REVIEW

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Offline to online: a systematic mapping review of evidence to inform nutrition-related policies applicable to online food delivery platforms

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Abstract

Background Online food delivery (OFD) platforms offer easy access to an abundance of energy-dense and nutrient-poor takeaway foods and may exacerbate existing unhealthy food environments. Efforts to improve population diets include a range of policy recommendations focused on improving the healthiness of food environments; however, the way in which such policies may apply to OFD platforms is not clear. This paper aimed to synthesise the existing evidence to inform nutrition-related policies applicable to OFD platforms for population health and well-being. A secondary aim was to scan existing nutrition-related policies in Australia and internationally, which have the potential to be applicable to OFD platforms.

Methods Seven electronic databases including Medline, Embase, CINAHL, Business Source Ultimate, Scopus, Web of Science, and Proquest were searched from January 2010 to October 2023. Evidence from studies was mapped to five existing policy domains outlined by the Healthy Food Environment Policy Index (Food-EPI) including (i) food labelling; (ii) food promotion; (iii) food composition and nutritional quality; (iv) food retail; and (v) food pricing. Relevant data sources were searched for currently implemented nutrition-related government policies that may have relevance to OFD platforms.

Results A total of 2012 records were screened, and 43 studies were included. There were 70 relevant study outcomes across the included studies, which addressed one or more of the 5 domains. Of these, 21 were relevant to 'Food Promotion' (30%), 18 to 'Food Retail' (26%), 15 to 'Food Composition (21%), 11 to 'Food Prices' (16%), and six to 'Food Labelling' (9%). Three existing policies from international jurisdictions (England, Singapore, EU) included OFD platforms, of which one was a voluntary measure. Several existing policies under food labelling have the potential to be amended to include OFD platforms under regulatory definitions.

Conclusion OFD platforms have emerged as a disruptor to how people acquire their food and have yet to be widely included in existing nutrition-related policies. Advancing the evidence base to support the design of effective policy

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actions and mitigate the potential negative health impacts of OFD platforms will support efforts to improve population diets.

Keywords Digital food environment, Online food delivery, OFD, Public policy, Nutrition policy, Food away from home

Background

Between 1990 and 2019, dietary risk-related non-communicable diseases (NCDs) accounted for 18.9% to 22.7% of all-cause deaths globally [1]. Worldwide, the top five dietary risks for deaths attributable to NCDs were diets high in sodium, low in whole grains, low in legumes, low in fruits, and high in meats [1]. In addition, since 1990, global obesity rates have quadrupled amongst children and adolescents aged 5 to 19 years [2] and more than doubled amongst adults [3]. Now, one in eight people are living with obesity globally [3]. Whilst diets are a known modifiable risk factor for NCDs such as obesity, diabetes, cardiovascular disease, and some types of cancer, shifting populations towards more positive dietary behaviours has proven to be challenging. Globally, almost 40% of populations in both high and low-middle-income countries do not adhere to their national dietary guidelines with overconsumption of red meats and underconsumption of vegetables [4]. Dietary guidelines are crucial reference standards for optimal nutrition and health, and prevention of NCDs [5].

Food environments are defined by the collective physical, economic, policy, and sociocultural surroundings, opportunities, and conditions that influence people's food choices and nutritional status [6]. Unhealthy food environments can be defined as food settings and conditions that are dominated by energy-dense and nutrient-poor foods that are widely available, relatively inexpensive, and heavily marketed [7]. Current food environments are considered predominantly unhealthy [7] and are increasingly undergoing digital transformation that may influence the accessibility and availability of healthy and unhealthy foods. There has been an evident expansion of food accessibility through the use of online food retail platforms, which may have been accelerated by the COVID-19 pandemic [8]. A review has classified online food retail into three distinct categories [9] consisting of online food delivery (OFD), including platforms offering ready-made takeaway meals from restaurants and food service outlets via third-party couriers [10], such as Uber Eats or Just Eat; online groceries for supermarket items such as, but not limited to, fresh produce and packaged foods; and meal kits with ingredients for cook-at-home meals. A systematic scoping review of 22 articles on OFD platforms, the first category of online food retail previously defined, suggested that the majority of these

platforms are likely to promote unhealthy food purchasing through extensive use of marketing practices such as price discounts and images and the dominance of unhealthy food offerings [11]. Globally, OFD platforms are dominated by large corporations forecasted to reach US$1.22 trillion in 2024 and estimated to reach 2.8 billion users by 2029 [10].

