>

Michelle A. Morris  <https://orcid.org/0000-0002-9325-619X>

Alexandra M. Johnstone  <https://orcid.org/0000-0002-5484-292X>

REFERENCES

- Baidal, J.A.W., Locks, L.M., Cheng, E.R., Blake-Lamb, T.L., Perkins, M.E. & Taveras, E.M. (2016) Risk factors for childhood obesity in the first 1,000 days: a systematic review. *American Journal of Preventive Medicine*, 50(6), 761–779. Available from: <https://doi.org/10.1016/j.amepre.2015.11.012>
- Bastian, A., Parks, C., Yaroch, A., McKay, F.H., Stern, K., van der Pligt, P. et al. (2022) Factors associated with food insecurity among pregnant women and caregivers of children aged 0–6 years: a scoping review. *Nutrients*, 14(12), 2407.
- Bayley, J., Phipps, D., Batac, M. & Stevens, E. (2017) Development of a framework for knowledge mobilisation and impact competencies. *Evidence and Policy*, 14(4), 725–738. Available from: <https://doi.org/10.1332/174426417X14945838375124>
- Bessette, G. (2004) *Involving the community: a guide to participatory development communication*. Ottawa: International Development Research Centre, p. 22.
- Black, R.E., Victora, C.G., Walker, S.P., Bhutta, Z.A., Christian, P., De Onis, M. et al. (2013) Maternal and child undernutrition and overweight in low-income and middle-income countries. *The Lancet*, 382(9890), 427–451. Available from: [https://doi.org/10.1016/S0140-6736\(13\)60937-X](https://doi.org/10.1016/S0140-6736(13)60937-X)
- Bornmann, L. (2012) Measuring the societal impact of research: research is less and less assessed on scientific impact alone—we should aim to quantify the increasingly important contributions of science to society. *EMBO Reports*, 13(8), 673–676. Available from: <https://doi.org/10.1038/embor.2012.99>
- Bornmann, L. (2013) What is societal impact of research and how can it be assessed? A literature survey. *Journal of the American Society for Information Science and Technology*, 64(2), 217–233. Available from: <https://doi.org/10.1002/asi.22803>
- Boulding, H., Kamenetzky, A., Ghiga, I., Ioppolo, B., Herrera, F., Parks, S. et al. (2020) Mechanisms and pathways to impact in public health research: a preliminary analysis of research funded by the National Institute for Health Research (NIHR). *BMC Medical Research Methodology*, 20, 1–20. Available from: <https://doi.org/10.1186/s12874-020-0905-7>
- Brett, J.O., Staniszewska, S., Mockford, C., Herron-Marx, S., Hughes, J., Tysall, C. et al. (2014) A systematic review of the impact of patient and public involvement on service users, researchers and communities. *The Patient-Patient-Centered Outcomes Research*, 7, 387–395. Available from: <https://doi.org/10.1007/s40271-014-0065-0>
- Buchanan, A. (2013) Impact and knowledge mobilisation: what I have learnt as chair of the Economic and Social Research Council evaluation committee. *Contemporary Social Science*, 8(3), 176–190. Available from: <https://doi.org/10.1080/21582041.2013.767469>
- Chandler, R., Anstey, E. & Ross, H. (2015) Listening to voices and visualizing data in qualitative research: Hypermodal dissemination possibilities. *SAGE Open*, 5(2), 2158244015592166. Available from: <https://doi.org/10.1177/2158244015592166>
- Cohen, D.A., Collins, R., Hunter, G., Ghosh-Dastidar, B. & Dubowitz, T. (2015) Store impulse marketing strategies and body mass index. *American Journal of Public Health*, 105, 1446–1452. Available from: <https://doi.org/10.2105/AJPH.2014.302220>
