Generating novel solutions to improve food systems for human and planetary health

Martin White
Professor of Population Health Research
Cambridge Global Food Security Annual Seminar
6th July 2023
Obesity and overweight prevalence, and government obesity strategies, England 1990-2020

Conservative Government

Labour Government

Coalition Government

Conservative Government

1992: Health of the Nation

1999: Strong Lives: Our Healthier Nation

2004: Choosing Health

2010: Healthy Lives, Healthy People

2011: A call to action on obesity in England

2015: Childhood Obesity: A plan for action

2018: Childhood Obesity: A plan for action

2013: Childhood Obesity: A plan for action, Chapter 3

2018: Tackling Obesity

2019: Tackling Obesity

Prevalence of obesity and overweight

Year


Men

Women

Children (Aged 2-15)

Complicated vs Complex

Characteristics of Complex Systems

A ‘complex’ system
- Emergent behavior that cannot be simply inferred from the behavior of the components

Complex Systems
- Involve: Many Components
  - Dynamically Interacting
  - and giving rise to
  - A Number of Levels or Scales which exhibit
  - Common Behaviors

A ‘simple’ system
- Hierarchies
- Self-Organization
- Control Structures
- Composites
  - Substructure Decomposability

Equilibrium
- Chaos
- Fine Scales Influence Large Scale Behavior

Evolution
- Transdisciplinary Concepts
  - Across Types of Systems, Across Scales, and thus Across Disciplines

Interactive and Visual Representations: Visualizing complex systems science (CSS) by Marshall Clemens
https://necsi.edu/visualizing-complex-systems-science
The need for a complex systems model of evidence for public health

Harry Rutter, Natalie Savona, Ketevan Glonti, Jo Bibby, Steven Cummins, Diane T Finegood, Felix Greaves, Laura Harper, Penelope Hawe, Laurence Moore, Mark Petticrew, Eva Rehfuess, Alan Shiel, James Thomas, Martin White

Despite major investment in both research and policy, many pressing contemporary public health challenges remain. To date, the evidence underpinning responses to these challenges has largely been generated by tools and methods that were developed to answer questions about the effectiveness of clinical interventions, and as such are grounded in linear models of cause and effect. Identification, implementation, and evaluation of effective responses to major public health challenges require a wider set of approaches and a focus on complex systems.
The commercial food system, food processing and NCDs

White M, et al. What role should the commercial food system play in promoting health through better diet? BMJ 2020; 368 :m545
Goals, actions and alignment of the commercial food system and public health

Commercial food system - primary goal = short term profit

Current actions:
- High processed food production
- Unhealthy fast food
- Aggressive marketing of unhealthy foods
- Defensive and offensive challenges to public interest and overall

Public health policy - primary goal = population health

Current actions:
- Regulation - taxation, advertising restrictions
- Mandatory nutritional back-of-pack labelling
- Advisory front-of-pack labelling
- Education - social marketing

Potential for closer alignment

- More profitable retailing of fruits, vegetables, legumes, nuts, seeds minimally processed whole grains, seafood; reduced reliance on marketing of, and profit from, highly processed foods high in energy density, salt, sugar, and unhealthy fats
- Takeaways and restaurants selling more food high in fruits, vegetables, legumes, nuts, seeds minimally processed whole grains, seafood; reduced reliance on marketing of, and profit from, highly processed foods high in energy density, salt, sugar, and unhealthy fats
- Voluntary policies promoting healthier food sales/restricting unhealthy foods sales
- Supportive public health regulation, advice and infrastructure to help industry achieve these goals, including a framework convention on healthy and sustainable food systems

White M, et al. What role should the commercial food system play in promoting health through better diet? BMJ 2020; 368 :m545
Published July 2021. Independent Review, commissioned by DEFRA in 2019 – with commitment to bring forward a White Paper on food system reform within 6 months of publication.

https://www.nationalfoodstrategy.org/

Government eventually released a national food strategy in June 2022

Welcome to the Transforming UK Food Systems Programme

We aim to fundamentally transform the UK food system by placing healthy people and a healthy natural environment at the centre. To support this aim, we address critical questions, bring together different stakeholders across the food system and deliver evidence to enable action.