Given the potential public health challenges, there is an opportunity for governments to explore how nutrition-related policies, such as food labelling and restrictions on marketing unhealthy foods, apply to digital food environments. Additionally, targeted policies tailored for these digital contexts may be required. Drawing from other areas of nutrition research, several nutrition-related practices that OFD companies could take to create healthier food environments have been identified [12]. For example, it has been proposed that OFD companies could include public commitments to nutrition and health as part of their corporate strategies, ensure nutrition information on their platforms meet government regulations, restrict exposure of children to marketing of unhealthy foods and brands, increase visibility and accessibility of healthier products on platforms, and encourage restaurants to increase healthfulness of their offerings [12]. Despite these recommendations, it is recognised that voluntary actions from industry are often inadequate to sufficiently improve food environments and government regulation is often warranted to establish a 'level playing field' [12].

Nutrition policies targeting food environments have the potential to substantially improve population diets and may be effective [13] and cost-effective [14] initiatives to prevent the burden of obesity and related NCDs. Nutrition-related policy options available for the government include 'harder' policy instruments, such as laws, regulations, and economic instruments (e.g. tax and incentives), and 'softer' instruments such as community education (e.g. guidelines or mass media campaigns) [15, 16]. In Australia, nutrition-related policies have mostly focused on developing national strategies and aspects of food labelling including regulation of ingredient lists, nutrition information panels, and health claims [17, 18]. Worldwide, 'harder' policy instruments, such as taxes on sugar-sweetened beverages, have been successfully implemented in more than 50 jurisdictions, with evidence of positive impact on a range of outcomes, including reductions in sales of taxed beverages [19].

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To assist in the monitoring of policies and actions for progress towards better nutritional health, the International Network for Food and Obesity and Non-communicable Disease Research, Monitoring and Action Support (INFORMAS) developed the Healthy Food Environment Policy Index (Food-EPI) [20]. The Food-EPI framework includes seven key policy areas specific to food environments, including food composition, labelling, promotion, prices, provision, retail, trade, and investment [20]. These policy areas have been shown to have an important impact on population diets and obesity as they affect the accessibility, availability, and affordability of foods and beverages.

Whilst there are a wide range of nutrition-related policies that are likely to be effective in preventing diet-related NCDs, there are often challenges with implementation [21, 22]. These challenges include maintaining momentum and support for policies over time through changing political agendas and require cross-sectoral and multi-level cooperation between key stakeholders including civil society and businesses [23]. Furthermore, the regulation of OFD may face unique challenges [24]. For example, in an Australian context, OFD platforms operate in a policy and legal 'grey' zone where it is unclear if they are a retailer, manufacturer, food service outlet, or third-party courier [24]. Without this clear definition, OFD platforms are likely to resist regulation [25] under nutrition policies which would otherwise apply to a food retailer or manufacturer. Moreover, it is unclear whether existing regulations which apply to tangible in-person contexts like nutrition labelling on menu boards and product packaging can be directly transferred to online contexts.

As such, the regulation of OFD platforms will likely require careful navigation of existing nutrition policies or consideration of new policies which specifically apply to OFD and the online environment. The primary aim of this study was to synthesise the existing evidence on OFD platforms under relevant food policy areas to inform nutrition-related policies. A secondary aim was to scan and identify existing nutrition-related policies in Australia and internationally, which have the potential to be applied to OFD platforms.

Methods

A systematic mapping review was conducted to map existing evidence to inform the development and implementation of policies to improve the healthiness of online food delivery services under the key policy areas of Food-EPI. Mapping reviews are similar to scoping reviews as they both address a broad research question to guide future research priorities and decision-making [26]. However, unlike a scoping review which catalogues the evidence in response to what is found in the literature, a mapping review has pre-defined coding categories [26]. Food composition, labelling, promotion, retail, and prices were the pre-defined coding categories for this review as they were considered relevant policy domains for the context of OFD platforms. A mapping review also highlights the areas of uncertainty in the evidence base and summarises the existing evidence base in a visual or tabular way [27]. The review methodology was conducted in a systematic way by developing a review protocol, searching relevant databases, screening, coding, and data synthesis [28]. This review also adhered to the PRISMA-ScR checklist—please see Additional file 1: Table S1.

