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Exploring the potential impact of the proposed UK TV and online food advertising regulations: a concept mapping study

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4 1 **Exploring the potential impact of the proposed UK TV and online food**
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6 2 **advertising regulations: a concept mapping study**
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16 ABSTRACT

17 **Objectives** In July 2020 the UK Government announced an intention to restrict advertisements for
18 products high in fat, salt and sugar on live broadcast, catch-up and on-demand television before 9pm;
19 and paid for online advertising. As no other jurisdiction has implemented similar regulations, there is
20 no empirical evidence about how they might perturb the food system. To guide the regulations'
21 implementation and evaluation, we aimed to develop a concept map to hypothesise their potential
22 consequences for the commercial food system, health and society.

23 **Methods** We used adapted group concept mapping in four workshops virtually with food marketing
24 and regulation experts across academia, civil society, government organisations, and industry (N=14),
25 supported by Miro software. We merged concepts derived from the four workshops to develop a
26 master map and then invited feedback from participants via email to generate a final concept map.

27 **Results** The concept map shows how the reactions of stakeholders to the regulations may reinforce
28 or undermine the impact on the commercial food system, health and society.

29 **Conclusions** We use the concept map to illustrate pathways in three potential scenarios: (i)
30 adaptations are made to the regulations in ways that reinforce positive impacts on public health; (ii)
31 adaptations are made to the regulations in ways that undermine impacts on public health; and (iii)
32 technicalities of the regulations cover too few unhealthy food products and advertising opportunities
33 to make a substantial difference to public health.

34 Prior to the regulations' initial implementation or subsequent iterations, they could be altered to
35 maximise the potential for reinforcing adaptations, minimise the potential for undermining
36 adaptations, and ensure they cover a wide range of advertising opportunities and foods. The concept
37 map will also inform the design of an evaluation of the regulations and could be used to inform the
38 design and evaluation of similar regulations elsewhere.

39 STRENGTHS AND LIMITATIONS OF THIS STUDY

- 40 • By including a diverse range of experts, we developed the first comprehensive articulation of
41 the potential pathways through which new advertising regulations may impact on the
42 commercial food system, health and society.
- 43 • Holding the workshops online may have facilitated greater attendance, particularly as we
44 employed techniques to minimise the limitations of online data collection.
- 45 • Timing the workshops after sufficient details are known about the regulations allowed for a
46 meaningful discussion about their impact but with enough time for the study's findings to feed
47 into the regulations' design.

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3 48 • Though we did not aim to achieve saturation in this study, we found it difficult to recruit
4 participants from industry.
5 49
6 50 • We necessarily invited more individuals than those who ultimately participated, which may
7 affect the transferability of the study's findings.
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 - We necessarily invited more individuals than those who ultimately participated, which may affect the transferability of the study's findings.

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52 INTRODUCTION

53 The World Health Organization (WHO) recommends that member states limit children's exposure to
54 marketing for less healthy foods.[1] The recommendation reflects evidence that marketing influences
55 food preferences and consumption, both at an individual (micro-level impacts)[2,3] and societal level
56 (macro-level impacts).[4] Marketing has been defined as "the activity, set of institutions, and
57 processes for creating, communicating, delivering, and exchanging offerings that have value for
58 customers, clients, partners, and society at large".[5] Marketing is exerted through a range of
59 activities, including those related to the product, its place, price and promotion.[6] Promotion includes
60 building games around products (advergaming), social media 'influencers', and paid for advertising in
61 any medium. Products high in fat, salt, or sugar (HFSS) are disproportionately advertised in the UK,
62 with only 2.5% of total food and soft drink advertising spend going towards fruit and vegetables in
63 2020.[7] Though the causal pathways between advertising and obesity are likely to be complex,[8] it
64 is estimated that 6.4% (95% confidence interval (CI): 2.0-13.8) of UK childhood obesity and 5.0% (95%
65 CI: 1.5-10.9) of overweight is attributable to HFSS television advertising alone.[9]

66 To address concerns about the prevalence of childhood obesity, in July 2020 the United Kingdom's
67 (UK) Government Department of Health and Social Care published an intention to restrict
68 advertisements for HFSS food and drink products on live broadcast, catch-up and on-demand
69 television ('TV') before 9pm and paid for online advertising ('online').[10] Current details of these
70 proposed regulations are summarised in **Box 1**, and though they have passed through the House of
71 Lords in the Health and Care Bill,[11] details of the regulations may change before they receive Royal
72 Assent and are implemented.

73 INSERT BOX 1 HERE

74 The TV and online regulations proposed for the UK will be some of the most restrictive worldwide,
75 and the first to explicitly address paid for online advertising.[12] Overall, 18% of UK advertising spend
76 is for TV slots and at least 63% for online slots.[13] Though there has been a recent decline in broadcast
77 TV viewing in the UK, average viewing time remains around three hours per day for ages 4 years and
78 above.[13] The Covid-19 pandemic has accelerated use of subscription video-on-demand services,
79 with viewing of services such as Netflix and Amazon Prime Video almost doubling in 2020 to an
80 estimated 1 hour per person per day.[14] Such services would be covered by the proposed online
81 regulation rather than the TV one. While the decline in broadcast TV viewing has been more
82 pronounced among younger people (for 16-24 year olds down 18%, and for children 4-15 year olds
83 down 16% in 2019),[13] this has corresponded with an increase in viewing of subscription video-on-
84 demand services among younger people (by 55 minutes to an average of two hours per day between

1
2
3 85 April 2019 and April 2020).[14] It has been estimated that a pre-9pm ban on HFSS TV food advertising
4 86 would result in a 4.6 (1.4-9.5)% reduction in childhood obesity and a 3.6 (1.1-7.4)% reduction in
5 87 childhood overweight prevalence.[9] Effects were two-fold greater in the least compared to the most
6 88 affluent social groups and would likely be amplified by comparable restrictions on online food
7 89 promotion.[9] The ultimate results of such a regulation were predicted to depend on how HFSS
8 90 advertising patterns change in response.[9]

91 Few evaluations of such food advertising restrictions have been conducted worldwide,[12] partly
92 because there have been few comparable regulations. There are also challenges to evaluating this
93 type of intervention that is delivered to whole populations and so is impractical to subject to
94 experimental evaluation techniques such as randomised controlled trials.[15] Furthermore, the
95 commercial food sector exhibits characteristics of a complex adaptive system.[16] Adaptations made
96 by stakeholders residing in the system that is regulated may lead to both intended and unintended
97 consequences that ultimately impact on the overall effectiveness of regulations.[16] The 'balloon
98 effect' proposes that restrictions on one type of marketing can lead to increases in others,[17] as
99 companies and other aspects of the food system adapt. Articulating these possible adaptations and
100 their potential consequences should help refine details of the regulations before implementation.
101 Understanding possible adaptations and consequences should also help inform the design of any
102 evaluation.

103 To maximise the applicability of evaluation findings to policymakers outside of the UK, it is helpful for
104 evaluators to test theories as well as evaluate interventions.[18] Theory-driven evaluation first
105 requires the development and clear articulation of program theory.[19] Concept mapping is an
106 approach particularly useful for public health researchers interested in developing theory.[20] A
107 concept map is a "diagram of proposed relationships among a set of concepts....about a particular
108 question....or topic".[21] Concept maps can be used to help organise ideas, demarcate an area of
109 interest and plan evaluations. Group concept mapping is a structured approach involving group work
110 that is flexible to many public health contexts.[22]

111 **Objectives**

112 In this study, we used an approach inspired by group concept mapping to develop a concept map of
113 how the new TV and online advertising regulations may impact on the commercial food system, health
114 and society. We aimed to describe how the regulations may interact with the food system so that
115 evaluations of the regulations can be grounded in clearly articulated theory, and so that adaptations
116 to the regulations that could improve the health impact can be identified before implementation.

117 **METHODS**

118 **Study design**

119 We created a concept map of the potential pathways through which the regulations may impact on
120 the commercial food system, health and society. By 'food system' we mean the interdependent
121 network of entities involved in agriculture and fisheries, food processing and production, storage and
122 distribution, wholesaling and retailing, and preparation and marketing of raw, processed and ready to
123 eat foods.[16] By 'society', we mean the wider social system in which the food system is embedded.
124 We developed the map using an adapted version of a group concept mapping method in four
125 workshops.[22] The study reporting adheres to the Consolidated Criteria for Reporting Qualitative
126 Research (COREQ) (**Appendix 1**),[23] but recognises proposed amendments relating to gender.[24]

127 **Participant recruitment**

128 Workshop participants were recruited from academia, civil society, government organisations and
129 industry (e.g., food industry, media, advertising). Individuals were eligible for inclusion if they had
130 professional knowledge and experience of food marketing regulation within their sector and were
131 based in the UK. We identified individuals from our existing contacts in these sectors and by searching
132 the websites of relevant organisations. Individuals were invited by email to take part in the study. We
133 aimed to recruit up to 20 individuals, approximately evenly distributed across the participant groups.
134 As we were not aiming to reach 'saturation',[25] we decided on the number of people to recruit to
135 the study pragmatically, based on the resources available to us but allowing for sufficient breadth.

136 Participants from industry attended a separate workshop to those from academia, civil society and
137 government organisations due to the potential for conflicts of interests between sectors. We set a
138 limit of 10 participants per workshop in addition to the facilitators (JA and HF, who both had qualitative
139 research experience, e.g., [26,27]), which is considered a manageable total number of participants to
140 permit dialogue and engagement.[22] Workshops were arranged around participants' availability in
141 July and August 2021 and lasted 2 hours each.

142 **Data collection**

143 Building on previous work that has used group concept mapping to inform the design of evaluations
144 of population health interventions,[28] we used the first three steps of group concept mapping
145 (preparation, generation and structuring)[22] and added a fourth (reflection). The first three steps
146 were achieved in the workshops, and the final step was achieved using an online feedback form. We
147 held the workshops on Zoom, an online videoconferencing software (<https://zoom.us/>) to minimise
148 time demands on participants and as data collection took place during COVID-19 restrictions. In the

1
2
3 149 workshops, we used a combination of pre-piloted Microsoft PowerPoint slides and Miro software
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5 150 (<https://miro.com/>) to provide instructions to participants and visualise their contributions as they
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7 151 were made, respectively. Our data consisted of screenshots of maps as they developed, the map from
8
9 152 each workshop, audio recordings of the workshops, and post-workshop feedback returned through
10
11 153 an online form. Workshops were held under the Chatham House Rule[29]: participants were told they
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13 154 could use the information discussed in the workshops, but they could not reveal the identity or
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15 155 affiliation of other participants. **Figure 1** summarises the method used to develop the final concept
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17 156 map.

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INSERT FIGURE 1 HERE

158 Preparation

159 Preparation entailed setting out the aims and processes of the workshop and agreeing the focus area
160 of the map.[22] At the beginning of each workshop, the workshop facilitators introduced the aims and
161 processes. They reminded participants of the intervention details, the withdrawal process and that
162 the workshops were being recorded. The facilitators proposed that the focus area was “what are the
163 potential pathways through which the intervention might impact on health, the commercial food
164 system and society?”. Participants were invited to help refine this during a discussion of approximately
165 5 minutes.

166 Generation

167 Generation is a divergent process where participants individually brainstorm a long list of responses
168 to the focus area and consider the relative importance of each response.[22] Participants were given
169 around 10 minutes to independently generate a list of as many responses as possible to the refined
170 focus area, including pathways to both positive and negative impacts arising from the regulations.

171 Structuring

172 Structuring is a convergent process where participants organise and critically reflect on ideas and
173 relationships between concepts.[22] For approximately 60 minutes, participants were asked in turn
174 to contribute responses to the focus area from their individual brainstorming in order of relative
175 importance. These were structured and visualised in real-time using Miro, which was shared on-screen
176 with participants, with new concepts and relationships added to a draft map as participants suggested
177 them (see **Figure 2**). Once all responses were included, participants were invited to reflect on the map,
178 adding additional concepts and relationships as required. We adopted an inclusive approach to adding
179 concepts and relationships to maps, including everything mentioned and not deleting anything
180 previously added.

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5 182 Reflection
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8 183 After the workshops, we merged the map from each workshop into one 'master' map. We used a
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10 184 method inspired by those employed in other mapping projects.[30] First, all concepts in the maps
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12 185 were documented in a Microsoft Excel sheet, and similar or identical concepts across the maps were
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14 186 grouped and refined into simplified concepts and accompanying descriptions. Second, these refined
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16 187 concepts were mapped in a way that corresponded with pathways depicted in the four separate maps.
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18 188 Concepts not immediately fitting anywhere were placed to the side for further deliberation.

19 189 We then circulated the master map to all workshop participants by email. The email contained a link
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21 190 to an online form issued via REDCap (<https://www.project-redcap.org/>) that asked questions about
22
23 191 the map to seek suggested changes. We used the suggestions to produce a final concept map.

24 192 **Analysis**

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26 193 Beyond merging the maps from each workshop into a master map, no formal analyses were
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28 194 conducted.

29 195 **Ethics**

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31 196 The study received favourable review from the University of Cambridge School of Humanities and
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33 197 Social Science Research Ethics Committee in June 2021, reference number 21.276. Participants were
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35 198 provided with an information sheet about the study and provided informed consent before joining a
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37 199 workshop using an e-consent form issued via REDCap.

38 200 **Patient and public involvement**

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41 201 Patients and/or the public were not involved in the design, conduct, reporting or dissemination plans
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43 202 of this research.

44 203 **RESULTS**

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47 204 From four workshops with a total of 14 participants, we developed a concept map to describe how
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49 205 the proposed TV and online advertising regulations may impact on the commercial food system,
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51 206 health and society. Here we present the concept map and describe its component concepts.
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207 Participant characteristics

208 We held four workshops: one with individuals from industry, and three with individuals from
 209 academia, civil society, and government organisations (see **Table 1**). As the focus was on generating
 210 the map as a group, we did not collate any demographic information about participants.[30]

211 **Table 1 Sectors included in each workshop**

Participant sectors per workshop	Workshop 1	Workshop 2	Workshop 3	Workshop 4	Total
Academia	2	1	1	0	4
Civil society	2	1	3	0	6
Government organisation	0	1	1	0	2
Industry	0	0	0	2	2
				Grand total	14

212 Concept map of anticipated adaptations to the regulations

213 The maps produced in each workshop are provided in **Appendix 2**, and they illustrate the nuance in
 214 focus between workshops. For example, the workshop with industry participants focused more on the
 215 technical difficulties presented by the regulations than in other workshops. The resultant conceptmap
 216 is presented in **Figure 3**, and it depicts the possible pathways of change that could follow the
 217 regulations. Colour coding is used to differentiate the groups of reactions to the regulations:
 218 government, food and beverage companies, public, society and health. Pathways depicted are not
 219 exhaustive, as it is possible that other links between concepts exist that were not captured in the
 220 workshops. The map is also accompanied by a list of factors that may modify the impact of pathways
 221 that it depicts, such as socioeconomic position and company size. The concepts contained in each
 222 workshop map, and the corresponding concepts they were assigned in the final concept map, are
 223 provided in **Appendix 3**. Concepts are described in more detail in **Table 2**.

224 INSERT FIGURE 3 HERE

225 **Table 2 Description of concepts in the concept map**

Statement	Description
Anticipation	Food and drink companies foresee the introduction of the regulations ^a , and possibly other related legislation e.g., volume and location price promotion.
Availability of HFSS products	Availability of <i>all</i> HFSS foods and beverages, both within and outside the scope of the regulations ^a , in physical and online shops.
Bodyweight	In terms of Body Mass Index (BMI), overweight or obesity status.

Statement	Description
Calorie consumption	Total energy intake of individuals.
Child purchasing requests for HFSS products	Degree to which children make purchasing requests to caregivers for <u>all</u> HFSS products, both within and outside the scope of the regulations ^a .
Commercial food system	Interdependent networks of commercial entities involved in agriculture and fisheries, food processing and production, storage and distribution, wholesaling and retailing, and preparation and marketing of raw, processed, and ready to eat foods.[16]
Company engagement with health issues	Degree to which food and beverage companies orientate their business around public health goals.
Company profitability	A company's ability to make profit.
Consumption of regulated HFSS products	Individual's intake of foods and beverages within the scope of the regulations ^a .
Consumption of unregulated products	Individual's intake of foods and beverages that are not within the scope of the regulations ^a .
Definitions	Information used to define or enforce the regulation ^a , including the UK Nutrient Profiling Model and the food categories from the Sugar Reduction Strategy. Importantly, the regulations ^a cover a group of foods that is different from those covered by other UK dietary public health regulations. Enforcement is based on information provided by companies.
Demand for regulated HFSS products	Public desire to purchase or consume foods and beverages within the scope of the regulations ^a .
Demand for unregulated products	Public desire to purchase or consume foods and beverages outside of the scope of the regulations ^a .
Digital surveillance	Digital data collated by website to inform regulation ^a enforcement.
Employment	Number of people employed in the commercial food system.
Exposure to advertising for unregulated products	Adverts for products outside of the scope of the regulations. For foods and beverages, this could be HFSS products within companies' portfolios that are outside of the scope of the regulations, healthier products (e.g., fruit and vegetables), or food delivery companies. Also includes non-food and beverage products and services, but not clear what health impacts they might have.
Exposure to advertising for regulated HFSS products	Exposure to advertising for food and beverages within the scope of the regulations ^a .