- Consumer Data Research Centre (CDRC). (2022) *Priority Places for Food Index, Version 1*. Available from: <https://data.cdrc.ac.uk/dataset/priority-places-food-index/resource/priority-places-food-index> [Accessed 17th November 23]
- Corbie-Smith, G., Wynn, M., Richmond, A., Rennie, S., Green, M., Hoover, S.M. et al. (2018) Stakeholder-driven, consensus development methods to design an ethical framework and guidelines for engaged research. *PLoS One*, 13(6), e0199451. Available from: <https://doi.org/10.1371/journal.pone.0199451>
- DEFRA (Department for Environment, Food & Rural Affairs). (2022) *Policy paper: Government Food Strategy*. Available from: <https://www.gov.uk/government/publications/government-food-strategy> [Accessed 14th May 2024]
- Deverka, P.A., Lavalley, D.C., Desai, P.J., Esmail, L.C., Ramsey, S.D., Veenstra, D.L. et al. (2012) Stakeholder participation in comparative effectiveness research: defining a framework for effective engagement. *Journal of Comparative Effectiveness Research*, 1(2), 181–194. Available from: <https://doi.org/10.2217/ce.12.7>
- DHSC (Department of Health & Social Care). (2020) *Policy Paper: Tackling obesity: empowering adults and children to live healthier lives*. Available from: <https://www.gov.uk/government/publications/tackling-obesity-government-strategy/tackling-obesity-empowering-adults-and-children-to-live-healthier-lives#empowering-everyone-with-the-right-information-to-make-healthier-choices> [Accessed 14th May 2024]
- DHSC (Department of Health & Social Care). (2023) *Guidance: restricting promotions of products high in fat, sugar or salt by location and by volume price: implementation guidance*. Available from: <https://www.gov.uk/government/publications/restricting-promotions-of-products-high-in-fat-sugar-or-salt-by-location-and-by-volume-price/restricting-promotions-of-products-high-in-fat-sugar-or-salt-by-location-and-by-volume-price-implementation-guidance#introduction> [Accessed 10th April 2024]
- Department of Health (DoH). (2011) *Nutrient Profiling Technical Guidance*. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/216094/dh_123492.pdf [Accessed 10th April 2024]
- Douglas, F. (2023) What qualitative research can tell us about food and nutrition security in the UK and why we should pay attention to what it is telling us. *Proceedings of the Nutrition Society*, 1–10. Available from: <https://doi.org/10.1017/S0029665123003713>
- Elwy, A.R., Maguire, E.M., Kim, B. & West, G.S. (2022) Involving stakeholders as communication partners in research

- dissemination efforts. *Journal of General Internal Medicine*, 37(Suppl 1), 123–127. Available from: <https://doi.org/10.1007/s11606-021-07127-3>
- Feed. (2022) *Feed Inquiry*. Available from: <https://www.feeduk.org/formulaisfood-inquiry22> [Accessed 28th September 23]
- Fildes, A., Kininmonth, A., Ennis, E., Jenneson, V. & Morris, M.A. (2024) Protocol: a mixed methods evaluation of retailer and customer responses to the implementation of the high fat, sugar and salt (HFSS) product placement restrictions legislation in England. Open Science Framework. Available from: <https://osf.io/d8bkf> [Accessed 9th August 2024]
- First Steps Nutrition. (2022) *Costs of infant formula, follow-on formula and milks marketed as foods for special medical purposes available over the counter in the UK: First Steps Nutrition Trust*. Available from: <https://infantmilkinfo.org/costs/> [Accessed 28th September 23]
- Frank, L. (2020) *Out of Milk: infant food insecurity in a rich nation*. Canada: UBC Press.