→ Find out more about our work
Food system trials to encourage healthy, sustainable diets

Funders: Economic and Social Research Council (ESRC)

Co-funders: Department for Environment, Food and Rural Affairs (Defra), Evaluation Task Force, Cabinet Office and HM Treasury, Food Standards Agency (FSA), Department of Health and Social Care (DHSC), Department for Levelling Up, Housing and Communities (DLUHC), Department for Education (DfE)

The Evaluation Accelerator Fund (EAF) supports evaluation across government to transform our understanding of the impact of activity in priority policy areas.
Our people

• Mandala is an interdisciplinary consortium of international experts in population health, food and nutrition, environmental sustainability, systems science, health economics and commerce

• Investigators come from the Universities of Birmingham, Cambridge, Exeter and Warwick, and the London School of Hygiene and Tropical Medicine, University College London and King’s College London

• We are partnering with:
  • Birmingham City Council
  • NGOs, including the Food Foundation, Soil Association, Growing Communities, Sustainable Food Places

• We are also working with:
  • Commercial partners including industry associations, wholesalers, supermarkets and other retailers, and social businesses
Our Vision

- To catalyse urban food system transformation, focusing on the City of Birmingham as a scalable case study, partnering with citizens and food system stakeholders to create a reproducible, collaborative change process
- To forge a novel, research ecosystem to ensure the co-production of evidence-informed solutions to current food system challenges
- To generate food system interventions that will lead to meaningful health, environmental, economic and societal impacts
- To influence action in cities across the UK and internationally using the body of knowledge generated
Theory of change

Inputs

- Engaged stakeholders & citizens from City of Birmingham
- Investment by stakeholders (e.g. BCC, food businesses)
- Research programme (6 work packages)
- Interdisciplinary research team expertise and effort
- Research funding (UKRI)

Interventions

- Knowledge synthesis
- Knowledge exchange (multimedia multichannel communications)

Preconditions

- Changes in preferences & social norms

Long term goals

- Habital Healthier Diet (mainly plant-based, sufficient energy & nutrients)
- Human Health (Obesity & NCDs)
- Health care costs
- Social costs
- Costs to economy
- Environmental costs

Key:
- Stakeholder activities
- Research activities
- Population preconditions
- Population goals
- Planetary preconditions
- Planetary goals
- Externalities

Changes in balance of foods in favour of a healthier, more affordable & more sustainable offer.
- Development & delivery of multiple, complementary interventions (powerful levers for food system change): education, training, procurement, economic incentives, regulations, etc.
- Change in balance of foods in favour of a healthier, more affordable & more sustainable offer.
- Demand for less healthy foods.
- Demand for less healthy foods.
- Demand for less Sustainable foods.
- Demand for more Sustainable foods.
- Healthier; and more sustainable, equitable and economically viable food system
- Healthier Diet (mainly plant-based, sufficient energy & nutrients)
- Environmental Degradation (Biodiversity, Pollution, Water depletion, Climate change)
- Planetary Health & Resilience (supporting diverse life on Earth)
Our principles

- Co-production with stakeholders, including all sectors and the public
- Closer alignment of commercial and population health and sustainability goals
- Minimise external costs of the food system (environmental, social and health)
- Prioritise population level, low agency interventions
- Design and deliver interventions within complex adaptive systems framework
- Anticipate and mitigate unwanted industry reactions to interventions
Inputs, outputs and flow

WP1 – Engage stakeholders & map food system

WP2 – Curate evidence & data resources

WP3 – Envision & prioritise food system interventions

WP4 – Optimise & evaluate interventions & system change

WP5 – Model health, equity, environmental & economic impacts

WP6 – Synthesise findings & ensure impact

Research Impacts
- Stakeholder & citizen engagement
- Food system transformation
- Health, equity, environmental & economic impacts
- New theory, methods, tools and data
- Generalisable knowledge

Estimated medium to long term health, economic, equity & environmental effects

Priority outcomes
- Principal system nodes & pathways

Leverage points
- Food system challenges
- Priority outcomes

Priority interventions for delivery & evaluation

Intervention & policy processes

Estimated intervention effect sizes
Sectors: relationships and characteristics

Wholesale and supply chains – fresh and ambient – different for chains vs independents