Statement	Description
Exposure to unregulated marketing of HFSS products	Exposure to advertising for <u>all</u> HFSS products on media that are outside of the scope of the regulations ^a . Includes offline advertising (e.g., print media), forms of marketing online that are exempt from the regulations (e.g., in owned media), sponsorship, brand advertising and creative modes of marketing that are hard to capture with regulation.
Health	Overall health, including and beyond bodyweight and non-communicable diseases (NCDs).
Lobbying against further interventions	Activities undertaken by, or on behalf of, food and beverage companies to resist further policy or regulations.
Market share	The size of the total market held by a company. Few companies that each hold a large market share creates a concentrated market.
Portion size	Size of food and beverage products in grams or calories, or recommended portion size.
Price	Price of food and beverage products, including price discounts.
Product innovation for unregulated products	Developing new products that are outside of the scope of the regulations ^a , or reformulating existing products so they are no longer within the scope of the regulations. Could include reformulation using artificial ingredients or developing e.g., saltier products that are currently an exempt category. Some categories of products are easier to change than others, and some companies are better able to respond in this way than others.
Public awareness	Degree of public awareness of both the regulations ^a and the problems they are trying to address.
Public support	Degree of public support for the regulations ^a .
Purchases of regulated HFSS products	Sales (from company perspective) or purchases (from individual perspective) of food and beverage products within the scope of the regulations ^a .
Purchases of unregulated products	Sales (from company perspective) or purchases (from individual perspective) of food and beverage products outside of the scope of the regulations ^a .
Regulatory and political landscape	Wider landscape of regulation and policy, including others relating to marketing (e.g., location and volume price regulations) and COVID-19. The degree to which the regulations ^a harmonise with the wider political and regulatory landscape.
Regulatory precedent	Implementation of the regulations ^a serves as precedent for any future regulation.
Risk of diet-related NCDs	Risk of developing NCDs influenced by dietary behaviours.
Social norms around food	Implicit or explicit beliefs, attitudes, or behaviours about eating, at both an individual and family level.

Statement	Description
Society	The wider social system in which the food system is embedded.
Societal shifts	Exposure to advertising effects social norms and may contribute to societal changes in consumerism and culture.

226 Notes: BMI = body mass index; HFSS = high fat, salt, and sugar; NCD = Non-communicable disease.

227 ^aThe regulations apply to online and TV advertising for a subset of HFSS products, defined by the
 228 2004 to 2005 UK Nutrient Profiling Model and within particular categories from the Sugar Reduction
 229 Strategy. This means there are HFSS products (unregulated HFSS) and non-HFSS products outside
 230 of the scope of the regulations.

231 **DISCUSSION**

232 **Overview of findings**

233 Using an adapted group concept mapping method in four expert workshops, we developed a concept
 234 map to visualise how the proposed TV and online food advertising regulations may impact on the
 235 commercial food system, health and society. The concept map illustrates that the pathways between
 236 the regulations and these impact domains will be determined by the reactions of stakeholders.

237 **Strengths and limitations**

238 To our knowledge, this is the first cross-sectoral attempt to explicitly theorise how regulations of this
 239 kind may impact on the commercial food system, health and society. Incorporating the views of a
 240 range of experts with different perspectives and interests allowed us to create a comprehensive
 241 articulation of the ways the regulations may positively or negatively affect public health. As with any
 242 qualitative research, our map does not claim to be representative of views of the wider groups that
 243 participants represent.[30] Instead, we intended to sample a diverse range of expert views related to
 244 food marketing and its regulation. Including participants from diverse sectors is a strength of the study
 245 as it enabled the proposed regulations to be theorised expansively.

246 We necessarily invited more individuals than those who ultimately participated. The timing of the data
 247 collection period was a common reason for non-participation in the workshops, as it coincided with
 248 summer and school holidays in the UK, which may have made it difficult for those with child caring
 249 responsibilities to attend. To accommodate individuals' other commitments, we held smaller
 250 workshops across various times and days. Doing so increased the participation in our study, but it may
 251 have lost some discussion and synergy that larger groups allow.

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2
3 252 We found it difficult to recruit individuals from industry and government organisations. Employees
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5 253 from these sectors rarely have their contact details listed on public-facing websites, unlike those from
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7 254 academia and civil society. Government organisations expressed reluctance to contribute information
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9 255 beyond what was already in the public domain.[31] There may have also been reluctance from
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11 256 industry to engage with our research due to inherent differences between the goals of public health
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13 257 researchers and of the food industry. Industry perspectives in our study may therefore be more
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15 258 sympathetic to public health goals than those of the wider sector. Participants may have also taken
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17 259 part in our study to pursue their own agenda, as industry actors have previously sought to undermine
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19 260 food advertising regulations.[32,33] There are some differences in the contributions made by industry
20
21 261 participants compared with non-industry ones (**Appendix 2** and **3**). However, the nature of the
22
23 262 workshop content, holding workshops with experts from non-industry sectors, and verifying findings
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25 263 with all participants, left little room for industry interests to overly-dominate our concept map.

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27 264 Conducting the workshops in person may have achieved different results, as some participants may
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29 265 have felt more able to share sensitive information in person. However, online workshops widened
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31 266 attendance to those who would have been unable to attend in-person. To avoid some of the potential
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33 267 challenges of collecting data using Zoom, we employed several recommended strategies.[34] This
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35 268 included using screen-sharing and clear greetings to develop rapport, using back-up recording devices,
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37 269 holding facilitator briefings to avoid technical issues, and establishing 'house rules' to ease
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39 270 participants' experiences.[34] To maintain participant engagement, workshop duration was limited to
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41 271 two hours, and primarily focused on capturing concepts rather than exhaustively detailing the
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43 272 pathways between them. Though it may have increased participant fatigue and burden, holding longer
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45 273 workshops may have allowed time to capture additional concepts and pathways. As a form of
46
47 274 member-checking,[35] we verified the master map with all workshop participants by email, in a
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49 275 further attempt to ensure the final concept map accurately represented participants' contributions
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51 276 and to allow additional comments.

277 **Interpretation of findings**

52
53 278 The concept map can be used to illustrate pathways through which the reactions of food and drink
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55 279 companies may serve or undermine the public health goals of the regulations. Here, we describe three
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57 280 potential scenarios: (i) adaptations are made to the regulations in ways that reinforce positive impacts
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59 281 on public health; (ii) adaptations are made to the regulations in ways that undermine impacts on public
60
282 health; and (iii) technicalities of the regulations cover too few unhealthy food products and advertising
283 opportunities to make a substantial difference to public health. As it is unlikely all companies will

1
2
3 284 respond uniformly, a combination of the three scenarios may follow the implementation of the
4
5 285 regulations.

6
7 286 Scenario 1: adaptations reinforce positive impacts of the regulations on public health

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9 287 Companies may reduce their TV and online advertising for regulated HFSS products, as they will have
10
11 288 less opportunity for advertisements. Doing so reduces people's exposure to HFSS adverts, which may
12
13 289 prompt corresponding reductions in demand, purchases and consumption of the associated HFSS
14
15 290 products. Consequently, this will reduce the total number of calories consumed by individuals,
16
17 291 improving health outcomes both associated with, and independent of, body weight.

18
19 292 To make up lost revenue from fewer HFSS product purchases, companies may increase TV and online
20
21 293 advertising for their products that are out of the scope of the regulations (e.g., 'spotlighting' low-fat,
22
23 294 -salt and -sugar alternatives). They may also engage with diet-related health issues, which could
24
25 295 include developing and advertising new products that are out of scope of the regulations, particularly
26
27 296 if there is public support for the regulations and corresponding falls in demand for HFSS products.
28
29 297 Doing so reduces the proportion of HFSS products (relative to non-HFSS) available in the food system.

29
30 298 Reduced exposure to HFSS adverts may change social norms about the acceptability of consuming
31
32 299 HFSS products. It may also change a consumerism mindset that may be encouraged by adverts to over-
33
34 300 purchase and consume products. These changes could contribute to societal shifts that reinforce
35
36 301 lower demand for HFSS products and change macro-level eating behaviours.

37 302 Scenario 2: adaptations undermine impacts of the regulations on public health

38
39 303 Food and drink companies could also minimise losses incurred by the regulations by redirecting their
40
41 304 efforts towards unregulated forms of marketing ('balloon effect'). Companies could increase their
42
43 305 expenditure on brand advertising, sports sponsorship, or advertising outdoors or in print or audio
44
45 306 media, none of which are intended to be covered by the regulations. It is unclear how this may affect
46
47 307 people's total exposure to marketing, and their resultant demand for HFSS products. Companies may
48
49 308 also fear the implementation of further regulations that could affect their performance, and so may
50
51 309 lobby against them. Lobbying could change future regulations such that their impact is limited, and in
52
53 310 turn, may mean that other, comparable regulations also have less chance of being implemented.

54
55 311 To implement regulations, companies may increase the amount of data they collect about the
56
57 312 population. Such data gathering constitutes greater digital surveillance that impacts society (for
58
59 313 example, privacy rights),[36] but could also inform more targeted marketing that is known to be highly
60
314 effective at encouraging sales and consumption.[37–39]

1
2
3 315 Scenario 3: technicalities hinder potential impacts of the regulations on public health
4

5 316 The regulations have a specific set of HFSS withing scope, which has notable exemptions such as some
6
7 317 salty foods. TV and online advertising for products exempt from the regulations may continue, as may
8
9 318 the corresponding purchasing and consumption of these products. Some participants reported that
10
11 319 the proposed scope of the regulations differ to that of other policies. Lack of consistency with other
12
13 320 regulations may make it costly – perhaps to the point of being futile – for companies to respond to
14
15 321 the regulations by developing new products that are compliant with all related regulations. Limited
16
17 322 development of new products would restrict the degree of transformation in the food system.
18
19 323 Furthermore, unlike other regulations, these advertising regulations are not defined by portion size
20
21 324 nor are smaller portion sizes an explicit objective of the regulations. This means there is no incentive
22
23 325 for companies to produce smaller product sizes, which could otherwise contribute towards reducing
24
25 326 calorie consumption via HFSS products.

26
27 327 As advertising by small and medium enterprises are also exempt from the regulations, larger
28
29 328 companies may ‘atomise’ by creating smaller off-shoot companies, which can continue to advertise
30
31 329 and sell HFSS products without limitation by the regulations. Advertising of HFSS outside of the
32
33 330 watershed hours will still be permitted on TV and on-demand services, and large HFSS companies can
34
35 331 afford the high price of advertising slots likely to occur after 9pm. TV advertising after 9pm may
36
37 332 therefore become saturated with HFSS products, which may limit the impact of the regulations on
38
39 333 adults’ and older teenagers’ consumption habits and, by extension, that of the children they are
40
41 334 responsible for.

335 **Comparison to existing literature**

42
43 336 Many existing models exist to illustrate how food marketing affects behaviour and health (e.g.,[8])
44
45 337 and logic models are regularly produced to illustrate how other diet-related public health regulations
46
47 338 may work. Methods for developing such models have evolved to appreciate the complexity of the
48
49 339 surrounding system in which they reside,[40] but to our knowledge, these have been rarely applied in
50
51 340 the context of diet-related health interventions,[41] and not applied to food advertising regulations
52
53 341 before. The concept map we developed here is the first we are aware of to show how food marketing
54
55 342 regulations may work by interacting with their surrounding system.

56
57 343 The concept map we developed illustrates ways that reactions to the regulations will reinforce or
58
59 344 undermine their impact on public health, reinforcing the hypotheses of earlier work. [9] The potential
60
345 for some of these pathways to exist has been evidenced elsewhere. Analyses have found that 57 of
346 65 brands associated with HFSS had an easily identifiable HFSS product, and the majority (84%) of

1
2
3 347 these products had an alternative non-HFSS product from the same brand, master brand, parent
4
5 348 company, or license holder company brand portfolio in the UK.[42] Evidence also indicates that HFSS
6
7 349 companies have reformulated and developed new products in responses to diet-related policies in the
8
9 350 UK, such as the Soft Drinks Industry Levy.[43,44] This evidence corresponds with pathways in the map
10 351 that show how companies could redistribute advertising from regulated to unregulated products.

11
12 352 Pathways that illustrate the risk of food companies undermining the regulations may be particularly
13
14 353 plausible given existing evidence has documented industry opposition to HFSS advertising regulations
15
16 354 in the UK.[32,33] The UK government's Department for Digital, Culture, Media & Sport impact
17
18 355 assessment of the regulations also assumed that a degree of HFSS advertising will be displaced to
19 356 other media,[31] as has existing research on the TV regulation specifically.[9,45] It is also widely
20
21 357 documented in broader literature that efforts to undermine such regulations often form part of wider
22
23 358 market strategies that, when exerted by powerful and global corporations, are difficult to address with
24
25 359 singular regulations.[46] Our concept map builds on this evidence by elucidating pathways through
26
27 360 which regulation may be undermined, from which it may be possible to adapt the proposed
28
29 361 regulations or implement additional, complementary ones to maximise the likelihood of the
30
31 362 regulations achieving their public health goals.

31 363 **Implications and further research**

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33
34 364 As the TV and online advertising regulations are not yet implemented, our findings could be used to
35
36 365 augment the proposed legislation to encourage stakeholder reactions that maximise the regulations
37
38 366 potential benefits. Ensuring that definitions underpinning the legislation, particularly those relating to
39
40 367 product categories, harmonise with other legislation affecting commercial food providers may double-
41
42 368 down the incentive to reformulate or develop new, non-HFSS products rather than market HFSS
43
44 370 products by other means. Expanding the existing definition to a wider range of foods (e.g., salty snacks
45
46 371 currently exempt) could have the same effect. Implementing comparable regulations on other forms
47
48 372 of marketing, such as a ban on outdoor advertising of HFSS as has been seen in London,[47] would
49
50 373 also limit opportunity to redistribute advertising spend for HFSS. Expediting the implementation of
51
52 374 other regulations affecting the commercial food system, such as the proposed volume and location
53
54 375 price promotion regulations,[48] has similar potential to maximise the benefit of the TV and online
55
56 376 advertising ones by limiting opportunities for redistributing efforts to unregulated marketing. Some
57
58 377 of these proposed alterations echo responses to the Department of Health and Social Care, and
59
60 378 Department For Digital, Culture, Media and Sport 2020 policy consultation 2020 policy
379
380 379 consultation.[49] That they were repeated and validated by experts in multiple related fields included
in our study reinforce their potential benefit.

1
2
3 380 The concept map could be used to design a complexity-informed evaluation of the regulations.
4
5 381 Complex explanations of intervention impacts appreciate that instead of a singular cause-effect
6
7 382 pathway, interventions can act as stimuli that send reverberations across the system in which they
8
9 383 reside.[50,51] Complex adaptive system methods also appreciate the role of relationships between
10
11 384 actors contributing to a variety of processes operating at different levels and scale to produce
12
13 385 intervention outcomes.[40] In doing so, they help avoid finding a wrong answer to important
14
15 386 questions,[52,53] and may help measure the impact of unintended consequences alongside the
16
17 387 outcomes that the policy sets out to achieve.[54] By explicitly exploring the connections in a complex
18
19 388 system, these methods may also identify novel leverage points which could be targeted by future
20
21 389 interventions. Though the map developed in our study was not explicitly conceived in systems
22
23 390 thinking, it has many systemic qualities (e.g., emphasises the role of relationships) and correlates with
24
25 391 other methods such as 'system mapping' that have been identified as a key component of systems-
26
27 392 informed evaluations.[40] The concept map could be used to define focal areas for evaluative studies
28
29 393 of both the intended and unintended consequences of the regulations or could form the basis of other
30
31 394 systems evaluation methods.

32
33 395 A benefit of theory, here in the form of a concept map, is that it enables the application of findings
34
35 396 elsewhere.[18,19] The presence of food marketing regulations in other countries[55] – albeit different
36
37 397 to the ones proposed in the UK - suggests there may be political appetite to learn from the UK's
38
39 398 experience. For example, policymakers could refer to the map to consider mechanisms and pathways
40
41 399 that are particularly relevant to their country context, and thus important to consider in developing
42
43 400 their legislation. Findings that emerge from an evaluation based on the map would also be particularly
44
45 401 applicable in other countries and contexts, as the maps clarifies how they are embedded with other
46
47 402 stakeholders' adaptations following the implementation of the regulations.

43 403 **CONCLUSIONS**

44
45 404 While the proposed UK TV and online food advertising regulations will be some of the most restrictive
46
47 405 in the world, the concept map developed in this paper illustrates that the extent to which they improve
48
49 406 diet-related health will ultimately be determined by stakeholder reactions in the surrounding system.
50
51 407 The map may be used as a basis for establishing a comprehensive evaluation of the UK regulations,
52
53 408 and to inform similar regulations elsewhere. To realise the full potential of the regulations, UK
54
55 409 policymakers may also use the map to identify and prevent loopholes in the legislations before they
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57 410 are implemented.

58 411 **FIGURE LEGEND**

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60 412 Figure 1 Summary of method used to develop the concept map

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413 Figure 2 Examples of mapping concepts and pathways using Miro

414 Figure 3 Concept map of pathways through which the proposed UK TV and online advertising

415 regulations may affect the commercial food system, health and society

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1
2
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14
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23
24 427 Community Interest Company in the UK that is leading work on food insecurity, including
25
26 428 coordinating an ongoing independent inquiry into childhood food insecurity, led by the All-Party
27
28 429 Parliamentary Group on Hunger and Food Poverty. HF previously worked for a market research
29
30 430 company, which conducts research on behalf of many companies, including those from the food and
31
32 431 drink industry. HF, JA and MW have submitted evidence to the Department of Health and Social
33
34 432 Care, and Department For Digital, Culture, Media and Sport 2020 consultation for the regulations
35
36 433 under study, available here: [https://www.cedar.iph.cam.ac.uk/resources/evidence-](https://www.cedar.iph.cam.ac.uk/resources/evidence-submissions/#HFSSadban)
37
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49
50 439 **DATA AVAILABILITY STATEMENT**

51
52 440 Each workshop map is available in **Appendix 2** but recordings are not available as it is not possible to
53
54 441 sufficiently anonymise participants.

55
56 442 **EXCLUSIVE LICENSE**

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22 458 **CONTRIBUTORS**

23 459 EB, PS, RS, MW and JA conceived the study and acquired funding. HF and JA developed the
24
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26
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28
29 462 MA and JA. All authors approved the final manuscript.