The review protocol was registered on Open Science Framework on 19 September 2023 (https://doi.org/10.17605/OSF.IO/2SWKQ).

Inclusion and exclusion criteria

The inclusion and exclusion criteria used for the systematic mapping review are outlined in Table 1. Briefly, studies were included if they related to OFD platforms and provided evidence on the Food-EPI domains of interest. Whilst the focus of this review was OFD platforms offering ready-made takeaway meals from restaurants and food service outlets, our search terms were designed to also identify evidence that may apply for other categories of online food retail in the digital food environment such as online groceries and meal-kit subscription services.

Search strategy

For our primary research question, a systematic search of Medline (via Ovid), Embase (via Ovid), CINAHL Complete (via Ovid), Scopus, Web of Science (Web of Science Core Collection (1965–present)), ProQuest Central, Business Source Ultimate was conducted from January 2010 to October 2023, using the following search term categories, combinations, truncations, and synonyms: 'food marketing' OR 'food accessibility' OR 'food labelling' OR 'nutritional quality' OR 'price' AND 'digital platforms' OR 'mobile applications' OR 'internet' AND 'online food delivery' OR 'online food shopping' OR 'online food ordering' OR 'meal delivery'. The full Medline search strategy is provided in Additional file 1: Table S2.

For our second research question, a systematic search of relevant policies was conducted firstly using the Benchmarking Food-EPI in Australia progress report by Sacks & Mann, 2023 [18] and the Food Policy Index resources as a starting point. All of these resources are considered the most up-to-date documentation of the Australian government's progress on nutrition-related policies and are authored by members of INFORMAS—a team of food policy experts with deep knowledge of international best-practice standards [17, 18, 20].

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Table 1 PICO with inclusion and exclusion criteria for the mapping review component

PICO	Inclusion	Exclusion
Population	People from all countries, ages, and genders	N/A
Intervention/Exposure	Studies on OFD platforms that relate to one or more areas of Food-EPI including food composition, food labelling, food marketing, food retail, and food prices	Studies that observed food safety/hygiene, consumer behaviours or intention, health or conditions of delivery workers, environmental impacts of OFD, non-commercial food delivery platforms (e.g. for school canteens). Food provision and food trade and investment were considered the least relevant Food-EPI areas that would be applicable to OFD platforms and were excluded
Context	Studies focusing on OFD platforms only. No restrictions on the country of where research was conducted	Clinical settings, online groceries, or supermarkets
Outcomes	Primary outcomes related to each policy area of the Food-EPI and relevant to diet, nutrition, and public health including: • Outcomes on diet, dietary intake, and nutritional status • Food retail: availability and/or accessibility of food outlets • Food composition: nutritional composition or portion sizes or choices of menu/food/beverage items • Food promotion: prevalence and/or analysis of marketing techniques • Food labelling: prevalence of nutrition information including energy/calorie labelling of menu/food/beverage items • Food prices: any outcomes related to pricing, affordability, food purchases, expenditure, spending, and associated behaviours	N/A
Study design	Peer-reviewed journal articles were included such as: cross-sectional studies, cohort studies, qualitative studies, quasi-experimental studies, randomised controlled trials, narrative reviews, and systematic reviews	Study protocols, conference abstracts, theses or dissertations, news articles, market reports, commentaries/editorials/opinions
Other features	Publications from any country; however, in English language only. Studies from 2010 to present were included, as OFD platforms only began to grow in popularity around this time [29]	

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Additional searches for international policies were manually conducted in the following databases: NOURISHING framework [30], GINA database (WHO) [31], and Google Scholar. In the NOURISHING and GINA databases, all the listed policies were checked for its relevance to OFD platforms. Key search terms relating to (i) 'policy' or 'guideline' and (ii) 'online food delivery' were used in Google Scholar. All results in Google Scholar were checked. Policies were included if they (i) related to one or more Food-EPI policy area, (ii) had potential to cover OFD settings, and (iii) were relevant to diet and diet-related health outcomes.