- Gabbay, J., Le May, A., Pope, C., Brangan, E., Cameron, A., Klein, J.H. et al. (2020) Uncovering the processes of knowledge transformation: the example of local evidence-informed policy-making in United Kingdom healthcare. *Health Research Policy and Systems*, 18, 1–15. Available from: <https://doi.org/10.1186/s12961-020-00587-9>
- Gatton, M.L. & Gallegos, D. (2023) A 5-year review of prevalence, temporal trends and characteristics of individuals experiencing moderate and severe food insecurity in 34 high income countries. *BMC Public Health*, 23, 2215. Available from: <https://doi.org/10.1186/s12889-023-17139-9>
- Goodman, M.S., Ackermann, N., Bowen, D.J. & Thompson, V.S. (2020) Reaching consensus on principles of stakeholder engagement in research. *Progress in Community Health Partnerships: Research, Education, and Action*, 14(1), 117–127. Available from: <https://doi.org/10.1353/cpr.2020.0014>
- GOV.UK. (2016) *The Eatwell guide*. Available from: <https://www.gov.uk/government/publications/the-eatwell-guide> [Accessed 10th April 2024]
- GOV.UK. (2019) *English indices of deprivation 2019*. Available from: <https://www.gov.uk/government/statistics/english-indices-of-deprivation-2019> [Accessed 10th April 2024]
- Greenhalgh, T. & Fahy, N. (2015) Research impact in the community-based health sciences: an analysis of 162 case studies from the 2014 UK research excellence framework. *BMC Medicine*, 13, 1–12. Available from: <https://doi.org/10.1186/s12916-015-0467-4>
- Harrison, J. D., Auerbach, A. D., Anderson, W., Fagan, M., Carnie, M., Hanson, C., Banta, J., Symczak, G., Robinson, E., Schnipper, J., Wong, C., & Weiss, R. (2019). Patient stakeholder engagement in research: A narrative review to describe foundational principles and best practice activities. *Health Expectations*, 22(3), 307–316. Portico. <https://doi.org/10.1111/hex.12873>
- Hunter, E., Douglas, F. & Johnstone, A. (2023) Diet and health inequalities (DIO) food project: feeding intentions and practices of parents and carers of infants (0–6 months) living on a low income in the UK. *Open Science Framework* <https://doi.org/10.17605/OSF.IO/834HU>
- Independent Food Aid Network (IFAN). (2023) *IFAN Data November 2023*. Available from: <https://www.foodaidnetwork.org.uk/data> [Accessed 10th April 2024]
- INVOLVE. (2012) *Briefing notes for researchers: public involvement in NHS, Public Health and social care research*. Available from: https://www.invo.org.uk/wp-content/uploads/2014/11/9938_INVOLVE_Briefing_Notes_WEB.pdf [Accessed 4th April 2024]
- Jenneson, V., Greenwood, D.C., Clarke, G.P., Hancock, N., Cade, J.E. & Morris, M.A. (2020) Restricting promotions of 'less healthy' foods and beverages by price and location: a big data application of UK nutrient profiling models to a retail product dataset. *Nutrition Bulletin*, 45, 389–402. Available from: <https://doi.org/10.1111/nbu.12468>
- Jenneson, V., Greenwood, D.C., Clarke, G.P., Rains, T., Tempest, B., Shute, B. et al. (2023) Supermarket transaction records in dietary evaluation: the STRIDE study: validation against self-reported dietary intake. *Public Health Nutrition*, 26(12), 2662–2676. Available from: <https://doi.org/10.1017/S13688980023001842>
- Jenneson, V. & Morris, M.A. (2021) Data considerations for the success of policy to restrict in-store food promotions: a commentary from a food industry nutritionist consultation. *Nutrition Bulletin*, 46, 40–51. Available from: <https://doi.org/10.1111/nbu.12486>
- Jenneson, V., Pontin, F., Ennis, E., Fildes, A. & Morris, M.A. (2024a) Protocol: using retail sales data to evaluate impacts of the high fat, sugar and salt (HFSS) product placement restrictions legislation in England. *Open Science Framework* <https://doi.org/10.17605/OSF.IO/KTSZA>
- Jenneson, V., Pontin, F., Ennis, E., Fildes, A. & Morris, M.A. (2024b) Has HFSS legislation led to healthier food and beverage sales? The DIO-food protocol – using supermarket sales data for policy evaluation. *International Journal of Population Data Science*, 9(4), 2426. Available from: <https://doi.org/10.23889/ijpds.v9i4.2426>