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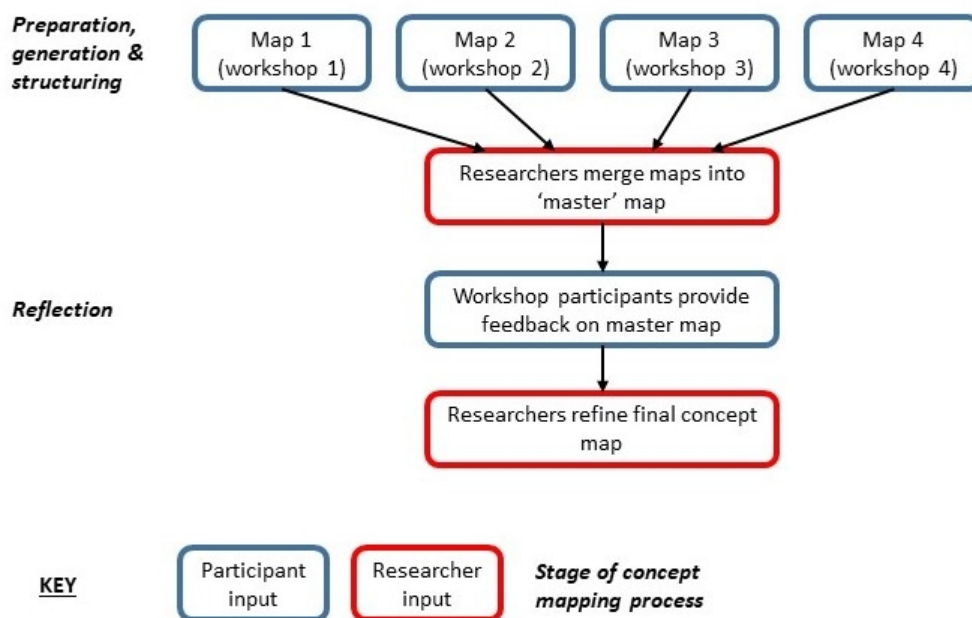


Figure 1 Summary of method used to develop the concept map

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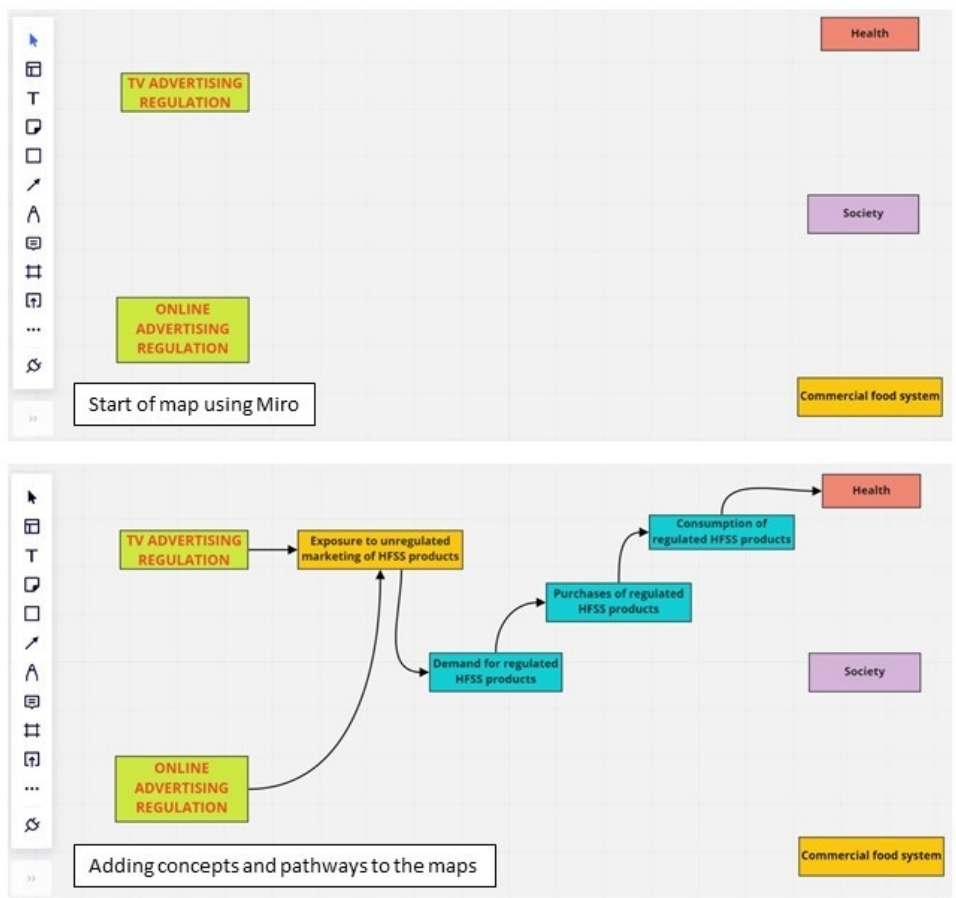


Figure 2 Examples of mapping concepts and pathways using Miro
176x158mm (96 x 96 DPI)

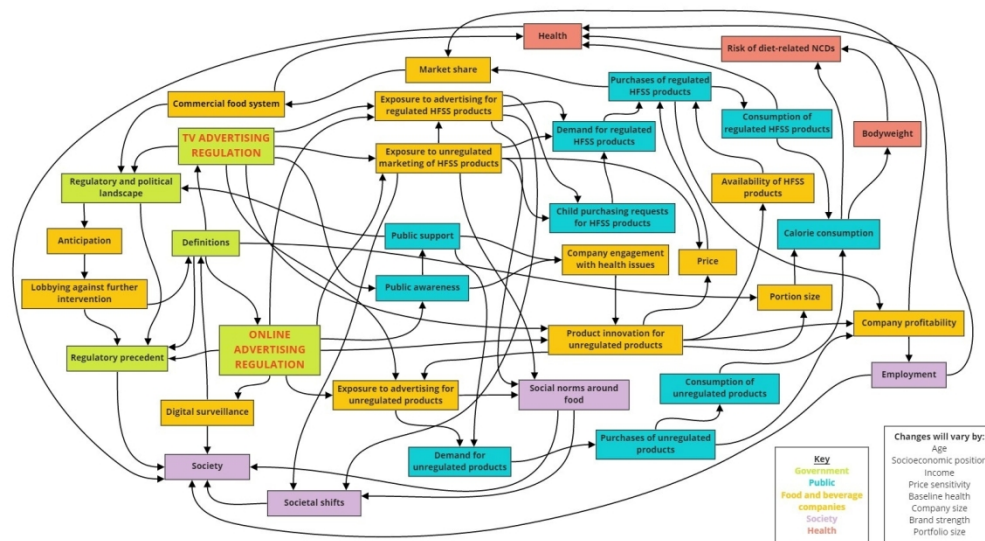


Figure 3 Concept map of pathways through which the proposed UK TV and online advertising regulations may affect the commercial food system, health

425x236mm (96 x 96 DPI)

BOX 1: Regulation details

It is expected that two new regulations will be implemented before the end of 2022:

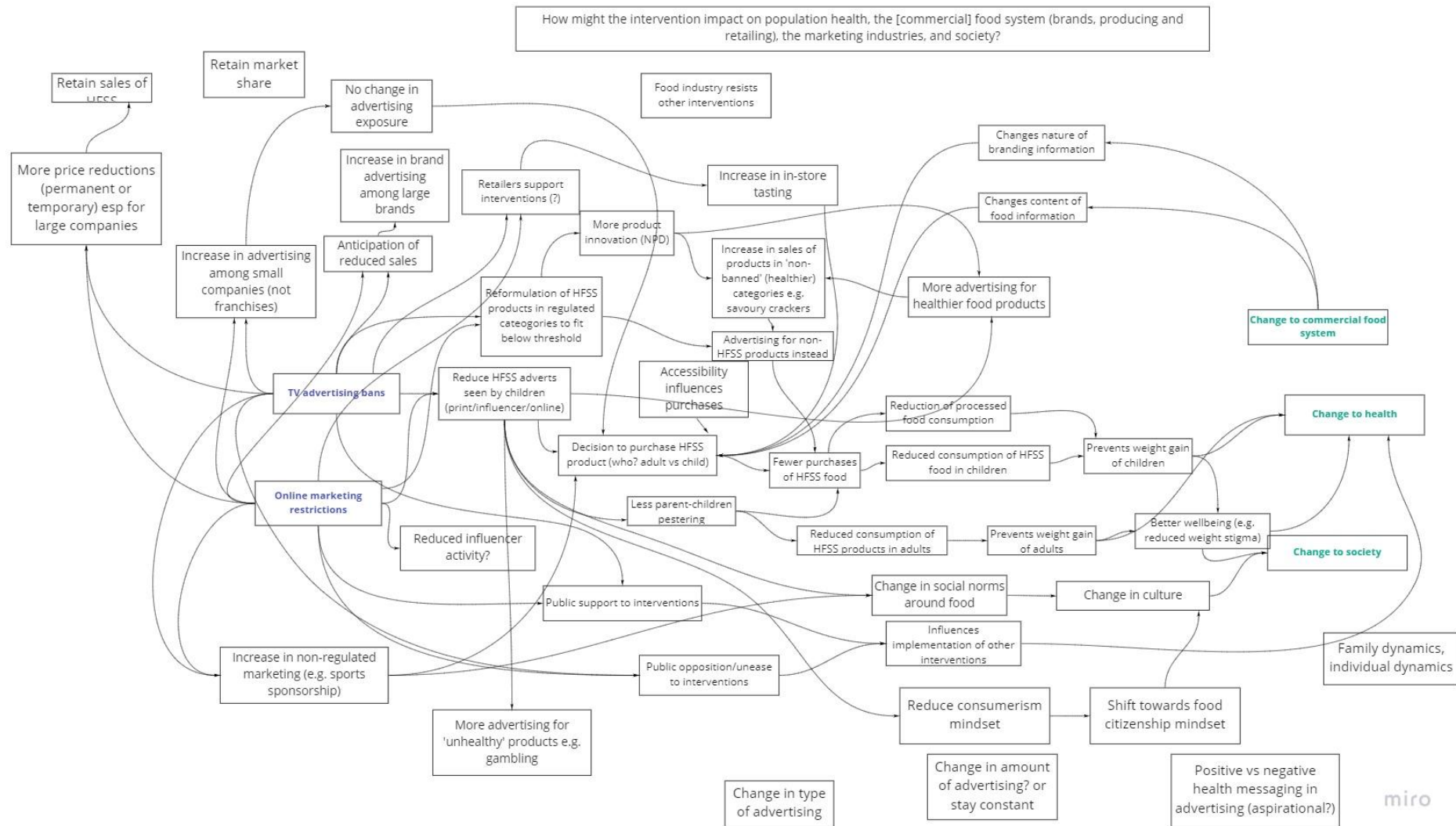
1. A ban on advertisements for HFSS products shown on live broadcast TV from 0530-2100 ('TV advertising watershed'), including:
 - a. on-demand programme services under the jurisdiction of the UK.
2. A ban on online advertisements for HFSS products, including:
 - a. Non-UK regulated on-demand programme services;
 - b. Social media influencers, commercial text messaging and email, all website advertising, paid-for search listings, preferential listings on price comparison sites, in-game advertisements, in-app advertising, advergames and advertorial, online display and online video.

Restrictions will not apply to 'owned media' (online property owned and controlled, usually by a brand), brand advertising, small and media enterprises (fewer than 250 employees), audio and broadcast radio, business to business (online only), or transactional content.

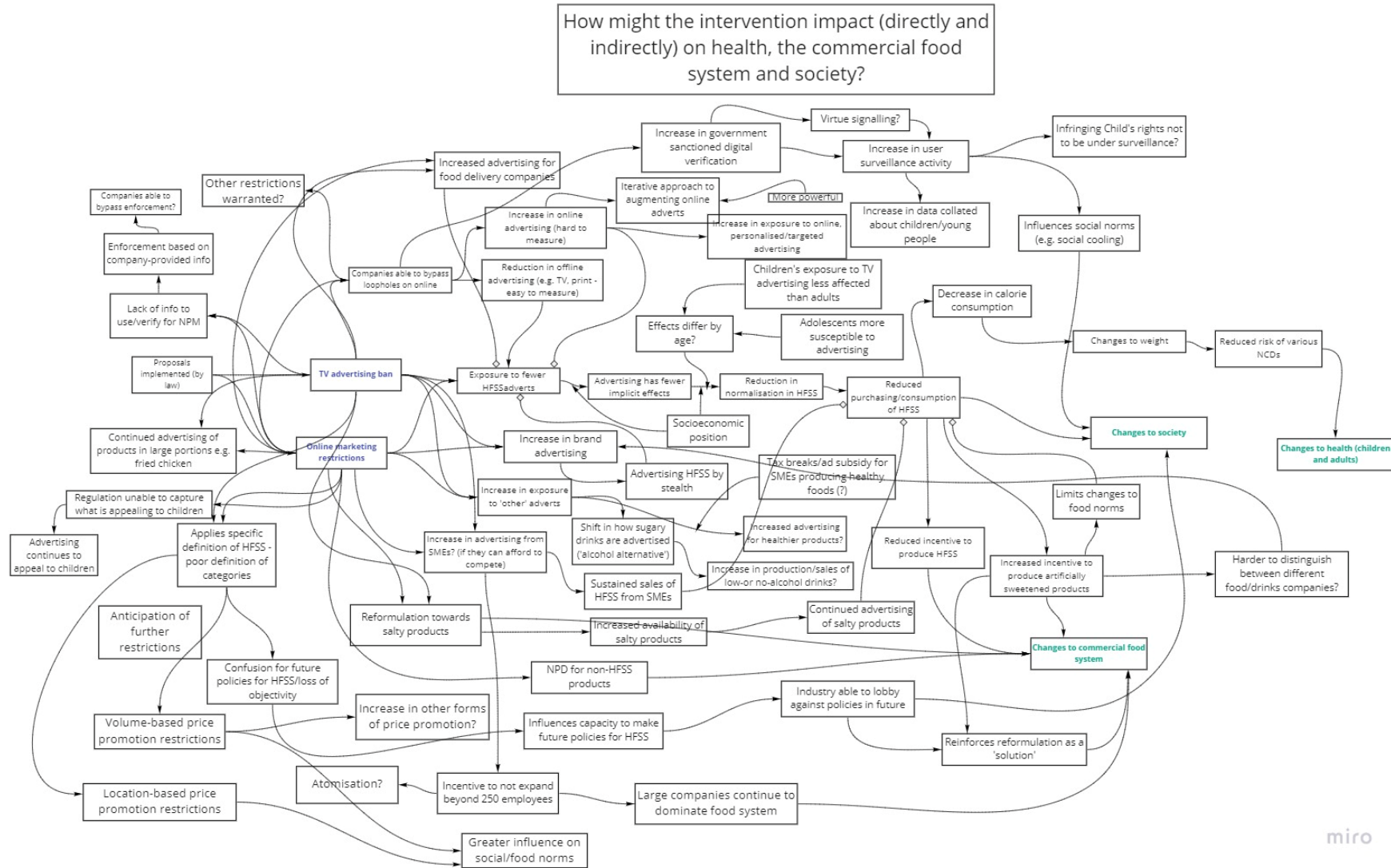
'HFSS' will be defined by the 2004/2005 UK Nutrient Profiling Model and within particular categories from the Sugar Reduction Strategy. Details of the regulations may change in the lead up to implementation.