Grocery
- Supermarkets
- Convenience stores

Informal
- Emergency aid
- Affordable food

OOH
- Take away
- Eat in

Institutional catering
- Public sector
- Private sector

Chains

Independents

Consumers / households

Food waste
Grocery sector Causal Loop Diagram
Feedback loops identify leverage points
## Grocery CLD

<table>
<thead>
<tr>
<th>Problem</th>
<th>Potential solution</th>
</tr>
</thead>
</table>
| 1. Category management leads to overall imbalance of unhealthy/healthy in stores and means customers have work out how to turn ingredients into meals (requires complex knowledge and skills, time and effort) | • Different ways to present foods in ways more meaningful to consumers?  
• Start with an aisle dedicated to meal collections (like a menu box scheme) – focused on healthy and sustainable meals  
• Accompany with QR codes for recipes or an app (Whisk?) |
| 2. Manufacturer and retailer marketing out of/in store prompts impulse purchases (product placement, advertising, offers etc.) | • Work out how to promote planned purchases to drive home food preparation and drive down impulse purchases - ?digital solutions for online/in-store shopping/links to loyalty cards?  |
| 3. Convenience stores struggle to sell fresh produce – due to lack of space, chillers, supplies | • Work out solutions to improve efficiency and enable supply logistics (e.g. digital supply system) |
Mandala intervention selection

Intervention long-list (n = ) generated from both:
- Analysis of leverage points
- Rapid Solution Scan

Harvest stakeholder intervention ideas and test key intervention ideas from intermediate-list for discussion in stakeholder workshops/interviews (and raise remainder of interventions in conversation where possible)

Intermediate-list ranked using ‘Round 2’ criteria and assessed against informal conversations considering feasibility

Short-list of most promising intervention ideas tested with stakeholders; leading to prioritised interventions for each sector

Prioritised intervention ideas assessed as part of Mandala package, across all sectors, using ‘Round 3’ criteria (+ (rapid) evidence reviews?)

Final selection of 3-6 interventions (in place for development work)

A standardised, systematic process to ensure good coverage and sufficient scrutiny of potential ideas. Results can be shared with BCC, written for publication and used as the basis for future work (context-setting; generating a vision for a future food system)

- Ideas eliminated based on application of ‘Round 1’ criteria to create intermediate-list
- Ideas added from stakeholder engagement
- Ideas eliminated from stakeholder engagement
- Ideas with lowest ranking eliminated to create short-list
- Ideas not part of a coherent, promising package eliminated