- Johnstone, A., Lonnie, M. & FIO-Food project team. (2023) The cost-of-living crisis is feeding the paradox of obesity and food insecurities in the UK. *Obesity (Silver Spring, Md.)*, 31, 1461–1462. Available from: <https://doi.org/10.1002/oby.23740>
- Johnstone, A.M. & Lonnie, M. (2023) Tackling diet inequalities in the UK food system: is food insecurity driving the obesity epidemic? (the FIO food project). *Proceedings of the nutrition society*, 1–20. <https://doi.org/10.1017/S0029665123004871>
- Joseph Rowntree Foundation. (2023) *5.7 million low-income households having to cut down or skip meals, as JRF's cost of living tracker shows "horrendous new normal"*. Available from: <https://www.jrf.org.uk/news/57-million-low-income-households-having-to-cut-down-or-skip-meals-as-jrfs-cost-of-living> [Accessed 7th March 2024]
- Kay, M.C., Cholera, R., Flower, K.B., Yin, H.S., Rothman, R.L., Sanders, L.M. et al. (2020) Are Low-income, diverse mothers able to meet breastfeeding intentions after 2 months of breastfeeding? *Breastfeeding Medicine*, 15, 435–442. Available from: <https://doi.org/10.1089/bfm.2020.0025>
- Langley-Evans, S.C. (2015) Nutrition in early life and the programming of adult disease: a review. *Journal of Human Nutrition and Dietetics*, 28, 1–14. Available from: <https://doi.org/10.1111/jhn.12212>
- Lonnie, M., Crabtree, D.R. & Johnstone, A. (2024) Tackling dietary inequalities in the UK food system: an exploration of stakeholders' experiences to deliver national recommendations for policy and health care practitioners (a framework for action). *Open Science Framework* <https://doi.org/10.31219/osf.io/evc9y>
- Lonnie, M., Hunter, E., Stone, R.A., Dineva, M., Aggreh, M., Greatwood, H. et al. (2023) Food insecurity in people living with obesity: improving sustainable and healthier food choices in the retail food environment—the FIO food project. *Nutrition Bulletin*, 48(3), 390–399. Available from: <https://doi.org/10.1111/nbu.12626>
- Martin, B.R. (2011) The research excellence framework and the 'impact agenda': are we creating a Frankenstein monster? *Research Evaluation*, 20(3), 247–254. Available from: <https://doi.org/10.3152/095820211X13118583635693>
- McMillan, B., Fox, S., Lyons, M., Bourke, S., Mistry, M., Ruddock, A. et al. (2018) Using patient and public involvement to improve the research design and funding application for a project aimed at fostering a more collaborative approach to the NHS health check: the CaVIAR project (better care via

- improved access to records). *Research Involvement and Engagement*, 4, 1–9. Available from: <https://doi.org/10.1186/s40900-018-0101-7>
- Morales, M.E. & Berkowitz, S.A. (2016) The relationship between food insecurity, dietary patterns, and obesity. *Dietary Patterns and Behaviour*, 5, 54–60. Available from: <https://doi.org/10.1007/s13668-016-0153-y>
- Muir, S., Dhuria, P., Roe, E., Lawrence, W., Baird, J. & Vogel, C. (2023) UK government's new placement legislation is a 'good first step': a rapid qualitative analysis of consumer, business, enforcement and health stakeholder perspectives. *BMC Medicine*, 21(1), 33. Available from: <https://doi.org/10.1186/s12916-023-02726-9>
- Münscher, R., Vetter, M. & Scheuerle, T. (2016) A review and taxonomy of choice architecture techniques. *Journal of Behavioral Decision Making*, 29, 511–524. Available from: <https://doi.org/10.1002/bdm.1897>
- National Food Strategy Independent Review. (2021) *The Plan*. Available from: <https://www.nationalfoodstrategy.org/> [Accessed 11th November 22]
- National Institute for Health Research (NIHR). (2014) *Patient and public involvement in health and social care research: A handbook for researchers*. Available from: <https://oxfordbrc.nihr.ac.uk/wp-content/uploads/2017/03/RDS-PPI-Handbook-2014-v8-FINAL-2.pdf> [Accessed 1st April 2024]
- National Institute for Health Research (NIHR). (2019) *How to disseminate your research*. Available from: <https://www.nihr.ac.uk/documents/how-to-disseminate-your-research/19951#:~:text=Stakeholder%20engagement%3A%20Work%20out%20who,waiting%20audience%20for%20your%20outputs> [Accessed 1st April 2024]