Government will appoint Ofcom as the statutory regulator, who will then appoint a day-to-day regulator (expected to be ASA).²³

Workshop 2 Map

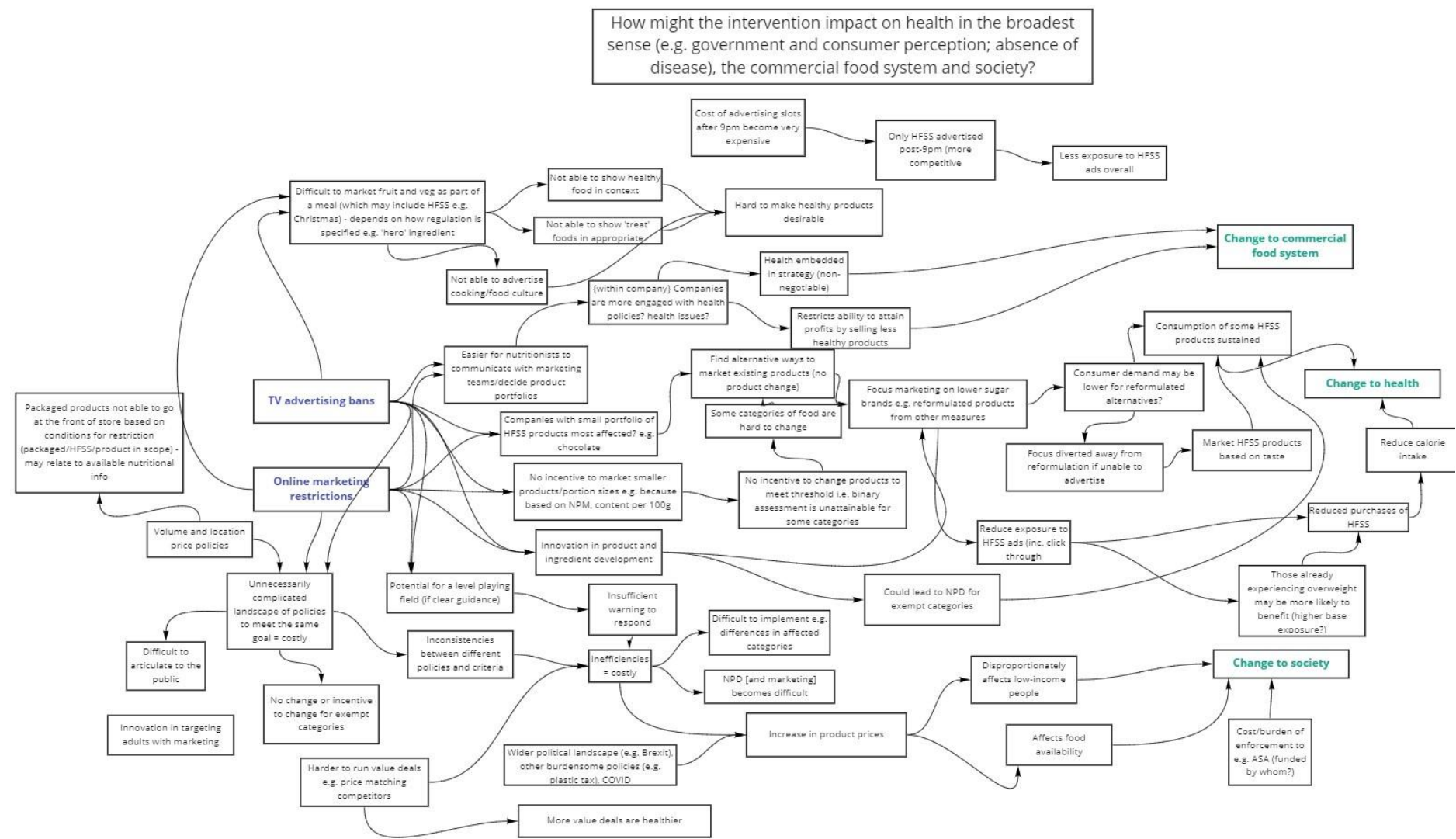


Workshop 3 Map



miro

Workshop 4 Map



Appendix 3: Concepts from workshop maps and resulting concepts in the final map

Workshop 1 (non-industry)	Workshop 2 (non-industry)	Workshop 3 (non-industry)	Workshop 4 (industry)	Final map
More adept at regulations	Anticipation of reduced sales	Anticipating further restrictions		
Behaviour to pre-empt? e.g., product changes		Proposals implemented by law		Anticipation
Anticipate regulation				
Change product availability			Affects food availability	Availability of HFSS products
	Prevents weight gain of children	Changes to weight		Bodyweight
	Prevents weight gain of adults			
		Decrease in calorie consumption	Reduced calorie intake	Calorie consumption
Parent/child interactions	Less parent-children pestering			Child purchasing requests for HFSS products
Reduction in pester power				
Better shopping experience				Commercial food system
			{within company} companies are more engaged with health policies? Health issues?	Company engagement with health issues
			Health embedded in strategy (non-negotiable)	
			Easier for nutritionists to communicate with marketing teams	
Reduction in food company revenue			Restricts ability to attain profits by selling less healthy products	Company profitability

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Workshop 1 (non-industry)	Workshop 2 (non-industry)	Workshop 3 (non-industry)	Workshop 4 (industry)	Final map
Change in sector profitability			Cost/burden of enforcement to e.g. ASA (funded by whom?)	
			Inefficiencies = costly	
Less screen-driven snacking	Reduced consumption of HFSS products in adults	Reduced purchasing/ consumption of HFSS	Consumption of some HFSS products sustained	Consumption of regulated HFSS products
Change in consumption	Reduction of processed food consumption			
Doing something else that's good for you	Reduced consumption of HFSS products in children			
Change in diet				Consumption of unregulated products
		Applies specific definition of HFSS - poor definitions of categories	Inconsistencies between different policies and criteria	Definitions
		Enforcement based on company-provided info		
		Lack of info to use/verify for NPM		
Reduction in demand				Demand for regulated HFSS products
Increase in money saved				
			Consumer demands may be lower for reformulated alternatives?	Demand for unregulated products
		Increase in user surveillance activity		Digital surveillance
		Infringing Child's rights not to be under surveillance?		
		Increase in surveillance activity		

Workshop 1 (non-industry)	Workshop 2 (non-industry)	Workshop 3 (non-industry)	Workshop 4 (industry)	Final map
		Increase in data collated about children/young people		
Changes in employment		Incentive to not expand beyond 250 employees		Employment
Reductions in sharing of foods on social media	No change in advertising exposure	Exposure to fewer HFSS adverts	Less exposure to ads overall	Exposure to advertising for regulated HFSS products
	Reduced influencer activity?	Children's exposure to TV advertising less affected than adults	Reduce exposure to HFSS ads (inc. through click through)	
	Change in amount of advertising or stay constant	Advertising has fewer implicit effects	Market HFSS products based on taste	
	Reduce HFSS adverts seen by children	More powerful	Only HFSS advertised post-9pm (more competitive)	
	Positive vs. negative health messaging in advertising (aspirational)	Virtue signalling		
	Changes content of food information	Harder to distinguish between different food/drinks companies		
		Iterative approach to augmenting online adverts		
Replaced with something else (?) i.e., not HFSS	Advertising for non-HFSS products instead	Exposure to non-HFSS adverts	Focus marketing on lower sugar brands e.g., reformulated products from other measures	Exposure to advertising for unregulated products
Increase advertising of F&V, healthier products in brand	More advertising for healthier food products	Increased advertising for healthier products	More value deals are healthier	
	More advertising for 'unhealthy products' e.g., gambling	Increase in exposure to 'other' adverts	Cost of advertising slots after 9pm become very expensive	
		Continued advertising of salty products		
		Increased advertising for food delivery companies		

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Workshop 1 (non-industry)	Workshop 2 (non-industry)	Workshop 3 (non-industry)	Workshop 4 (industry)	Final map
Balloon effect	Change in type of advertising	Increase in exposure to online, personalised/targeted advertising	Difficult to market fruit and veg as part of a meal (which may include HFSS e.g., Christmas) - depends on how regulation is specified e.g. 'hero' ingredient	Exposure to unregulated marketing of HFSS products
Increase in sponsorship	Increase in non-regulated marketing (e.g., sports sponsorship)	Advertising continues to appeal to children	Not able to show healthy food in context	
'Unrelated' advertising e.g., CSR	Increase in in-store tasting	Companies able to bypass enforcement	Not able to show 'treat' foods in appropriate	
Loopholes	More price reductions especially for large companies	Increase in online advertising (hard to measure)	Hard to make healthy products desirable	
Location based promotions	Increase in advertising among small companies (not franchises)	Companies able to bypass loopholes online	Focus diverted away from reformulation if unable to advertise	
Increase in price promotions	Changes nature of branding information	Shift in how sugary drinks are advertised (alcohol alternatives)	Not able to advertise cooking/food culture	
Brand awareness reduces	Increase in brand advertising among large brands	Reduction in offline advertising (e.g., TV, print - easy to measure)	Find alternative ways to market existing products (no product change)	
Brand engagement/identification decreases		Continued advertising of products in large portions e.g., fried chicken	Innovation in targeting adults with marketing	
Brand association decreases		Advertising HFSS by stealth		
		Increase in other forms of price promotion?		
		Regulation unable to capture what is appealing to children		
	Better wellbeing (e.g., reduced weight stigma)			Health
Alternative evidence of efficacy	Food industry resists other interventions	Industry able to lobby against policies in future		Lobbying against further interventions

Workshop 1 (non-industry)	Workshop 2 (non-industry)	Workshop 3 (non-industry)	Workshop 4 (industry)	Final map
Discredit public health evidence				
Concentration of HFSS market	Retain market share	Large companies continue to dominate food system		Market share
		Atomisation?		
		Continued advertising of products in large portions e.g., fried chicken	No incentive to market smaller products/portion sizes e.g., because based on NPM, content per 100g	Portion size
Change in affordability	More price reductions especially for large companies	Increase in other forms of price promotion?	Increase in product prices	Price
			Harder to run value deals e.g., price matching competitors	
Diversification of non-HFSS markets	More product innovation (NPD)	NPD for non-HFSS products	Could lead to NPD for exempt categories	Product innovation for unregulated products
Positive opportunity in supply chain	Reformulation of HFSS products in regulated categories to fit below threshold	Reformulation towards salty products	Some categories of food are hard to change	
Brand diversification		Reduced incentive to produce HFSS	NPD [and marketing] becomes difficult	
New product development (reformulation?)		Increased incentive to produce artificially sweetened products	No incentive to change products to meet threshold i.e., binary assessment is unattainable for some categories	
			No change or incentive to change for exempt categories	
			Innovation in product and ingredient development	
Change in public perception				
Awareness of regulation				
Higher awareness of harms				
Public awareness				

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Workshop 1 (non-industry)	Workshop 2 (non-industry)	Workshop 3 (non-industry)	Workshop 4 (industry)	Final map
Better perception of eating healthy especially among younger people				
	Public support for interventions		Difficult to articulate to the public	Public support
	Public opposition/unease to interventions			
Change in purchasing	Decision to purchase HFSS product (who? Adult vs child)	Reduced purchasing/consumption of HFSS	Reduced purchases of HFSS	Purchases of HFSS regulated products
	Fewer purchases of HFSS food			
	Retain sales of HFSS			
Change in purchasing	Increase in sales of products in 'non-banned' healthier categories e.g., savoury crackers	Increased availability of salty products		Purchases of unregulated products
		Increase in production/sales of low or no alcoholic drinks		
Durability of interventions	Retailers support interventions	Volume-based price promotion restrictions	Wider political landscape (e.g., Brexit) other burdensome policies (e.g., plastic tax, covid)	
Interact with other aspects of DPH policy		Location-based price promotion restrictions	Volume and location price policies	
Location based promotions		Other restrictions warranted	Unnecessarily complicated landscape of policies to meet the same goal = costly	
Covid-19 raised awareness		Reinforces reformulation as 'solution'	Potential for a level playing field (if clear guidance)	Regulatory and political landscape
Current events in public health		Tax breaks/ad subsidy for SMEs producing healthy foods (?)	Insufficient warning to respond	
Volume based promotions restrictions			Difficult to implement e.g., differences in affected categories	
			Packaged products not able to go at the front of store based on conditions for restrictions (packaged/HFSS/product in	

Workshop 1 (non-industry)	Workshop 2 (non-industry)	Workshop 3 (non-industry)	Workshop 4 (industry)	Final map
			scope) - may relate to available nutritional info)	
Legal precedent	Influences implementation of other interventions	Influences capacity to make future policies for HFSS		Regulatory precedent
Decision norming (more regs seem possible)		Confusion for future policies for HFSS/loss of objectivity		
Empower policymakers		Increase in government sanctioned digital verification		
		Reduced risk of various NCDs		Risk of diet-related NCDs
Fewer social connotations around food	Change in social norms around food	Influences social norms e.g., social cooling		Social norms around food
Changes in social norms	Family dynamics, individual dynamics	Reduction in normalisation of HFSS		
Change in engagement with foods		Limits changes to food norms		
Associations with young people change (e.g., aspirational)		Greater influence on social/food norms		
				Society
Changes link between food and personal identity	Shift towards food citizenship mindset			Societal shifts
Different retail environment	Reduce consumerism mindset			
Less time spent on social media	Change in culture			
Polarisation				
Small producers meeting nutritional criteria/ambient food increase sales	Accessibility influences purchases	Increase in advertising from SMEs? If they can afford to compete	Companies with small portfolio of HFSS products most affected? e.g., chocolate	Changes vary by...
Different price sensitivity	Increase in advertising among small companies (not franchises)	Sustained sales of HFSS from SMEs	Those already experiencing overweight may be more likely to benefit (higher base exposure?)	
Importance of brand amplified for low-income people		Effects differ by age?	Disproportionately affects low-income people	

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Workshop 1 (non-industry)	Workshop 2 (non-industry)	Workshop 3 (non-industry)	Workshop 4 (industry)	Final map
Importance of brand amplified for young people		Socioeconomic position		
Different groups more susceptible e.g., those exposed		Adolescents more susceptible to advertising		
Differential effects by socioeconomic position				
Baseline differences in health (socioeconomic gradient)				
Reduce health inequalities				
Distinguish effects by brand strength e.g., better for established brands				

Notes: HFSS: high fat, salt and sugar; NCD: non-communicable disease; NPD: new product development; NPM: Nutrient Profile Model; SME: small and medium enterprises.

Appendix 1: Consolidated criteria for reporting qualitative studies (COREQ): 32-item checklist

No.	Item	Guide questions/description	Page #
Domain 1: Research team and reflexivity			
Personal characteristics			
1.	Interviewer/facilitator	Which author/s conducted the interviews or focus groups?	6
2.	Credentials	What were the researcher's credentials? e.g., PhD, MD	Title page
3.	Occupation	What was their occupation at the time of the study?	Title page
4.	Gender	Was the researcher male or female?	See note
5.	Experience and training	What experience or training did the researcher have?	6
Relationship with participants			
6.	Relationship established	Was a relationship established prior to study commencement?	6
7.	Participant knowledge of the interviewer	What did the participants know about the research? e.g., personal goals, reasons for doing the research	6
8.	Interviewer characteristics	What characteristics were reported about the interviewer/facilitator? e.g., bias, assumptions, reasons and interests in the research topic	N/A
Domain 2: study design			
Theoretical framework			
9.	Methodological orientation and Theory	What methodological orientation was stated to underpin the study? e.g., grounded theory, discourse analysis, ethnography, phenomenology, content analysis	6
Participant selection			
10.	Sampling	How were the participants selected? e.g., purposive, convenience, consecutive, snowball	6
11.	Method of approach	How were participants approached? e.g., face-to-face, telephone, mail, email	6
12.	Sample size	How many participants were in the study?	8
13.	Non-participation	How many people refused to participate or dropped out? Reasons?	N/A
Setting			
14.	Setting of data collection	Where was the data collected? e.g., home, clinic, workplace	6-7
15.	Presence of non-participants	Was anyone else present besides the participants and researchers?	N/A
16.	Description of sample	What are the important characteristics in the sample? e.g., demographic data, date	8
Data collection			
17.	Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	6
18.	Repeat interviews	Were repeat interviews carried out? If yes, how many?	N/A
19.	Audio/visual recording	Did the research use audio or visual recording to collect the data?	7
20.	Field notes	Were field notes made during and/or after the interview or focus group?	7
21.	Duration	What was the duration of the interviews or focus group?	6
22.	Data saturation	Was data saturation discussed?	6
23.	Transcripts returned	Were transcripts returned to participants for comment and/or correction?	8

No.	Item	Guide questions/description	Page #
Domain 3: analysis and findings			
Data analysis			
24.	Number of data coders	How many data coders coded the data?	N/A
25.	Description of the coding tree	Did authors provide a description of the coding tree?	N/A
26.	Derivation of themes	Were themes identified in advance or derived from the data?	N/A
27.	Software	What software, if applicable, was used to manage the data?	6-7
28.	Participant checking	Did participants provide feedback on the findings?	8
Reporting			
29.	Quotations presented	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g., participant number	N/A
30.	Data and findings consistent	Was there consistency between the data presented and the findings?	9
31.	Clarity of major themes	Were major themes clearly presented in the findings?	N/A
32.	Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	N/A

Taken from: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *Int J Qual Health Care*. 2007;19(6):349-357. doi:10.1093/intqhc/mzm042

Question on gender omitted in response to recent update: Albury C, Pope C, Shaw S, et al. Gender in the consolidated criteria for reporting qualitative research (COREQ) checklist. *International Journal for Quality in Health Care*. 2021;33(4):2021. doi:10.1093/intqhc/mzab12

BMJ Open

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Secondary Subject Heading:	Global health, Health policy, Qualitative research
Keywords:	PUBLIC HEALTH, NUTRITION & DIETETICS, QUALITATIVE RESEARCH

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4 1 **Exploring the potential impact of the proposed UK TV and online food**
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6 2 **advertising regulations: a concept mapping study**
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16 **ABSTRACT**

17 **Objectives** In July 2020 the UK Government announced an intention to restrict advertisements for
18 products high in fat, salt or sugar on live broadcast, catch-up and on-demand television before 9pm;
19 and paid for online advertising. As no other jurisdiction has implemented similar regulations, there is
20 no empirical evidence about how they might perturb the food system. To guide the regulations'
21 implementation and evaluation, we aimed to develop a concept map to hypothesise their potential
22 consequences for the commercial food system, health and society.

23 **Methods** We used adapted group concept mapping in four virtual workshops with food marketing and
24 regulation experts across academia, civil society, government organisations, and industry (N=14),
25 supported by Miro software. We merged concepts derived from the four workshops to develop a
26 master map and then invited feedback from participants via email to generate a final concept map.

27 **Results** The concept map shows how the reactions of stakeholders to the regulations may reinforce
28 or undermine the impact on the commercial food system, health and society. The map shows
29 adaptations made by stakeholders that could reinforce, or undermine, positive impacts on public
30 health. It also illustrates potential weaknesses in the design and implementation of the regulations
31 that could result in little substantial difference to public health.

32 **Conclusions**

33 Prior to the regulations' initial implementation or subsequent iterations, they could be altered to
34 maximise the potential for reinforcing adaptations, minimise the potential for undermining
35 adaptations, and ensure they cover a wide range of advertising opportunities and foods. The concept
36 map will also inform the design of an evaluation of the regulations and could be used to inform the
37 design and evaluation of similar regulations elsewhere.

38 **Strengths and limitations of this study**

- 39 • By including a diverse range of experts, we developed the first comprehensive articulation of
40 the potential pathways through which new advertising regulations may impact on the
41 commercial food system, health and society.
- 42 • Holding the workshops online may have facilitated greater attendance, particularly as we
43 employed techniques to minimise the limitations of online data collection.
- 44 • Timing the workshops after sufficient details were known about the regulations allowed for a
45 meaningful discussion about their impact but with enough time for the study's findings to feed
46 into the regulations' design.

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3 47 • Though we did not aim to achieve saturation in this study, we found it difficult to recruit
4 participants from industry.
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7 49 • We necessarily invited more individuals than those who ultimately participated, which may
8 affect the transferability of the study's findings.
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 - We necessarily invited more individuals than those who ultimately participated, which may affect the transferability of the study's findings.