Intervention ideas for: recommendation to BCC Food Strategy Action Plan; SALIENT (ESRC); other funded evaluations (e.g. PhDs)
<table>
<thead>
<tr>
<th>CRITERIA &amp; CATEGORY</th>
<th>DETAILS</th>
<th>CONSIDERATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FOOD SYSTEM IMPACTS</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Level (Reach) \( (R_1;\ R_2) \) | Population level interventions tend to minimise demands on individuals | • Impact = Reach x Effect Size  
• Helpful to distinguish where intervention has the potential for effects – e.g. environment vs population  
• Levels where there is large variation in outcomes may be most promising for intervention |
| System Leverage Points \( (R_1;\ R_2) \) | Identified Leverage Point/Barrier to Healthy Sustainable Food System Addressed | • Powerful vs Weak Leverage Point? |
| Transformative Potential \( (R_1;\ R_2) \) | Potential for ‘disruptive innovation’ | • Will it really lead to a step-change in current practice?  
• Does it represent a tipping point? |
| Outcomes \( (R_3) \) | Priority Food System Outcomes Addressed (Healthier; More Environmentally Sustainable; Fairer; Economically Viable) | • Primary Outcomes/ Secondary Outcomes  
• Trade-Offs between outcomes are likely  
• Possible unintended consequences |
| Activities \( (R_3) \) | Food System Activities Addressed | • Primary Activities/Potential Secondary Activities (Wider system impacts from ripple effects)  
• Potential for changing demand and supply  
• Potential for private/public sector change  
• Possible unintended consequences |
| **FEASIBILITY OF IMPLEMENTATION** | | |
| Cost (Financial) \( (R_2) \) | Costliness to implement (as a pilot for evaluation, or for mainstream delivery) | • Who will pay (and why)  
• Possible funding sources from public or private sector, for piloting or mainstream delivery |
<p>| Technical ( (R_2) ) | Technical barriers to delivery | Can these be readily solved with R&amp;D? |
| Deliverability ( (R_2) ) | Actors required for delivery | • Who? |</p>
<table>
<thead>
<tr>
<th>CRITERIA &amp; CATEGORY</th>
<th>DETAILS</th>
<th>CONSIDERATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EVIDENCE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Theory (R1: CLDs &amp; literature; R3: ToC)</td>
<td>Suitability based on theory</td>
<td>- Coherence based on existing theory (theory from literature, or theory as indicated by the CLD)</td>
</tr>
<tr>
<td>Need (R1; R3 comparative assessment)</td>
<td>Evidence of need for intervention</td>
<td>- Epidemiological, environmental, or other evidence</td>
</tr>
</tbody>
</table>
| Effectiveness (R2; R3) | Existing evidence of *effectiveness*, or *cost-effectiveness* | - Unlikely to be direct evidence of the intervention if an entirely novel design. In this case, could potentially identify evidence for components of the intervention, or evidence of interventions in other sectors. Alternatively, theory may provide a strong rationale for a novel intervention.  
  - Or modelling evidence suggestive of likely efficiency or effectiveness  
  - Evidence may come from international peer-reviewed literature or grey literature (e.g. policy evaluations, including local evaluations in B’ham or by commercial or other organisations – NB Risk of bias) |
| **(POLICY) COHERENCE** |         |                |
| Existing B’ham Interventions (R1) | Alignment with existing B’ham interventions and other activities | - Anything similar already operating in B’ham now?  
  - Anything like this been tried in B’ham before? |
| National Level Policy (R1) | Alignment with outcomes and interventions at national level | - National food policy priorities  
  - National food policy activities (e.g. DEFRA trials) |
| Commercial or organisational Strategy (R2) | Alignment with commercial or other stakeholder strategy (if applicable). | - Is the proposed intervention acceptable to the stakeholder? Does it align with their strategy? What changes would be needed to ensure alignment? |
| Local Policy/BCC Food System Strategy (R3) | Alignment with BCC outcomes and interventions (identified in the Strategy) | - BCC outcomes that the intervention targets  
  -Overlap with interventions proposed in Strategy/in stakeholder consultation  
  -Our interventions do not need to align with BCC strategy, although in some cases it may be important |
| Internal Mandala (R3) | Coherence with other Mandala Interventions | - Synergies – do interventions ‘work’ together?  
  - Tensions – are two or more interventions antagonistic? |
<table>
<thead>
<tr>
<th>CRITERIA &amp; CATEGORY</th>
<th>DETAILS</th>
<th>CONSIDERATIONS</th>
</tr>
</thead>
</table>
| Evaluability (R3)   | Is the intervention readily evaluable? 5 Questions. | • Data availability, desk research  
| Synergy and Evaluation (R3) | Can interventions be evaluated together (e.g. in factorial design)? Can we evaluate the combined effect of interventions in different parts of the system? | • Relationship between chosen interventions and evaluations will need careful consideration.  
• Opportunities for combined evaluation should be considered.  
• Scope for system level evaluation of all interventions needs to be considered |
OOH intervention: Affordable, healthy takeaway

What is the intervention and how will it work practically?
• Vegetarian, healthy, street-front takeaway in Balsall Heath, using mostly surplus food.
• Pay-what-you-feel/pay-it-forward model: full price, discounted, minimum contribution (£1/free).
• Fridge for cook-chill meals to heat at home.
• Up to 10 seats, parklet at the front.

How will it change the system?
• By increasing exposure to healthy outlets (via increased number and density of outlets), it could increase preference for healthy OOH options, especially for individuals on a lower income / living in lower-income neighbourhoods.
• By altering the ratio of unhealthy food price: healthy food price (due to reduced costs and reduced need for profit), if could increase consumption and consumer buying power.
• Could reduce meat consumption, reduce food waste and increase training and job opportunities.

Who will deliver it and on what timescale?
• ChangeKitchen, social enterprise caterers.
• Launching in early June, pilot funded by BCC and others.