- National Institute for Health Research (NIHR). (2023) *Plan Knowledge Mobilisation*. Available from: <https://www.nihr.ac.uk/researchers/i-need-help-designing-my-research/plan-knowledge-mobilisation.htm> [Accessed 8th April 2024]
- Newell, S. (2023a) *Unveiling the Significance of Research Impact: Driving Change and Advancements*. Available from: <https://researchfish.com/blog/research-characteristics-significance/> [Accessed 2nd May 2024]
- Newell, S. (2023b) *Reaching Far and Wide: Exploring the Reach of Research Impact*. Available from: <https://researchfish.com/blog/research-characteristics-reach/> [Accessed 2nd May 2024]
- NIHR (National Institute for Health Research). (2020) *A strategy for impact*. Available from: https://sphr.nihr.ac.uk/wp-content/uploads/2021/02/Impact-strategy_guidance-doc_and-resources.pdf [Accessed 1st May 2024]
- Office for National Statistics (ONS). (2024) *Cost of living insights: Food*. Available from: <https://www.ons.gov.uk/economy/inflationandpriceindices/articles/costoflivinginsights/food> [Accessed 25th March 2024]
- Penfield, T., Baker, M.J., Scoble, R. & Wykes, M.C. (2014) Assessment, evaluations, and definitions of research impact: a review. *Research Evaluation*, 23(1), 21–32. Available from: <https://doi.org/10.1093/reseval/rvt021>
- Phipps, D., Pepler, D., Craig, W., Cummings, J. & Cardinal, S. (2016) The co-produced pathway to impact describes knowledge mobilization processes. *Journal of Community Engagement and Scholarship*, 9(1), 31–40. Available from: <https://doi.org/10.54656/gokh9495>
- Pollard, C.M. & Booth, S. (2019) Food insecurity and hunger in rich countries-it is time for action against inequality. *International Journal of Environmental Research and Public Health*, 16(10), 1804. Available from: <https://doi.org/10.3390/ijerph16101804>
- Pool, U. & Dooris, M. (2022) Prevalence of food security in the UK measured by the food insecurity experience scale. *Journal of Public Health*, 44(3), 634–641. Available from: <https://doi.org/10.1093/pubmed/fdab120>
- Ray, K.N. & Miller, E. (2017) Strengthening stakeholder-engaged research and research on stakeholder engagement. *Journal of Comparative Effectiveness Research*, 6(4), 375–389. Available from: <https://doi.org/10.2217/ce-2016-0096>
- Reed, M.S., Ferré, M., Martin-Ortega, J., Blanche, R., Lawford-Rolfe, R., Dallimer, M. et al. (2021) Evaluating impact from research: a methodological framework. *Research Policy*, 50(4), 104147. Available from: <https://doi.org/10.1016/j.respol.2020.104147>
- Scott, S.F. (2022) *Understanding the individual narratives of women who use formula in relation to the master narrative of "breast is best"*. Indianapolis: Indiana University-Purdue University.
- Scottish Government. (2017) *Scottish maternal and infant nutrition survey 2017*. Available from: <https://www.gov.scot/publications/scottish-maternal-infant-nutrition-survey-2017/pages/8/> [Accessed 10th April 2024]
- Scottish Government. (2024) *Restricting promotions of food and drink high in fat, sugar or salt: business and regulatory impact assessment – partial*. Available from: <https://www.gov.scot/publications/restricting-promotions-food-drink-high-fat-sugar-salt-partial-business-regulatory-impact-assessment/pages/4/> [Accessed 25th March 2024]
- Shaw, S.C., Ntani, G., Baird, J. & Vogel, C.A. (2020) A systematic review of the influences of food store product placement on dietary-related outcomes. *Nutrition Reviews*, 78(12), 1030–1045. Available from: <https://doi.org/10.1093/nutrit/nuaa024>
- Skeggs, H. & McHugh, L. (2023) Changing the retail food environment. *Nutrition Bulletin*, 48(4), 435–441. Available from: <https://doi.org/10.1111/mbu.12646>
- Statista. (2023) *Supermarkets in the United Kingdom – statistics & facts*. Available from: <https://www.statista.com/topics/1983/supermarkets-in-the-united-kingdom-uk/#editorPicks> [Accessed 1st March 2024]
- Stone, R.A., Brown, A., Douglas, F., Green, M.A., Hunter, E., Lonnie, M. et al. (2024) The impact of the cost of living crisis and food insecurity on food purchasing behaviours and food preparation practices in people living with obesity. *Appetite*, 196, 107255. Available from: <https://doi.org/10.1016/j.appet.2024.107255>