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51 INTRODUCTION

52 The World Health Organization (WHO) recommends that member states limit children's exposure to
53 marketing for less healthy foods.[1] The recommendation reflects evidence that marketing influences
54 food preferences and consumption, both at an individual (micro-level impacts)[2,3] and societal level
55 (macro-level impacts).[4] Marketing has been defined as "the activity, set of institutions, and
56 processes for creating, communicating, delivering, and exchanging offerings that have value for
57 customers, clients, partners, and society at large".[5] Marketing is exerted through a range of
58 activities, including those related to the product, its place, price and promotion.[6] Promotion includes
59 building games around products (advergaming), social media 'influencers', and paid for advertising in
60 any medium. Products high in fat, salt, or sugar (HFSS) are disproportionately advertised in the UK,
61 with only 2.5% of total food and soft drink advertising spend going towards fruit and vegetables in
62 2020.[7] Though the causal pathways between advertising and obesity are likely to be complex,[8] it
63 is estimated that 6.4% (95% confidence interval (CI): 2.0-13.8) of UK childhood obesity and 5.0% (95%
64 CI: 1.5-10.9) of overweight is attributable to HFSS television advertising alone.[9]

65 To address concerns about the prevalence of childhood obesity, in July 2020 the United Kingdom's
66 (UK) Government Department of Health and Social Care published an intention to restrict
67 advertisements for HFSS food and drink products on live broadcast, catch-up and on-demand
68 television ('TV') before 9pm and paid for online advertising ('online').[10] Current details of these
69 proposed regulations are summarised in **Box 1**, and though they have passed through the House of
70 Lords in the Health and Care Bill,[11] details of the regulations may change before they receive Royal
71 Assent and are implemented. Although these regulations are likely to impact on both TV and online
72 advertising content that adults see, they have been consistently framed in policy documents as
73 focusing on tackling childhood obesity. The first government document they were proposed in was a
74 Childhood Obesity Strategy,[12] and subsequent strategies and policy documents have repeatedly
75 referred to them in the context of childhood obesity.[10,13] Further, the design of the TV aspect
76 (banning HFSS adverts from 0530-2100) reflects hours when children are most likely to be watching.

BOX 1: Regulation details

It is expected that two new regulations will be implemented before the end of 2022:

1. *A ban on advertisements for HFSS products shown on live broadcast TV from 0530-2100 ('TV advertising watershed'), including:*
 - a. *on-demand programme services under the jurisdiction of the UK.*
2. *A ban on online advertisements for HFSS products, including:*
 - a. *Non-UK regulated on-demand programme services;*
 - b. *Social media influencers, commercial text messaging and email, all website advertising, paid-for search listings, preferential listings on price comparison sites, in-game advertisements, in-app advertising, advergames and advertorial, online display and online video.*

Restrictions will not apply to 'owned media' (online property owned and controlled, usually by a brand), brand advertising, small and medium enterprises (fewer than 250 employees), audio and broadcast radio, business to business (online only), or transactional content.

'HFSS' will be defined by the 2004/2005 UK Nutrient Profiling Model and within particular categories from the Sugar Reduction Strategy. Details of the regulations may change in the lead up to implementation.

Government will appoint Ofcom as the statutory regulator, who will then appoint a day-to-day regulator (expected to be ASA).[13]

77 The TV and online regulations proposed for the UK will be some of the most restrictive worldwide,
 78 and the first to explicitly address paid for online advertising.[14] Overall, 18% of UK advertising spend
 79 is for TV slots and at least 63% for online slots.[15] Though there has been a recent decline in broadcast
 80 TV viewing in the UK, average viewing time remains around three hours per day for ages 4 years and
 81 above.[15] The Covid-19 pandemic has accelerated use of subscription video-on-demand services,
 82 with viewing of services such as Netflix and Amazon Prime Video almost doubling in 2020 to an
 83 estimated 1 hour per person per day.[16] Such services would be covered by the proposed online
 84 regulation rather than the TV one. While the decline in broadcast TV viewing has been more
 85 pronounced among younger people (for 16-24 year olds down 18%, and for children 4-15 year olds
 86 down 16% in 2019),[15] this has corresponded with an increase in viewing of subscription video-on-
 87 demand services among younger people (by 55 minutes to an average of two hours per day between
 88 April 2019 and April 2020).[16] It has been estimated that a pre-9pm ban on HFSS TV food advertising
 89 would result in a 4.6 (1.4-9.5)% reduction in childhood obesity and a 3.6 (1.1-7.4)% reduction in
 90 childhood overweight prevalence.[9] Effects were two-fold greater in the least compared to the most
 91 affluent social groups and would likely be amplified by comparable restrictions on online food

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3 92 promotion.[9] The ultimate results of such a regulation were predicted to depend on how HFSS
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5 93 advertising patterns change in response.[9] Though less is known about the potential effects of an
6
7 94 online ban, emerging evidence indicates that online marketing techniques (e.g., use of social media
8
9 95 influencers) may be particularly pervasive and persuasive.[17–19]

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11 96 Few evaluations of such food advertising restrictions have been conducted worldwide,[14] partly
12
13 97 because there have been few comparable regulations. There are also challenges to evaluating this
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15 98 type of intervention that is delivered to whole populations and so is impractical to subject to
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17 99 experimental evaluation techniques such as randomised controlled trials.[20] Furthermore, the
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19 100 commercial food sector exhibits characteristics of a complex adaptive system.[21] Adaptations made
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21 101 by stakeholders residing in the system that is regulated may lead to both intended and unintended
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23 102 consequences that ultimately impact on the overall effectiveness of regulations.[21] The ‘balloon
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25 103 effect’ proposes that restrictions on one type of marketing can lead to increases in others,[22] as
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27 104 companies and other aspects of the food system adapt. Articulating these possible adaptations and
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29 105 their potential consequences should help refine details of the regulations before implementation.
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31 106 Understanding possible adaptations and consequences should also help inform the design of any
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33 107 evaluation.

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35 108 Some other countries are following a similar path of legislation in this realm – though more often
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37 109 through industry self-regulation [23–27] – emphasising the need to develop generalisable evidence
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39 110 about the impact of the UK regulations. To maximise the applicability of evaluation findings to
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41 111 policymakers outside of the UK, it is helpful for evaluators to test theories as well as evaluate
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43 112 interventions.[28] Theory-driven evaluation first requires the development and clear articulation of
44
45 113 program theory.[29] Concept mapping is an approach particularly useful for public health researchers
46
47 114 interested in developing theory.[30] A concept map is a “diagram of proposed relationships among a
48
49 115 set of concepts....about a particular question....or topic”.[31] Concept maps can be used to help
50
51 116 organise ideas, demarcate an area of interest and plan evaluations. Group concept mapping is a
52
53 117 structured approach involving group work that is flexible to many public health contexts.[32]

54 118 **Objectives**

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56 119 In this study, we used an approach inspired by group concept mapping to develop a concept map of
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58 120 how the new TV and online advertising regulations may impact on the commercial food system, health
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60 121 and society. We aimed to describe how the regulations may interact with the food system so that
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123 122 evaluations of the regulations can be grounded in clearly articulated theory, and so that adaptations
to the regulations that could improve the health impact can be identified before implementation.

124 **METHODS**

125 **Study design**

126 We created a concept map of the potential pathways through which the regulations may impact on
127 the commercial food system, health and society. By 'food system' we mean the interdependent
128 network of entities involved in agriculture and fisheries, food processing and production, storage and
129 distribution, wholesaling and retailing, and preparation and marketing of raw, processed and ready to
130 eat foods.[21] By 'society', we mean the wider social system in which the food system is embedded.
131 We developed the map using an adapted version of a group concept mapping method in four
132 workshops.[32] The study reporting adheres to the Consolidated Criteria for Reporting Qualitative
133 Research (COREQ) (**Appendix 1**),[33] but recognises proposed amendments relating to gender.[34]

134 **Participant recruitment**

135 Workshop participants were recruited from academia, civil society, government organisations and
136 industry (e.g., food industry, media, advertising). Individuals were eligible for inclusion if they had
137 professional knowledge and experience of food marketing regulation within their sector and were
138 based in the UK. We identified individuals from our existing contacts in these sectors and by searching
139 the websites of relevant organisations. In total, 63 individuals were invited by email to take part in the
140 study (8 from academia, 15 from civil society, 11 from government organisations, and 29 from
141 industry). We aimed to recruit up to 20 individuals, approximately evenly distributed across the
142 participant groups. As we were not aiming to reach 'saturation',[35] we decided on the number of
143 people to recruit to the study pragmatically, based on the resources available to us but allowing for
144 sufficient breadth.

145 Participants from industry attended a separate workshop to those from academia, civil society and
146 government organisations due to the potential for conflicts of interests between sectors. We set a
147 limit of 10 participants per workshop in addition to the facilitators (JA and HF, who both had qualitative
148 research experience, e.g., [36,37]), which is considered a manageable total number of participants to
149 permit dialogue and engagement.[32] Workshops were arranged around participants' availability in
150 July and August 2021 and lasted 2 hours each.

151 **Data collection**

152 Building on previous work that has used group concept mapping to inform the design of evaluations
153 of population health interventions,[38] we used the first three steps of group concept mapping
154 (preparation, generation and structuring)[32] and added a fourth (reflection). The first three steps
155 were achieved in the workshops, and the final step was achieved using an online feedback form. We

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3 156 held the workshops on Zoom, an online videoconferencing software (<https://zoom.us/>) to minimise
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5 157 time demands on participants and as data collection took place during COVID-19 restrictions. In the
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7 158 workshops, we used a combination of pre-piloted Microsoft PowerPoint slides and Miro software
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9 159 (<https://miro.com/>) to provide instructions to participants and visualise their contributions as they
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11 160 were made, respectively. Our data consisted of screenshots of maps as they developed, the map from
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13 161 each workshop, audio recordings of the workshops, and post-workshop feedback returned through
14
15 162 an online form. Workshops were held under the Chatham House Rule[39]: participants were told they
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17 163 could use the information discussed in the workshops, but they could not reveal the identity or
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19 164 affiliation of other participants. **Figure 1** summarises the method used to develop the final concept
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21 165 map.

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INSERT FIGURE 1 HERE

167 Preparation

168 Preparation entailed setting out the aims and processes of the workshop and agreeing the focus area
169 of the map.[32] At the beginning of each workshop, the workshop facilitators introduced the aims and
170 processes. They reminded participants of the intervention details, the withdrawal process and that
171 the workshops were being recorded. The facilitators proposed that the focus area was “what are the
172 potential pathways through which the intervention might impact on health, the commercial food
173 system and society?”. Participants were invited to help refine this during a discussion of approximately
174 5 minutes.

175 Generation

176 Generation is a divergent process where participants individually brainstorm a long list of responses
177 to the focus area and consider the relative importance of each response.[32] Participants were given
178 around 10 minutes to independently generate a list of as many responses as possible to the refined
179 focus area, including pathways to both positive and negative impacts arising from the regulations.

180 Structuring

181 Structuring is a convergent process where participants organise and critically reflect on ideas and
182 relationships between concepts.[32] For approximately 60 minutes, participants were asked in turn
183 to contribute responses to the focus area from their individual brainstorming in order of relative
184 importance. These were structured and visualised in real-time using Miro, which was shared on-screen
185 with participants, with new concepts and relationships added to a draft map as participants suggested
186 them (see **Figure 2**). Once all responses were included, participants were invited to reflect on the map,
187 adding additional concepts and relationships as required. We adopted an inclusive approach to adding

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3 188 concepts and relationships to maps, including everything mentioned and not deleting anything
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9 191 Reflection

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12 192 After the workshops, we merged the map from each workshop into one 'master' map. We used a
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14 193 method inspired by those employed in other mapping projects.[40] First, HF charted all concepts in
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16 194 the maps into a Microsoft Excel sheet, and similar or identical concepts across the maps were grouped
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18 195 and refined into simplified concepts and accompanying descriptions. Second, these refined concepts
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20 196 were mapped in a way that corresponded with pathways depicted in the four separate maps. Concepts
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22 197 not immediately fitting anywhere were placed to the side for further deliberation with JA. As we took
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24 198 an inclusive approach, all concepts from the individual maps contributed to the master map. The
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26 199 master map was discussed with the wider research team (EB, PS, MW, RS) and steering committee,
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28 200 prompting some minor changes but notably, no areas of significant disagreement.

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30 201 We then circulated the master map to all workshop participants by email. The email contained a link
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32 202 to an online form issued via REDCap (<https://www.project-redcap.org/>) that asked questions about
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34 203 the map to seek suggested changes. We used the suggestions to produce a final concept map.

35 204 **Analysis**

36 205 Beyond merging the maps from each workshop into a master map, no formal analyses were
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38 206 conducted.

39 207 **Ethics**

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42 208 The study received favourable review from the University of Cambridge School of Humanities and
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44 209 Social Science Research Ethics Committee in June 2021, reference number 21.276. Participants were
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46 210 provided with an information sheet about the study and provided informed consent before joining a
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48 211 workshop using an e-consent form issued via REDCap.

49 212 **Patient and public involvement**

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52 213 Patients and/or the public were not involved in the design, conduct, reporting or dissemination plans
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54 214 of this research.

215 RESULTS

216 From four workshops with a total of 14 participants, we developed a concept map to describe how
 217 the proposed TV and online advertising regulations may impact on the commercial food system,
 218 health and society. Here we present the concept map and describe its component concepts.

219 Participant characteristics

220 We held four workshops: one with individuals from industry, and three with individuals from
 221 academia, civil society, and government organisations (see **Table 1**). As the focus was on generating
 222 the map as a group, we did not collate any demographic information about participants.[40]

223 **Table 1. Sectors included in each workshop**

Participant sectors per workshop	Workshop 1	Workshop 2	Workshop 3	Workshop 4	Total
Academia	2	1	1	0	4
Civil society	2	1	3	0	6
Government organisation	0	1	1	0	2
Industry	0	0	0	2	2
				Grand total	14

224 Concept map of anticipated adaptations to the regulations

225 The maps produced in each workshop are provided in **Appendix 2**, and they illustrate the nuance in
 226 focus between workshops. For example, the workshop with industry participants focused more on the
 227 technical difficulties presented by the regulations than in other workshops. Six workshop participants
 228 provided feedback on the master map during the reflection stage (academia = 2, civil society = 3,
 229 government organisation = 1). In response to the feedback, we refined some of the connections
 230 between concepts (e.g., adding a direct link connecting health and employment), and highlighted the
 231 regulations to make them more visibly striking.

232 The resultant concept map is presented in **Figure 3**, and it depicts the possible pathways of change
 233 that could follow the regulations. Colour coding is used to differentiate the groups of reactions to the
 234 regulations: government, food and beverage companies, public, society and health. Pathways
 235 depicted are not exhaustive, as it is possible that other links between concepts exist that were not
 236 captured in the workshops. The map is also accompanied by a list of factors that may modify the
 237 impact of pathways that it depicts, such as socioeconomic position and company size. The concepts
 238 contained in each workshop map, and the corresponding concepts they were assigned in the final
 239 concept map, are provided in **Appendix 3**. Concepts are described in more detail in **Table 2**.

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INSERT FIGURE 3 HERE

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243 Table 2. Description of concepts in the concept map

Statement	Description
Anticipation	Food and drink companies foresee the introduction of the regulations ^a , and possibly other related legislation e.g., volume and location price promotion.
Availability of HFSS products	Availability of <u>all</u> HFSS foods and beverages, both within and outside the scope of the regulations ^a , in physical and online shops.
Bodyweight	In terms of Body Mass Index (BMI), overweight or obesity status.
Calorie consumption	Total energy intake of individuals.
Child purchasing requests for HFSS products	Degree to which children make purchasing requests to caregivers for <u>all</u> HFSS products, both within and outside the scope of the regulations ^a .
Commercial food system	Interdependent networks of commercial entities involved in agriculture and fisheries, food processing and production, storage and distribution, wholesaling and retailing, and preparation and marketing of raw, processed, and ready to eat foods.[21]
Company engagement with health issues	Degree to which food and beverage companies orientate their business around public health goals.
Company profitability	A company's ability to make profit.
Consumption of regulated HFSS products	Individual's intake of foods and beverages within the scope of the regulations ^a .
Consumption of unregulated products	Individual's intake of foods and beverages that are not within the scope of the regulations ^a .
Definitions	Information used to define or enforce the regulation ^a , including the UK Nutrient Profiling Model and the food categories from the Sugar Reduction Strategy. Importantly, the regulations ^a cover a group of foods that is different from those covered by other UK dietary public health regulations. Enforcement is based on information provided by companies.
Demand for regulated HFSS products	Public desire to purchase or consume foods and beverages within the scope of the regulations ^a .
Demand for unregulated products	Public desire to purchase or consume foods and beverages outside of the scope of the regulations ^a .
Digital surveillance	Digital data collated by website to inform regulation ^a enforcement.
Employment	Number of people employed in the commercial food system.
Exposure to advertising for unregulated products	Exposure ^b to adverts for products outside of the scope of the regulations. For foods and beverages, this could be HFSS products within companies' portfolios that are outside of the scope of the regulations, healthier products (e.g., fruit and vegetables), or food delivery companies. Also includes non-food and beverage products and services, but not clear what health impacts they might have.
Exposure to advertising for regulated HFSS products	Exposure ^b to advertising for food and beverages within the scope of the regulations ^a .