Study selection
Records identified from the database searches were collated and uploaded to Covidence—a web-based collaboration software platform that streamlines the production of systematic and other literature reviews [32]. After removing any duplicates, four reviewers (SJ, ART, AAG, SRP) screened titles and abstracts. Each record was reviewed by two independent reviewers. Any discrepancies were resolved with a third reviewer. Following this, two independent reviewers, SJ and ART, screened full texts and checked against inclusion criteria. The remaining discrepancies were discussed and resolved through consensus.

Data extraction
The following relevant information were extracted from the full texts of included studies into a standardised form developed by investigator SJ: study information (author, year, country of origin, study design), participant information (number of participants, baseline characteristics, retention rate), primary outcomes, and relevant results.

Data synthesis
Findings were synthesised narratively and informed by the data extraction table. Relevant study outcomes for each of the five FOOD-EPI areas were extracted from studies. This may have resulted in the number of outcomes being greater than the number of included studies. Descriptions of study outcomes used the original wording and classification systems in each original article for precision.

Results
Study selection
After screening 2012 records, a total of 43 studies were included. Please see Fig. 1 for the PRISMA flow diagram.

Study characteristics
Most studies were cross-sectional in study design. All included studies were published between 2020 to 2023.

Thirteen study outcomes were from Europe or United Kingdom (UK) region (28%) with the majority conducted in England. This was closely followed by 11 study outcomes from Asia (23%)—mainly in China. Eight outcomes were from studies conducted in Oceania (17%). UberEats™ was the leading OFD platform investigated amongst the included studies ($n = 13$), Menulog™ or JustEat™ was investigated eight times, and Meituan™ was studied four times. See Table 2 for further details on study characteristics.

Study outcomes
Overall, there were 70 relevant outcomes mapped to Food-EPI areas across the 43 included studies (Table 3). Studies may have reported more than one relevant outcome. Most outcomes were relevant policies mapped under 'Food Promotion' (20/70, 29%), followed closely followed by 'Food Retail' (18/70, 26%), and 'Food Composition' (15/70, 21%). Fewer studies reported outcomes relevant to 'Food Prices' (11/70, 16%) and 'Food Labelling' (6/70, 9%).

### Food composition
Methodological approaches
Ten studies that examined the food composition or nutritional quality of food outlets and menu items on OFD applications used classification systems. Three studies based their evaluation on national dietary guidelines [33–35], dietary indices [36, 37] or health rating scores [38–40], nutrition calculators [41], or chemical analyses [72]. Two studies used more descriptive methods such as identifying cuisine or food type [42] and subjective measures from participants' perceptions [43].

Ratio of unhealthy to healthy options available on OFD
Across all 15 relevant study outcomes to 'Food Composition', it was evident that unhealthy options outnumber healthy options on OFD platforms. At the outlet level, in Australia and New Zealand, nearly three-quarters of food outlets available were classified as 'unhealthy' [33]. At the menu item level, over 70–80% of total menu items across OFD platforms in various studies were objectively classified as unhealthy [33–35, 40, 44]. In Brazil, beverages offered on the leading OFD platform were mostly ultra-processed (78%), followed by water (49%) and natural juices or smoothies (27%) [44]. A study conducted in Malaysia also observed participants subjectively perceived more than 78% of menu items as unhealthy [43].