Considerations and reflections
• Small scale; ChangeKitchen have ambitions to open more takeaways across the city.
• Located in a lower-income, highly diverse neighbourhood, on a street with a few other ‘unhealthy’ takeaways, on a busy cycle route into city centre.
• Fairly risky: the economics of this venture are untested (coffee offer is considered important stream of income).
• Scope for evaluating different models: pay-it-forward / pay-what-you-feel, food delivery.
# OOH intervention: Affordable, healthy takeaway

**Round 1 criteria**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rating</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level</td>
<td>Small potential reach; health &amp; env; may expand</td>
<td></td>
</tr>
<tr>
<td>System leverage points</td>
<td>Potentially powerful, but weak given low reach</td>
<td></td>
</tr>
<tr>
<td>Transformative potential</td>
<td>May not be scalable on current model</td>
<td></td>
</tr>
<tr>
<td>Theory (CLD)</td>
<td>Fits well</td>
<td></td>
</tr>
<tr>
<td>Evidence of need</td>
<td>?</td>
<td></td>
</tr>
<tr>
<td>Alignment with B’ham interventions</td>
<td>Funded by BCC</td>
<td></td>
</tr>
<tr>
<td>National level policy</td>
<td>Lots of previous discussion of something like this</td>
<td></td>
</tr>
</tbody>
</table>

**Round 2 criteria**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rating</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reach</td>
<td>Small potential reach; health &amp; env; may expand</td>
<td></td>
</tr>
<tr>
<td>System leverage points</td>
<td>Potentially powerful, but weak given low reach</td>
<td></td>
</tr>
<tr>
<td>Transformative potential</td>
<td>May not be scalable on current model</td>
<td></td>
</tr>
<tr>
<td>Financial cost</td>
<td>BCC supporting; costs are key evaluation Q</td>
<td></td>
</tr>
<tr>
<td>Technical barriers</td>
<td>Needs demonstration</td>
<td></td>
</tr>
<tr>
<td>Deliverability</td>
<td>ChangeKitchen</td>
<td></td>
</tr>
<tr>
<td>Evidence of effectiveness</td>
<td>Theory proposes effective; needs broader review</td>
<td></td>
</tr>
<tr>
<td>Commerical/organisational strategy</td>
<td>ChangeKitchen proposed</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
</tr>
<tr>
<td>Medium</td>
</tr>
<tr>
<td>High</td>
</tr>
</tbody>
</table>
We will prioritise interventions with the best chance of large, equitable, and long-term effects on healthy, sustainable food purchasing.

We will test at least 10 interventions (single or in combination) across 3 sectors representing the majority of purchasing decisions: retail, catering and community support.

We will focus on:

<table>
<thead>
<tr>
<th>Interventions</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability</td>
<td>Increase/reduce availability of (un)healthy and (un)sustainable foods, e.g. via reformulation of existing unhealthy/unsustainable products.</td>
</tr>
<tr>
<td>Size</td>
<td>Reducing portion and package size of UPF.</td>
</tr>
<tr>
<td>Promotions</td>
<td>Restricting advertising, marketing</td>
</tr>
<tr>
<td>Price</td>
<td>Encouraging purchasing of HSF foods through favourable pricing/price promotions</td>
</tr>
<tr>
<td>Provision of information</td>
<td>Environment and nutrition labelling</td>
</tr>
</tbody>
</table>
Reflections and challenges

- Eminently possible to generate novel solutions to food system challenges using systems thinking tools
- Highly dependent on stakeholder engagement
- Which can be challenging with some sectors
- Leading to sub-optimal solutions
- Existing evidence needs complementing with creative approaches to solution generation
- Tools needed to prioritise candidate solutions
- Ultimately, bravery needed from policymakers
Next steps

• Securing meaningful intervention delivery from stakeholders
• The challenges of real-world evaluation and co-design
• Synthesising evidence within and between interventions
• Generating policy impact
• Turning our methods into usable tools
• Scaling up approach at national level
www.mandala-consortium.org.uk
www.salientfoodtrials.uk

twitter: @mandala_food,
@martinwhite33

Email: martin.white@mrc-epid.cam.ac.uk