Statement	Description
Exposure to unregulated marketing of HFSS products	Exposure ^b to advertising for <u>all</u> HFSS products on media that are outside of the scope of the regulations ^a . Includes offline advertising (e.g., print media), forms of marketing online that are exempt from the regulations (e.g., in owned media), sponsorship, brand advertising and creative modes of marketing that are hard to capture with regulation.
Health	Overall health, including and beyond bodyweight and non-communicable diseases (NCDs).
Lobbying against further interventions	Activities undertaken by, or on behalf of, food and beverage companies to resist further policy or regulations.
Market share	The size of the total market held by a company. Few companies that each hold a large market share creates a concentrated market.
Portion size	Size of food and beverage products in grams or calories, or recommended portion size.
Price	Price of food and beverage products, including price discounts.
Product innovation for unregulated products	Developing new products that are outside of the scope of the regulations ^a , or reformulating existing products so they are no longer within the scope of the regulations. Could include reformulation using artificial ingredients or developing e.g., saltier products that are currently an exempt category. Some categories of products are easier to change than others, and some companies are better able to respond in this way than others.
Public awareness	Degree of public awareness of both the regulations ^a and the problems they are trying to address.
Public support	Degree of public support for the regulations ^a .
Purchases of regulated HFSS products	Sales (from company perspective) or purchases (from individual perspective) of food and beverage products within the scope of the regulations ^a .
Purchases of unregulated products	Sales (from company perspective) or purchases (from individual perspective) of food and beverage products outside of the scope of the regulations ^a .
Regulatory and political landscape	Wider landscape of regulation and policy, including others relating to marketing (e.g., location and volume price regulations) and COVID-19. The degree to which the regulations ^a harmonise with the wider political and regulatory landscape.
Regulatory precedent	Implementation of the regulations ^a serves as precedent for any future regulation.
Risk of diet-related NCDs	Risk of developing NCDs influenced by dietary behaviours.
Social norms around food	Implicit or explicit beliefs, attitudes, or behaviours about eating, at both an individual and family level.
Society	The wider social system in which the food system is embedded.
Societal shifts	Exposure ^b to advertising effects social norms and may contribute to societal changes in consumerism and culture.

244 Notes: BMI = body mass index; HFSS = high fat, salt, and sugar; NCD = Non-communicable disease.

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3 245 ^aThe regulations apply to online and TV advertising for a subset of HFSS products, defined by the
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5 246 2004 to 2005 UK Nutrient Profiling Model and within particular categories from the Sugar Reduction
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7 247 Strategy. This means there are HFSS products (unregulated HFSS) and non-HFSS products outside
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9 248 of the scope of the regulations.

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13 249 ^bExposure is a function of advertising prevalence, but is also dependent on individual-level factors (e.g.,
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15 250 frequency of media use).

17 251 **DISCUSSION**

19 252 **Overview of findings**

21 253 Using an adapted group concept mapping method in four expert workshops, we developed a concept
22
23 254 map to visualise how the proposed TV and online food advertising regulations may impact on the
24
25 255 commercial food system, health and society. The concept map illustrates that the pathways between
26
27 256 the regulations and these impact domains will be determined by the reactions of stakeholders.

29 257 **Strengths and limitations**

31 258 To our knowledge, this is the first cross-sectoral attempt to explicitly theorise how regulations of this
32
33 259 kind may impact on the commercial food system, health and society. Incorporating the views of a
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35 260 range of experts with different perspectives and interests allowed us to create a comprehensive
36
37 261 articulation of the ways the regulations may positively or negatively affect public health. As with any
38
39 262 qualitative research, our map does not claim to be representative of all views, nor comprehensive, of
40
41 263 the wider groups that participants represent.[40] Instead, we intended to sample a diverse range of
42
43 264 expert views related to food marketing and its regulation. Including participants from diverse sectors
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45 265 is a strength of the study as it enabled the proposed regulations to be theorised expansively.
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47 266 Nonetheless, it is possible that other concepts and pathways may exist but were not captured by our
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49 267 map.

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51 268 We necessarily invited more individuals than those who ultimately participated. The timing of the data
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53 269 collection period was a common reason for non-participation in the workshops, as it coincided with
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55 270 summer and school holidays in the UK, which may have made it difficult for those with child caring
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57 271 responsibilities to attend. To accommodate individuals' other commitments, we held smaller
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59 272 workshops across various times and days. Doing so increased the participation in our study, but it may
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273 have lost some discussion and synergy that larger groups allow.

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3 274 We found it difficult to recruit individuals from industry and government organisations. Employees
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5 275 from these sectors rarely have their contact details listed on public-facing websites, unlike those from
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7 276 academia and civil society. Government organisations expressed reluctance to contribute information
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9 277 beyond what was already in the public domain.[41] There may have also been reluctance from
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11 278 industry to engage with our research due to inherent differences between the goals of public health
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13 279 researchers and of the food industry. Including a relatively small number of industry representatives
14
15 280 may have limited our final map, and those industry perspectives in our study may be more sympathetic
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17 281 to public health goals than those of the wider sector. However, one of the representatives of industry
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19 282 we did include worked for an umbrella group and so may have a particularly broad perspective to
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21 283 bring. Some of our participants representing other sectors also had previous experience of working
22
23 284 with industry. Participants may have also taken part in our study to pursue their own agenda, as
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25 285 industry actors have previously sought to undermine food advertising regulations.[42,43] There are
26
27 286 some differences in the contributions made by industry participants compared with non-industry ones
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29 287 (**Appendix 2 and 3**). However, the nature of the workshop content, holding workshops with experts
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31 288 from non-industry sectors, and verifying findings with all participants, left little room for industry
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33 289 interests to overly-dominate our concept map.

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35 290 Conducting the workshops in person may have achieved different results, as some participants may
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37 291 have felt more able to share sensitive information in person. However, online workshops widened
38
39 292 attendance to those who would have been unable to attend in-person. To avoid some of the potential
40
41 293 challenges of collecting data using Zoom, we employed several recommended strategies.[44] This
42
43 294 included using screen-sharing and clear greetings to develop rapport, using back-up recording devices,
44
45 295 holding facilitator briefings to avoid technical issues, and establishing 'house rules' to ease
46
47 296 participants' experiences.[44] To maintain participant engagement, workshop duration was limited to
48
49 297 two hours, and primarily focused on capturing concepts rather than exhaustively detailing the
50
51 298 pathways between them. Though it may have increased participant fatigue and burden, holding longer
52
53 299 workshops may have allowed time to capture additional concepts and pathways. As a form of
54
55 300 member-checking,[45] we verified the master map with all workshop participants by email, in a
56
57 301 further attempt to ensure the final concept map accurately represented participants' contributions
58
59 302 and to allow additional comments.

303 **Interpretation of findings**

304 The concept map can be used to illustrate pathways through which the reactions of food and drink
305 companies may serve or undermine the public health goals of the regulations. Here, we describe three
306 potential scenarios: (i) adaptations are made to the regulations in ways that reinforce positive impacts

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3 307 on public health (see **Figure 4**); (ii) adaptations are made to the regulations in ways that undermine
4
5 308 impacts on public health (see **Figure 5**); and (iii) technicalities of the regulations cover too few
6
7 309 unhealthy food products and advertising opportunities to make a substantial difference to public
8
9 310 health (see **Figure 6**). As it is unlikely all companies will respond uniformly, a combination of the three
10
11 311 scenarios may follow the implementation of the regulations.

12 312 Scenario 1: adaptations reinforce positive impacts of the regulations on public health

13
14 313 INSERT FIGURE 4 HERE

15
16
17 314 Companies may reduce their TV and online advertising for regulated HFSS products, as they will have
18
19 315 less opportunity for advertisements. Doing so reduces people's exposure to HFSS adverts, which may
20
21 316 prompt corresponding reductions in demand, purchases and consumption of the associated HFSS
22
23 317 products. Consequently, this will reduce the total number of calories consumed by individuals,
24
25 318 improving health outcomes both associated with, and independent of, body weight.

26 319 To make up lost revenue from fewer HFSS product purchases, companies may increase TV and online
27
28 320 advertising for their products that are out of the scope of the regulations (e.g., 'spotlighting' low-fat,
29
30 321 -salt or -sugar alternatives). They may also engage with diet-related health issues, which could include
31
32 322 developing and advertising new products that are out of scope of the regulations, particularly if there
33
34 323 is public support for the regulations and corresponding falls in demand for HFSS products. Doing so
35
36 324 reduces the proportion of HFSS products (relative to non-HFSS) available in the food system.

37 325 Reduced exposure to HFSS adverts may change social norms about the acceptability of consuming
38
39 326 HFSS products. It may also change a consumerism mindset that may be encouraged by adverts to over-
40
41 327 purchase and consume products. These changes could contribute to societal shifts that reinforce
42
43 328 lower demand for HFSS products and change macro-level eating behaviours.

44 329 Scenario 2: adaptations undermine impacts of the regulations on public health

45
46 330 INSERT FIGURE 5 HERE

47
48
49 331 Food and drink companies could also minimise losses incurred by the regulations by redirecting their
50
51 332 efforts towards unregulated forms of marketing ('balloon effect'). Companies could increase their
52
53 333 expenditure on brand advertising, sports sponsorship, or advertising outdoors or in print or audio
54
55 334 media, none of which are intended to be covered by the regulations. In their marketing messaging,
56
57 335 companies could also reframe diet-related health issues to position inactive lifestyles as a more
58
59 336 substantial contribution to NCDs. It is unclear how this may affect people's total exposure to
60
337 marketing, and their resultant demand for HFSS products. Companies may also fear the

1
2
3 338 implementation of further regulations that could affect their performance, and so may lobby against
4
5 339 them. Lobbying could change future regulations such that their impact is limited, and in turn, may
6
7 340 mean that other, comparable regulations also have less chance of being implemented.

8
9 341 To implement regulations, companies may increase the amount of data they collect about the
10
11 342 population. Such data gathering constitutes greater digital surveillance that impacts society (for
12
13 343 example, privacy rights),[46] but could also inform more targeted marketing that is known to be highly
14
15 344 effective at encouraging sales and consumption.[47–49]

16 345 Scenario 3: technicalities hinder potential impacts of the regulations on public health

17
18
19 346 INSERT FIGURE 6 HERE

20
21 347 The regulations have a specific set of HFSS withing scope, which has notable exemptions such as some
22
23 348 salty foods. TV and online advertising for products exempt from the regulations may continue, as may
24
25 349 the corresponding purchasing and consumption of these products. Some participants reported that
26
27 350 the proposed scope of the regulations differ to that of other policies. Lack of consistency with other
28
29 351 regulations may make it costly – perhaps to the point of being futile – for companies to respond to
30
31 352 the regulations by developing new products that are compliant with all related regulations. Limited
32
33 353 development of new products would restrict the degree of transformation in the food system.
34
35 354 Furthermore, unlike other regulations, these advertising regulations are not defined by portion size
36
37 355 nor are smaller portion sizes an explicit objective of the regulations. This means there is no incentive
38
39 356 for companies to produce smaller product sizes, which could otherwise contribute towards reducing
40
41 357 calorie consumption via HFSS products.

42
43 358 As advertising by small and medium enterprises are also exempt from the regulations, larger
44
45 359 companies may ‘atomise’ by creating smaller off-shoot companies, which can continue to advertise
46
47 360 and sell HFSS products without limitation by the regulations. Advertising of HFSS outside of the
48
49 361 watershed hours will still be permitted on TV and on-demand services, and large HFSS companies can
50
51 362 afford the high price of advertising slots likely to occur after 9pm. TV advertising after 9pm may
52
53 363 therefore become saturated with HFSS products, which may limit the impact of the regulations on
54
55 364 adults’ and older teenagers’ consumption habits and, by extension, that of the children they are
56
57 365 responsible for.

58 366 **Comparison to existing literature**

59 367 Many existing models exist to illustrate how food marketing affects behaviour and health (e.g.,[8])
60
368 and logic models are regularly produced to illustrate how other diet-related public health regulations
369 may work. Methods for developing such models have evolved to appreciate the complexity of the

1
2
3 370 surrounding system in which they reside,[50] but to our knowledge, these have been rarely applied in
4
5 371 the context of diet-related health interventions,[51] and not applied to food advertising regulations
6
7 372 before. The concept map we developed here is the first we are aware of to show how food marketing
8
9 373 regulations may work by interacting with their surrounding system.

10
11 374 The concept map we developed illustrates ways that reactions to the regulations will reinforce or
12
13 375 undermine their impact on public health, reinforcing the hypotheses of earlier work. [9] The potential
14
15 376 for some of these pathways to exist has been evidenced elsewhere. Analyses have found that 57 of
16
17 377 65 brands associated with HFSS had an easily identifiable HFSS product, and the majority (84%) of
18
19 378 these products had an alternative non-HFSS product from the same brand, master brand, parent
20
21 379 company, or license holder company brand portfolio in the UK.[52] Evidence also indicates that HFSS
22
23 380 companies have reformulated and developed new products in responses to diet-related policies in the
24
25 381 UK, such as the Soft Drinks Industry Levy.[53,54] This evidence corresponds with pathways in the map
26
27 382 that show how companies could redistribute advertising from regulated to unregulated products.

28
29 383 Pathways that illustrate the risk of food companies undermining the regulations may be particularly
30
31 384 plausible given existing evidence has documented industry opposition to HFSS advertising regulations
32
33 385 in the UK.[42,43] The UK government's Department for Digital, Culture, Media & Sport impact
34
35 386 assessment of the regulations also assumed that a degree of HFSS advertising will be displaced to
36
37 387 other media,[31] as has existing research on the TV regulation specifically.[9,55] It is also widely
38
39 388 documented in broader literature that efforts to undermine such regulations often form part of wider
40
41 389 market strategies that, when exerted by powerful and global corporations, are difficult to address with
42
43 390 singular regulations.[56] Our concept map builds on this evidence by elucidating pathways through
44
45 391 which regulation may be undermined, from which it may be possible to adapt the proposed
46
47 392 regulations or implement additional, complementary ones to maximise the likelihood of the
48
49 393 regulations achieving their public health goals.

46 394 **Implications and further research**

47
48 395 As the TV and online advertising regulations are not yet implemented, our findings could be used to
49
50 396 augment the proposed legislation to encourage stakeholder reactions that maximise the regulations
51
52 397 potential benefits. Ensuring that definitions underpinning the legislation, particularly those relating to
53
54 398 product categories, harmonise with other legislation affecting commercial food providers may double-
55
56 399 down the incentive to reformulate or develop new, non-HFSS products rather than market HFSS
57
58 400 products by other means. Expanding the existing definition to a wider range of foods (e.g., salty snacks
59
60 401 currently exempt) could have the same effect. Implementing comparable regulations on other forms
402
of marketing, such as a ban on outdoor advertising of HFSS as has been seen in London,[57] would

1
2
3 403 also limit opportunity to redistribute advertising spend for HFSS. Expediting the implementation of
4 404 other regulations affecting the commercial food system, such as the proposed volume and location
5 405 price promotion regulations,[58] has similar potential to maximise the benefit of the TV and online
6 406 advertising ones by limiting opportunities for redistributing efforts to unregulated marketing. Some
7 407 of these proposed alterations echo responses to the Department of Health and Social Care, and
8 408 Department For Digital, Culture, Media and Sport 2020 policy consultation.[13] That they were
9 409 repeated and validated by experts in multiple related fields included in our study reinforce their
10 410 potential benefit.

11 411 The concept map could be used to design a complexity-informed evaluation of the regulations.
12 412 Complex explanations of intervention impacts appreciate that instead of a singular cause-effect
13 413 pathway, interventions can act as stimuli that send reverberations across the system in which they
14 414 reside.[59,60] Complex adaptive system methods also appreciate the role of relationships between
15 415 actors contributing to a variety of processes operating at different levels and scale to produce
16 416 intervention outcomes.[50] In doing so, they help avoid finding a wrong answer to important
17 417 questions,[61,62] and may help measure the impact of unintended consequences alongside the
18 418 outcomes that the policy sets out to achieve.[63] By explicitly exploring the connections in a complex
19 419 system, these methods may also identify novel leverage points which could be targeted by future
20 420 interventions. Though the map developed in our study was not explicitly conceived in systems
21 421 thinking, it has many systemic qualities (e.g., emphasises the role of relationships) and correlates with
22 422 other methods such as 'system mapping' that have been identified as a key component of systems-
23 423 informed evaluations.[50] The concept map could be used to define focal areas for evaluative studies
24 424 of both the intended and unintended consequences of the regulations or could form the basis of other
25 425 systems evaluation methods. This could also help establish the relative 'strength' of each relationship.

26 426 A benefit of theory, here in the form of a concept map, is that it enables the application of findings
27 427 elsewhere.[28,29] The presence of food marketing regulations in other countries[64] – albeit different
28 428 to the ones proposed in the UK - suggests there may be political appetite to learn from the UK's
29 429 experience. For example, policymakers could refer to the map to consider mechanisms and pathways
30 430 that are particularly relevant to their country context, and thus important to consider in developing
31 431 their legislation. Findings that emerge from an evaluation based on the map would also be particularly
32 432 applicable in other countries and contexts, as the maps clarifies how they are embedded with other
33 433 stakeholders' adaptations following the implementation of the regulations.

434 **CONCLUSIONS**

435 While the proposed UK TV and online food advertising regulations will be some of the most restrictive
436 in the world, the concept map developed in this paper illustrates that the extent to which they improve
437 diet-related health will ultimately be determined by stakeholder reactions in the surrounding system.
438 The map may be used as a basis for establishing a comprehensive evaluation of the UK regulations,
439 and to inform similar regulations elsewhere. To realise the full potential of the regulations, UK
440 policymakers may also use the map to identify and prevent loopholes in the legislations before they
441 are implemented.