- The Food Foundation. (2022) *Children's Right2Food*. Available from: <https://foodfoundation.org.uk/initiatives/childrens-right2food> [Accessed 28th September 23]
- The Food Foundation. (2023a) *The Broken Plate 2023 report*. Available from: <https://foodfoundation.org.uk/publication/broken-plate-2022> [Accessed 6th March 2024]
- The Food Foundation. (2023b) *Food Insecurity Tracking*. Available from: <https://www.foodfoundation.org.uk/initiatives/foodinsecurity-tracking> [Accessed 6th March 2024]
- The Guardian. (2023) *Co-op stores in England put baby formula behind tills to deter theft*. Available from: <https://www.theguardian.com/business/2023/feb/19/co-op-stores-in-england-put-baby-formula-behind-tills-to-deter-theft> [Accessed 10th April 2024]
- The Institute of Grocery Distribution (IGD). (2023) *Reformulation by the food industry in the context of HFSS*. Available from: <https://www.igd.com/Social-Impact/Reports/Reformulation-by-the-food-industry-in-the-context-of-HFSS/23332> [Accessed 24 November 2023]
- The Trussell Trust. (2023) *1.5 million food parcels distributed as need continues to soar*. Available from: <https://www.trusselltrust.org/2023/11/08/1-5-million-food-parcels-distributed-as-need-continues-to-soar/> [Accessed 7th March 2024]
- Theis, D.R.Z. & White, M. (2021) Is obesity policy in England fit for purpose? Analysis of government strategies and policies, 1992–2020. *The Milbank Quarterly*, 99(1), 126–170. Available from: <https://doi.org/10.1111/1468-0009.12498>
- Trunfio, M. & Rossi, S. (2021) Conceptualising and measuring social media engagement: a systematic literature review. *Italian Journal of Marketing*, 2021(3), 267–292. Available from: <https://doi.org/10.1007/s43039-021-00035-8>

- UNICEF. (2022) *Supporting families with infants in food insecurity. Baby friendly initiative*. Available from: <https://www.unicef.org.uk/babyfriendly/local-authorities-guide/> [Accessed 28 September 23]
- UNICEF. (2023) *Supporting families with infants under 12 months experiencing food insecurity a guide for local authorities and health boards: UK Committee for UNICEF*. Available from: <https://www.unicef.org.uk/babyfriendly/local-authorities-guide/> [Accessed 28th September 23]
- University of Aberdeen. (2024) *Diet and Health Inequalities (DIO Food)*. Available from: <https://www.abdn.ac.uk/rowett/research/dio-food-1857.php#panel1863> [Accessed 14th May 2024]
- USDA Economic Research Service. (2022) Food security and nutrition assistance. Washington, USA: USDA Economic ResearchService. Available from: <https://www.ers.usda.gov/data-products/ag-and-food-statistics-charting-the-essentials/food-security-and-nutrition-assistance/>
- Vallance, K., Stockwell, T., Wettlaufer, A., Giesbrecht, N., Chow, C., Card, K.G. et al. (2022) Strategies for engaging policy stakeholders to translate research knowledge into practice more effectively: lessons learned from the Canadian alcohol policy evaluation project. *Drug and Alcohol Review*, 41(1), 246–255. Available from: <https://doi.org/10.1111/dar.13313>
- Vienni Baptista, B. & Rojas-Castro, S. (2019) Transdisciplinary institutionalization in higher education: a two-level analysis. *Studies in Higher Education*, 45(6), 1075–1092. Available from: <https://doi.org/10.1080/03075079.2019.1593347>
- Watermeyer, R. (2016) Impact in the REF: issues and obstacles. *Studies in Higher Education*, 41(2), 199–214. Available from: <https://doi.org/10.1080/03075079.2014.915303>
- Wilkins, E., Wickramasinghe, K., Pullar, J., Demaio, A.R., Roberts, N., Perez-Blanco, K.M. et al. (2021) Maternal nutrition and its intergenerational links to non-communicable disease metabolic risk factors: a systematic review and narrative synthesis. *Journal of Health, Population and Nutrition*, 40(1), 1–11. Available from: <https://doi.org/10.1186/s41043-021-00241-2>

How to cite this article: Crabtree, D.R., Hunter, E., Jenneson, V., Fildes, A., Kininmonth, A., Pontin, F. et al. (2024) Diet and health inequalities: Connecting with vulnerable groups to address food insecurity—the DIO food project. *Nutrition Bulletin*, 49, 561–571. Available from: <https://doi.org/10.1111/nbu.12709>