442

443 **Contributors**

444 EB, PS, RS, MW AND JA CONCEIVED THE STUDY AND ACQUIRED FUNDING. HF AND JA
445 DEVELOPED THE METHODOLOGY AND ACCOMPANYING RESOURCES AND CONDUCTED THE
446 WORKSHOPS. HF COLLATED AND VALIDATED THE DATA. HF PREPARED THE MANUSCRIPT,
447 AND THE DRAFT VERSIONS WERE CRITICALLY REVIEWED BY EB, PS, RS, MA AND JA. ALL
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455 **Competing interests**

456 JA and MW report research grants from the Medical Research Council, the Biotechnology and
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459 conduct of the study. MW is a member of the Expert Advisory Group of the Food Foundation, a
460 Community Interest Company in the UK that is leading work on food insecurity, including
461 coordinating an ongoing independent inquiry into childhood food insecurity, led by the All-Party
462 Parliamentary Group on Hunger and Food Poverty. HF previously worked for a market research
463 company, which conducts research on behalf of many companies, including those from the food and
464 drink industry. HF, JA and MW have submitted evidence to the Department of Health and Social

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3 465 Care, and Department For Digital, Culture, Media and Sport 2020 consultation for the regulations
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5 466 under study, available here: [https://www.cedar.iph.cam.ac.uk/resources/evidence-](https://www.cedar.iph.cam.ac.uk/resources/evidence-submissions/#HFSSadban)
6
7 467 [submissions/#HFSSadban](https://www.cedar.iph.cam.ac.uk/resources/evidence-submissions/#HFSSadban). RS reports grants from the Medical Research Council, National Institute
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12
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14
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16 472 **Data availability statement**

17
18 473 Each workshop map is available in **Appendix 2** but recordings are not available as it is not possible to
19
20 474 sufficiently anonymise participants.

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683 **FIGURE TITLES**

684 **Figure 1. Summary of method used to develop the concept map**

685 **Figure 2. Examples of mapping concepts and pathways using Miro**

686 **Figure 3. Concept map of pathways through which the proposed UK TV and online advertising
687 regulations may affect the commercial food system, health and society**

688 **Figure 4. Illustration of concept map use: scenario 1**

689 **Figure 5. Illustration of concept map use: scenario 2**

690 **Figure 6. Illustration of concept map use: scenario 3**

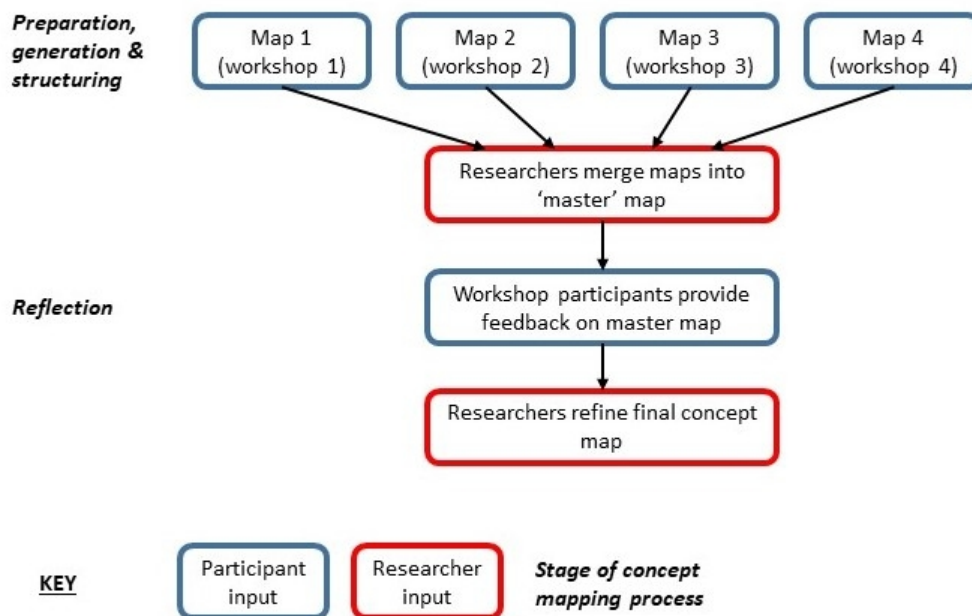


Figure 1 Summary of method used to develop the concept map

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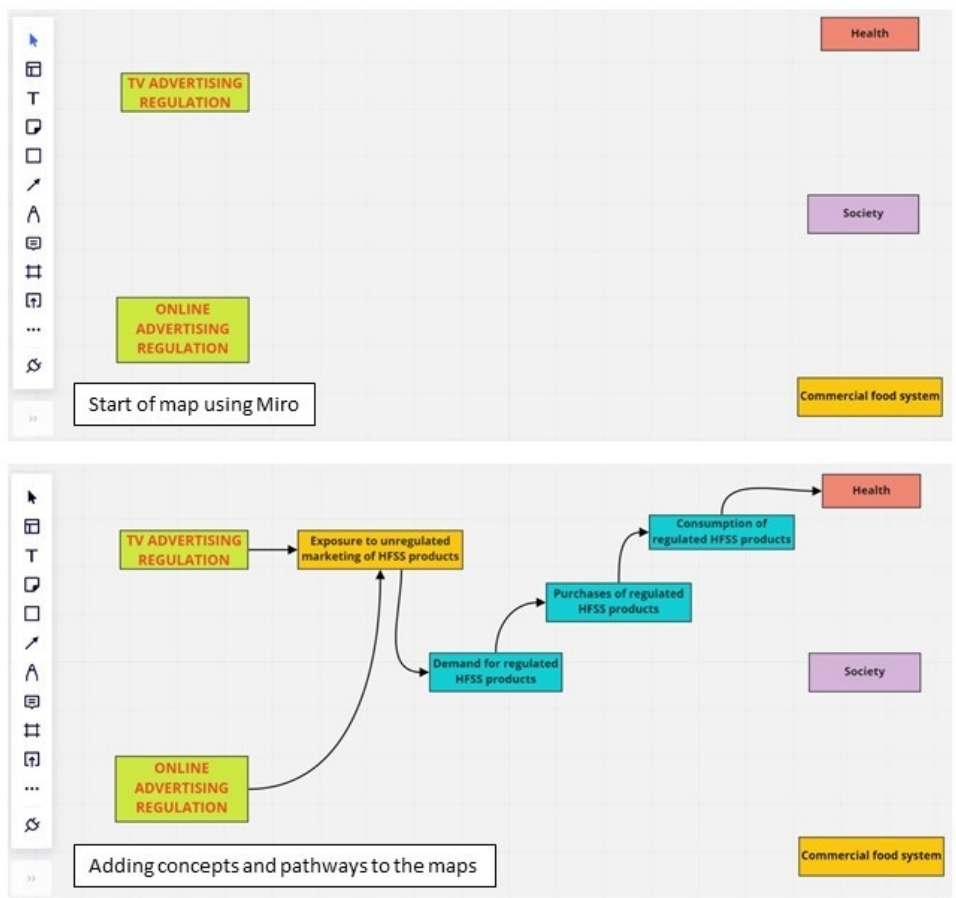


Figure 2 Examples of mapping concepts and pathways using Miro
 176x158mm (96 x 96 DPI)

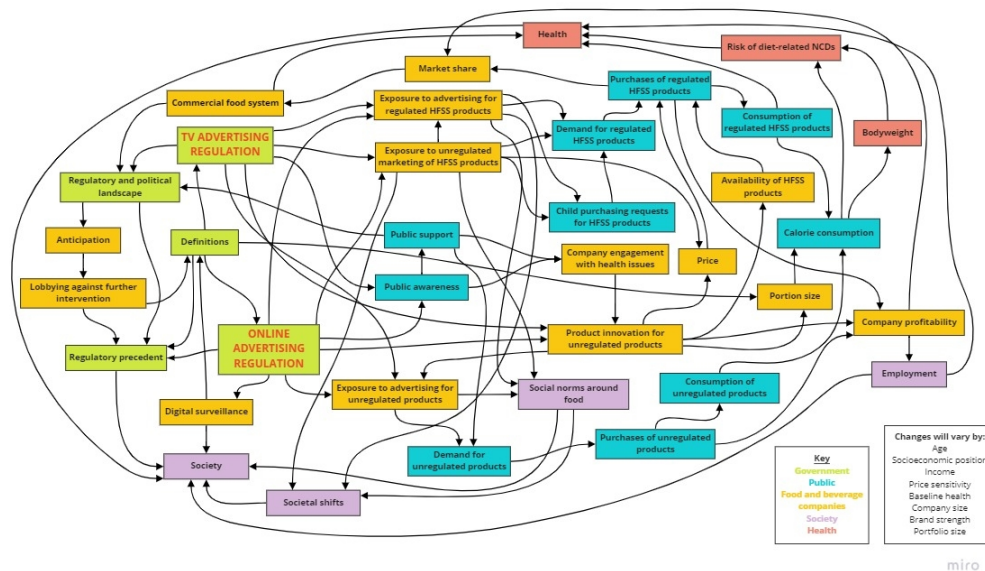
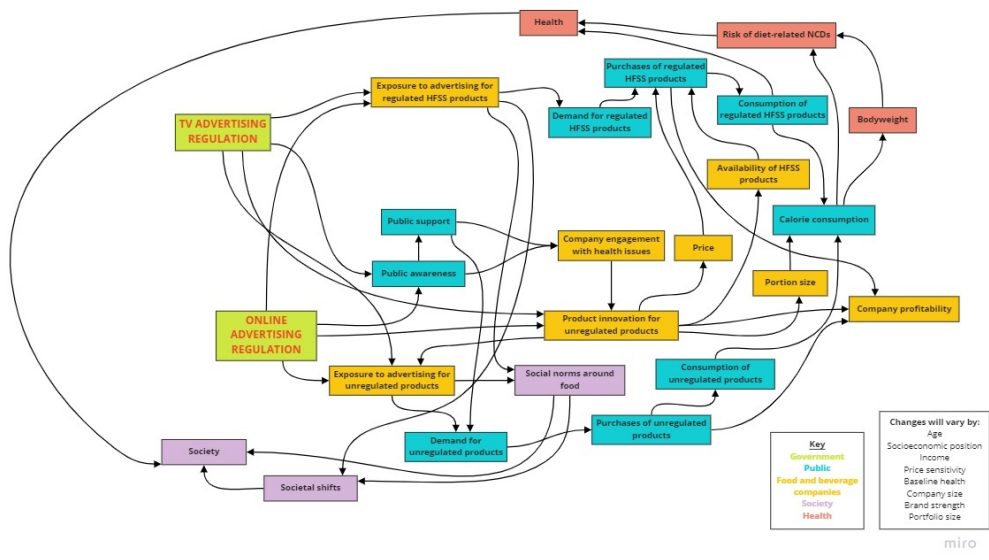


Figure 3 Concept map of pathways through which the proposed UK TV and online advertising regulations may affect the commercial food system, health

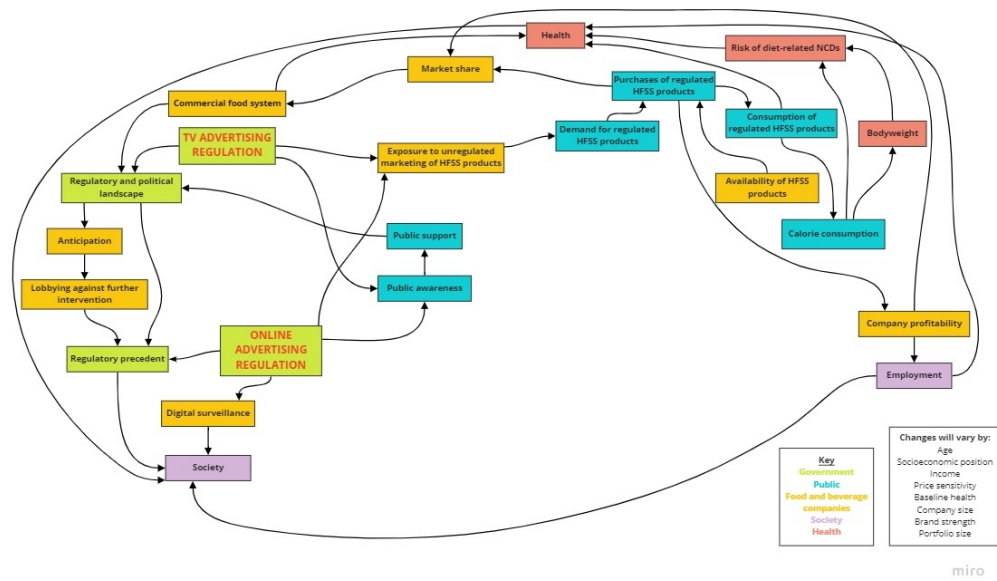
391x231mm (72 x 72 DPI)

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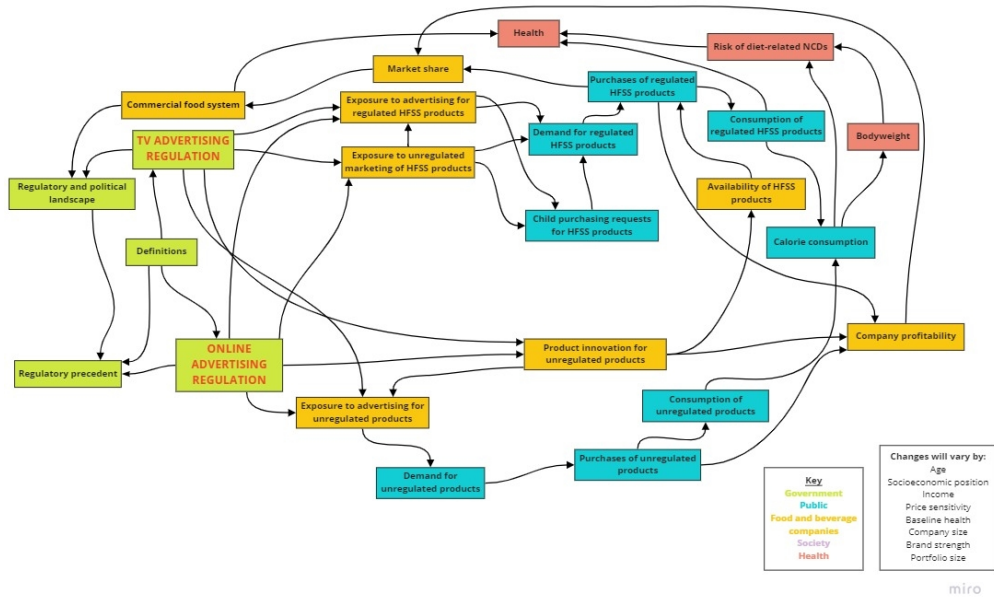
Scenario 1: adaptations reinforce positive impacts of the regulations on public health

398x226mm (72 x 72 DPI)



Scenario 2: adaptations undermine impacts of the regulations on public health

389x232mm (72 x 72 DPI)



Scenario 3: technicalities hinder potential impacts of the regulations on public health

383x236mm (72 x 72 DPI)

Appendix 1: Consolidated criteria for reporting qualitative studies (COREQ): 32-item checklist

No.	Item	Guide questions/description	Section
Domain 1: Research team and reflexivity			
Personal characteristics			
1.	Interviewer/facilitator	Which author/s conducted the interviews or focus groups?	6
2.	Credentials	What were the researcher's credentials? e.g., PhD, MD	Title page
3.	Occupation	What was their occupation at the time of the study?	Title page
4.	Gender	Was the researcher male or female?	See note
5.	Experience and training	What experience or training did the researcher have?	6
Relationship with participants			
6.	Relationship established	Was a relationship established prior to study commencement?	6
7.	Participant knowledge of the interviewer	What did the participants know about the research? e.g., personal goals, reasons for doing the research	6
8.	Interviewer characteristics	What characteristics were reported about the interviewer/facilitator? e.g., bias, assumptions, reasons and interests in the research topic	N/A
Domain 2: study design			
Theoretical framework			
9.	Methodological orientation and Theory	What methodological orientation was stated to underpin the study? e.g., grounded theory, discourse analysis, ethnography, phenomenology, content analysis	6
Participant selection			
10.	Sampling	How were the participants selected? e.g., purposive, convenience, consecutive, snowball	6
11.	Method of approach	How were participants approached? e.g., face-to-face, telephone, mail, email	6
12.	Sample size	How many participants were in the study?	8
13.	Non-participation	How many people refused to participate or dropped out? Reasons?	N/A
Setting			
14.	Setting of data collection	Where was the data collected? e.g., home, clinic, workplace	6-7
15.	Presence of non-participants	Was anyone else present besides the participants and researchers?	N/A
16.	Description of sample	What are the important characteristics in the sample? e.g., demographic data, date	8
Data collection			
17.	Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	6
18.	Repeat interviews	Were repeat interviews carried out? If yes, how many?	N/A
19.	Audio/visual recording	Did the research use audio or visual recording to collect the data?	7
20.	Field notes	Were field notes made during and/or after the interview or focus group?	7
21.	Duration	What was the duration of the interviews or focus group?	6
22.	Data saturation	Was data saturation discussed?	6
23.	Transcripts returned	Were transcripts returned to participants for comment and/or correction?	8

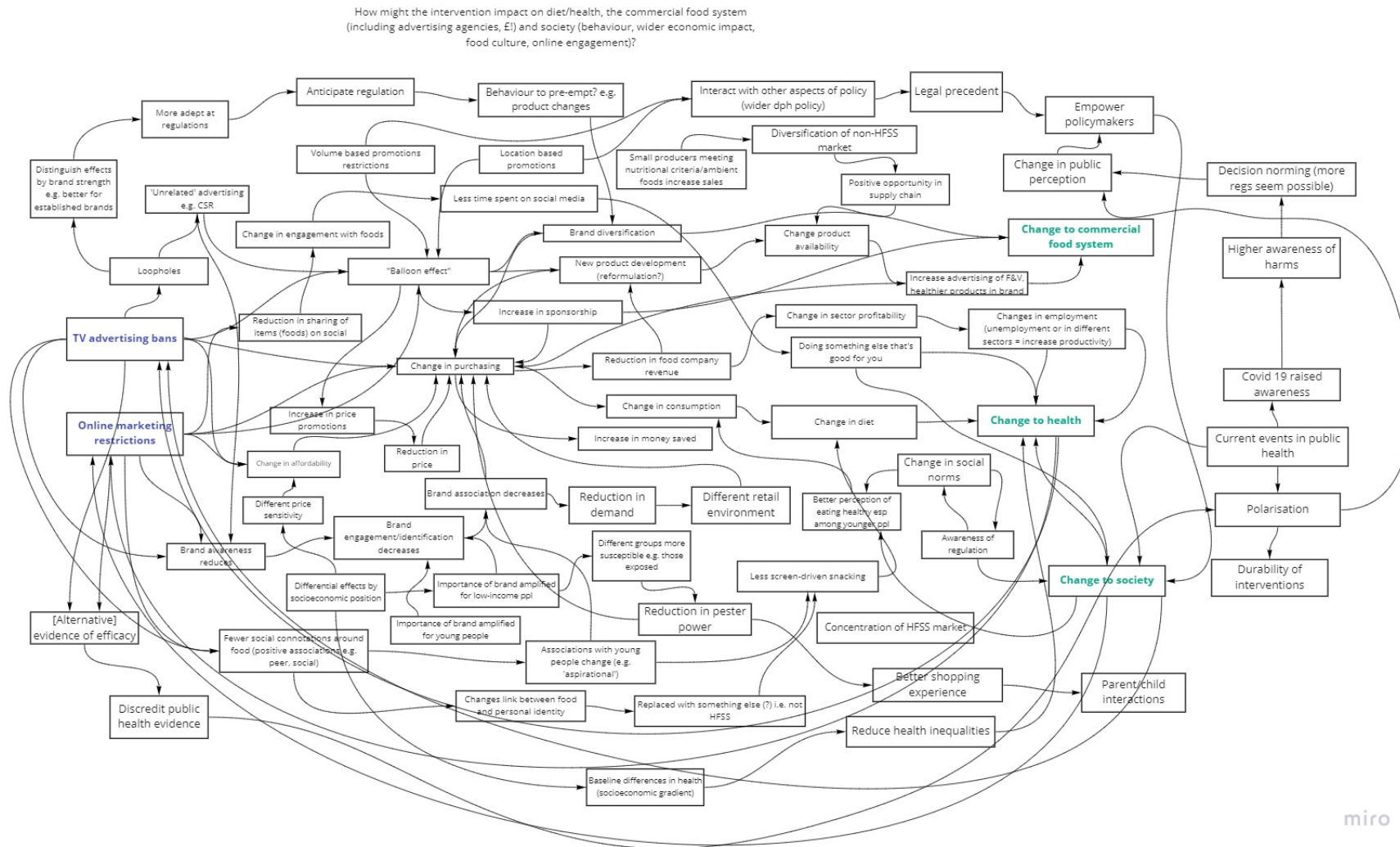
No.	Item	Guide questions/description	Section
Domain 3: analysis and findings			
Data analysis			
24.	Number of data coders	How many data coders coded the data?	N/A
25.	Description of the coding tree	Did authors provide a description of the coding tree?	N/A
26.	Derivation of themes	Were themes identified in advance or derived from the data?	N/A
27.	Software	What software, if applicable, was used to manage the data?	6-7
28.	Participant checking	Did participants provide feedback on the findings?	8
Reporting			
29.	Quotations presented	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g., participant number	N/A
30.	Data and findings consistent	Was there consistency between the data presented and the findings?	9
31.	Clarity of major themes	Were major themes clearly presented in the findings?	N/A
32.	Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	N/A

Taken from: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *Int J Qual Health Care*. 2007;19(6):349-357. doi:10.1093/intqhc/mzm042

Question on gender omitted in response to recent update: Albury C, Pope C, Shaw S, et al. Gender in the consolidated criteria for reporting qualitative research (COREQ) checklist. *International Journal for Quality in Health Care*. 2021;33(4):2021. doi:10.1093/intqhc/mzab12

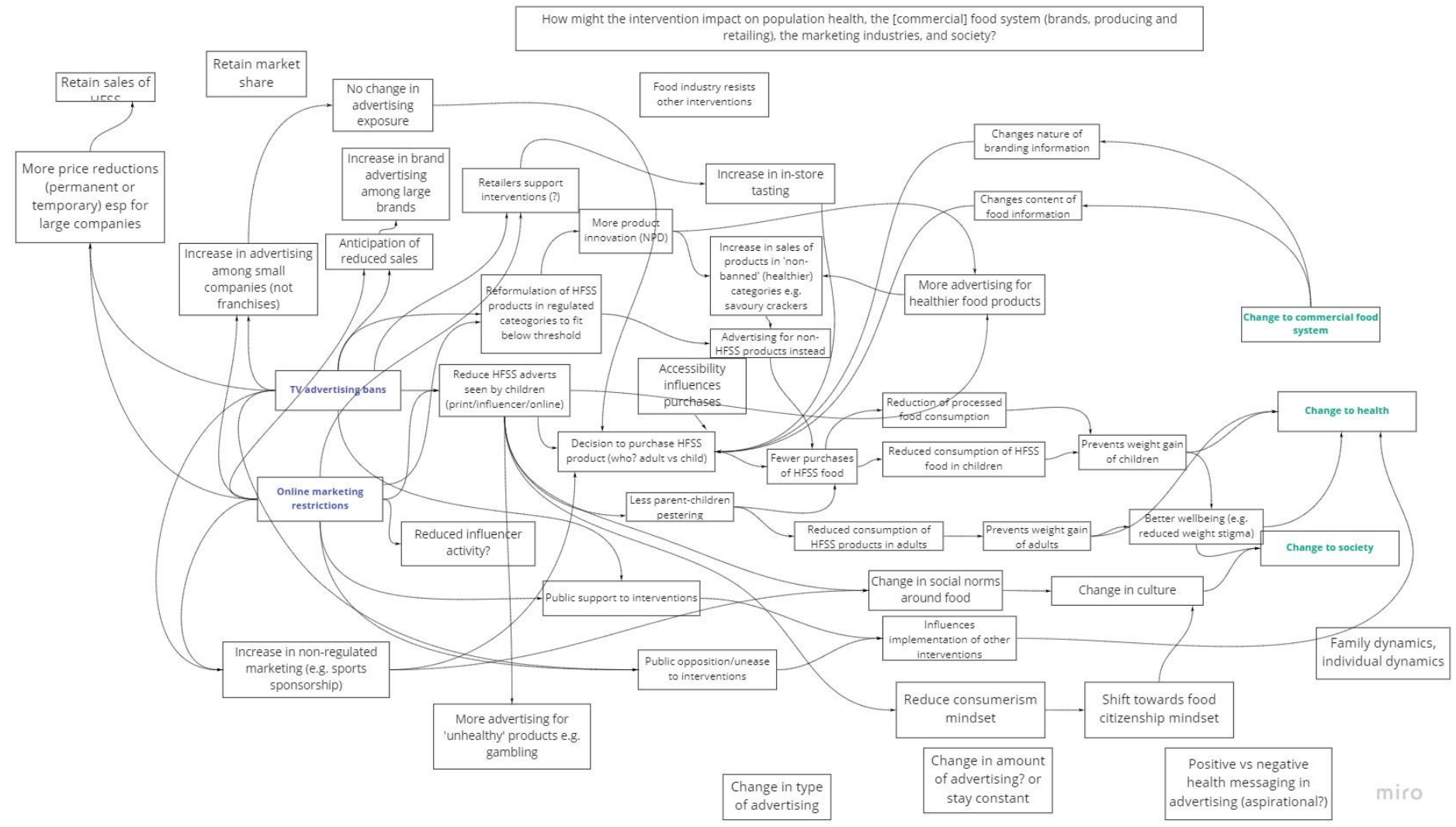
Appendix 2: Maps 1-4 produced by each workshop

Workshop 1 Map



miro

Workshop 2 Map



Appendix 3: Concepts from workshop maps and resulting concepts in the final map

Workshop 1 (non-industry)	Workshop 2 (non-industry)	Workshop 3 (non-industry)	Workshop 4 (industry)	Final map
More adept at regulations	Anticipation of reduced sales	Anticipating further restrictions		
Behaviour to pre-empt? e.g., product changes		Proposals implemented by law		Anticipation
Anticipate regulation				
Change product availability			Affects food availability	Availability of HFSS products
	Prevents weight gain of children	Changes to weight		Bodyweight
	Prevents weight gain of adults			
		Decrease in calorie consumption	Reduced calorie intake	Calorie consumption
Parent/child interactions	Less parent-children pestering			Child purchasing requests for HFSS products
Reduction in pester power				
Better shopping experience				Commercial food system
			{within company} companies are more engaged with health policies? Health issues?	Company engagement with health issues
			Health embedded in strategy (non-negotiable)	
			Easier for nutritionists to communicate with marketing teams	
Reduction in food company revenue			Restricts ability to attain profits by selling less healthy products	Company profitability

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Workshop 1 (non-industry)	Workshop 2 (non-industry)	Workshop 3 (non-industry)	Workshop 4 (industry)	Final map
Change in sector profitability			Cost/burden of enforcement to e.g. ASA (funded by whom?)	
			Inefficiencies = costly	
Less screen-driven snacking	Reduced consumption of HFSS products in adults	Reduced purchasing/ consumption of HFSS	Consumption of some HFSS products sustained	Consumption of regulated HFSS products
Change in consumption	Reduction of processed food consumption			
Doing something else that's good for you	Reduced consumption of HFSS products in children			
Change in diet				Consumption of unregulated products
		Applies specific definition of HFSS - poor definitions of categories	Inconsistencies between different policies and criteria	Definitions
		Enforcement based on company-provided info		
		Lack of info to use/verify for NPM		
Reduction in demand				Demand for regulated HFSS products
Increase in money saved				
			Consumer demands may be lower for reformulated alternatives?	Demand for unregulated products
		Increase in user surveillance activity		Digital surveillance
		Infringing Child's rights not to be under surveillance?		
		Increase in surveillance activity		

Workshop 1 (non-industry)	Workshop 2 (non-industry)	Workshop 3 (non-industry)	Workshop 4 (industry)	Final map
		Increase in data collated about children/young people		
Changes in employment		Incentive to not expand beyond 250 employees		Employment
Reductions in sharing of foods on social media	No change in advertising exposure	Exposure to fewer HFSS adverts	Less exposure to ads overall	Exposure to advertising for regulated HFSS products
	Reduced influencer activity?	Children's exposure to TV advertising less affected than adults	Reduce exposure to HFSS ads (inc. through click through)	
	Change in amount of advertising or stay constant	Advertising has fewer implicit effects	Market HFSS products based on taste	
	Reduce HFSS adverts seen by children	More powerful	Only HFSS advertised post-9pm (more competitive)	
	Positive vs. negative health messaging in advertising (aspirational)	Virtue signalling		
	Changes content of food information	Harder to distinguish between different food/drinks companies		
		Iterative approach to augmenting online adverts		
Replaced with something else (?) i.e., not HFSS	Advertising for non-HFSS products instead	Exposure to non-HFSS adverts	Focus marketing on lower sugar brands e.g., reformulated products from other measures	Exposure to advertising for unregulated products
Increase advertising of F&V, healthier products in brand	More advertising for healthier food products	Increased advertising for healthier products	More value deals are healthier	
	More advertising for 'unhealthy products' e.g., gambling	Increase in exposure to 'other' adverts	Cost of advertising slots after 9pm become very expensive	
		Continued advertising of salty products		
		Increased advertising for food delivery companies		

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Workshop 1 (non-industry)	Workshop 2 (non-industry)	Workshop 3 (non-industry)	Workshop 4 (industry)	Final map
Balloon effect	Change in type of advertising	Increase in exposure to online, personalised/targeted advertising	Difficult to market fruit and veg as part of a meal (which may include HFSS e.g., Christmas) - depends on how regulation is specified e.g. 'hero' ingredient	Exposure to unregulated marketing of HFSS products
Increase in sponsorship	Increase in non-regulated marketing (e.g., sports sponsorship)	Advertising continues to appeal to children	Not able to show healthy food in context	
'Unrelated' advertising e.g., CSR	Increase in in-store tasting	Companies able to bypass enforcement	Not able to show 'treat' foods in appropriate	
Loopholes	More price reductions especially for large companies	Increase in online advertising (hard to measure)	Hard to make healthy products desirable	
Location based promotions	Increase in advertising among small companies (not franchises)	Companies able to bypass loopholes online	Focus diverted away from reformulation if unable to advertise	
Increase in price promotions	Changes nature of branding information	Shift in how sugary drinks are advertised (alcohol alternatives)	Not able to advertise cooking/food culture	
Brand awareness reduces	Increase in brand advertising among large brands	Reduction in offline advertising (e.g., TV, print - easy to measure)	Find alternative ways to market existing products (no product change)	
Brand engagement/identification decreases		Continued advertising of products in large portions e.g., fried chicken	Innovation in targeting adults with marketing	
Brand association decreases		Advertising HFSS by stealth		
		Increase in other forms of price promotion?		
		Regulation unable to capture what is appealing to children		
	Better wellbeing (e.g., reduced weight stigma)			Health
Alternative evidence of efficacy	Food industry resists other interventions	Industry able to lobby against policies in future		Lobbying against further interventions

Workshop 1 (non-industry)	Workshop 2 (non-industry)	Workshop 3 (non-industry)	Workshop 4 (industry)	Final map
Discredit public health evidence				
Concentration of HFSS market	Retain market share	Large companies continue to dominate food system		Market share
		Atomisation?		
		Continued advertising of products in large portions e.g., fried chicken	No incentive to market smaller products/portion sizes e.g., because based on NPM, content per 100g	Portion size
Change in affordability	More price reductions especially for large companies	Increase in other forms of price promotion?	Increase in product prices	Price
			Harder to run value deals e.g., price matching competitors	
Diversification of non-HFSS markets	More product innovation (NPD)	NPD for non-HFSS products	Could lead to NPD for exempt categories	Product innovation for unregulated products
Positive opportunity in supply chain	Reformulation of HFSS products in regulated categories to fit below threshold	Reformulation towards salty products	Some categories of food are hard to change	
Brand diversification		Reduced incentive to produce HFSS	NPD [and marketing] becomes difficult	
New product development (reformulation?)		Increased incentive to produce artificially sweetened products	No incentive to change products to meet threshold i.e., binary assessment is unattainable for some categories	
			No change or incentive to change for exempt categories	
			Innovation in product and ingredient development	
Change in public perception				
Awareness of regulation				
Higher awareness of harms				
Public awareness				

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Workshop 1 (non-industry)	Workshop 2 (non-industry)	Workshop 3 (non-industry)	Workshop 4 (industry)	Final map
Better perception of eating healthy especially among younger people	Public support for interventions		Difficult to articulate to the public	Public support
	Public opposition/unease to interventions			
Change in purchasing	Decision to purchase HFSS product (who? Adult vs child)	Reduced purchasing/consumption of HFSS	Reduced purchases of HFSS	Purchases of HFSS regulated products
	Fewer purchases of HFSS food			
	Retain sales of HFSS			Purchases of unregulated products
Change in purchasing	Increase in sales of products in 'non-banned' healthier categories e.g., savoury crackers	Increased availability of salty products		
		Increase in production/sales of low or no alcoholic drinks		Regulatory and political landscape
Durability of interventions	Retailers support interventions	Volume-based price promotion restrictions	Wider political landscape (e.g., Brexit) other burdensome policies (e.g., plastic tax, covid)	
Interact with other aspects of DPH policy		Location-based price promotion restrictions	Volume and location price policies	Regulatory and political landscape
Location based promotions		Other restrictions warranted	Unnecessarily complicated landscape of policies to meet the same goal = costly	
Covid-19 raised awareness		Reinforces reformulation as 'solution'	Potential for a level playing field (if clear guidance)	
Current events in public health		Tax breaks/ad subsidy for SMEs producing healthy foods (?)	Insufficient warning to respond	
Volume based promotions restrictions			Difficult to implement e.g., differences in affected categories	Regulatory and political landscape
			Packaged products not able to go at the front of store based on conditions for restrictions (packaged/HFSS/product in	

Workshop 1 (non-industry)	Workshop 2 (non-industry)	Workshop 3 (non-industry)	Workshop 4 (industry)	Final map
			scope) - may relate to available nutritional info)	
Legal precedent	Influences implementation of other interventions	Influences capacity to make future policies for HFSS		Regulatory precedent
Decision norming (more regs seem possible)		Confusion for future policies for HFSS/loss of objectivity		
Empower policymakers		Increase in government sanctioned digital verification		
		Reduced risk of various NCDs		Risk of diet-related NCDs
Fewer social connotations around food	Change in social norms around food	Influences social norms e.g., social cooling		Social norms around food
Changes in social norms	Family dynamics, individual dynamics	Reduction in normalisation of HFSS		
Change in engagement with foods		Limits changes to food norms		
Associations with young people change (e.g., aspirational)		Greater influence on social/food norms		
				Society
Changes link between food and personal identity	Shift towards food citizenship mindset			Societal shifts
Different retail environment	Reduce consumerism mindset			
Less time spent on social media	Change in culture			
Polarisation				
Small producers meeting nutritional criteria/ambient food increase sales	Accessibility influences purchases	Increase in advertising from SMEs? If they can afford to compete	Companies with small portfolio of HFSS products most affected? e.g., chocolate	Changes vary by...
Different price sensitivity	Increase in advertising among small companies (not franchises)	Sustained sales of HFSS from SMEs	Those already experiencing overweight may be more likely to benefit (higher base exposure?)	
Importance of brand amplified for low-income people		Effects differ by age?	Disproportionately affects low-income people	

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Workshop 1 (non-industry)	Workshop 2 (non-industry)	Workshop 3 (non-industry)	Workshop 4 (industry)	Final map
Importance of brand amplified for young people		Socioeconomic position		
Different groups more susceptible e.g., those exposed		Adolescents more susceptible to advertising		
Differential effects by socioeconomic position				
Baseline differences in health (socioeconomic gradient)				
Reduce health inequalities				
Distinguish effects by brand strength e.g., better for established brands				

Notes: HFSS: high fat, salt and sugar; NCD: non-communicable disease; NPD: new product development; NPM: Nutrient Profile Model; SME: small and medium enterprises.