Identifying unhealthy vs healthy options
Menu items available on OFD that were analysed or scored to be the least healthy, tended to be set meals [36, 45], 'combos' (a type of meal that typically includes

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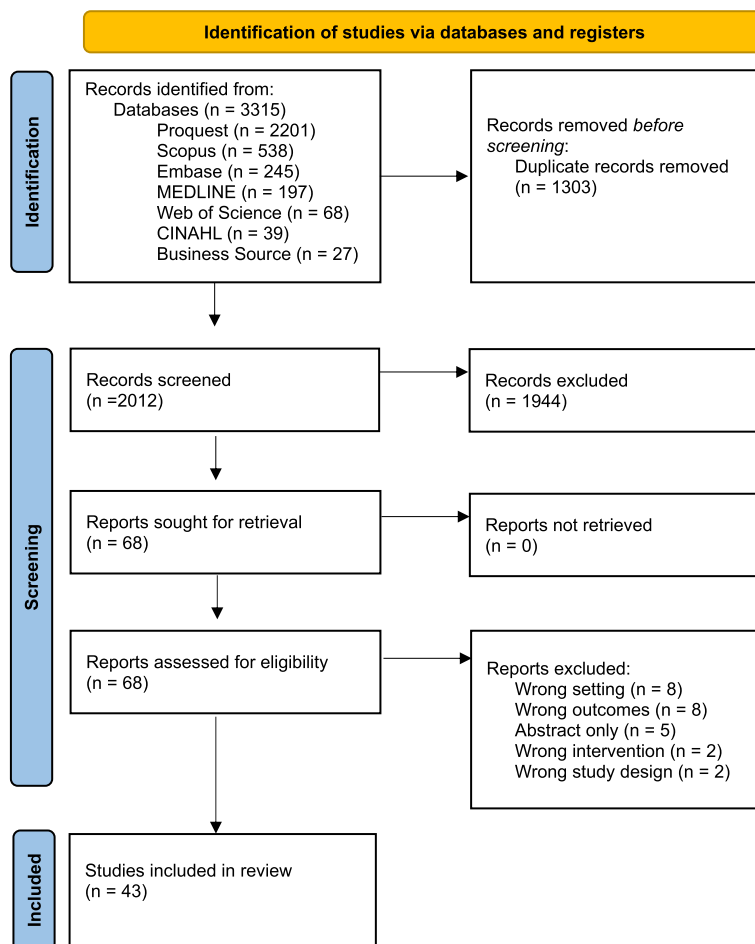
Fig. 1 PRISMA flow diagram using the PRISMA 2020 statement

food items and a beverage) [41], or cakes or desserts [41, 45]. A study from China analysed the healthiness of various food types including noodles and dumplings, set meals, seafood, pot meals, fried and BBQ foods, and healthy and light recipes. Amongst these food types, staple foods and Western fast food comprised the highest proportion of unhealthy meals included [38]. A study from the UK found that the following cuisine tags: pizza, halal, kebab, Italian, American food, Chinese food, desserts, cakes, fish, and chips frequently scored a low health rating of 0 or 1 out of 5 (with 5 being the healthiest) [39]. Indian food, curry, and Bangladeshi food scored slightly higher with a rating of 2 [39].

In contrast, OFD menu options that scored higher for healthiness included: beef and chicken breast salad set meals [36]. The study from the UK observed that Lebanese food scored more positively with a rating of 3 [39].

Nutrients of concern
High saturated fat [41, 42, 72], high sodium [45, 72], and low dietary fibre [72] were flagged as nutrients of concern and were typical of most fast-foods offered on OFD platforms.

Food labelling
Methods
Two studies assessed the prevalence of energy labelling or calorie disclosures on the online menus of third-party OFD platforms [46, 47]. One cross-sectional study observed the impact of energy labelling in a real-world OFD setting [48]. The other three remaining studies were experimental designs on simulated food delivery applications or interfaces, which examined the impact of labelling on food choices in a virtual setting [65–67].

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Table 2 Study characteristics (*n* = 43)

Study characteristics	Count (%)	References
Study design		
Cross-sectional	26/43 (60.5%)	[33–58]
Longitudinal	4/43 (9.3%)	[59–62]
Content analysis	3/43 (7.0%)	[44, 63, 64]
Experimental	4/43 (9.3%)	[65–68]
Spatial analysis	2/43 (4.7%)	[69, 70]
Randomised controlled trial	1/43 (2.3%)	[71]
Chemical analysis	1/43 (2.3%)	[72]
Desktop review	1/43 (2.3%)	[73]
Qualitative study	1/43 (2.3%)	[74]
Geographical region[a]		
Europe/UK	13/47 (28%)	[39, 42, 53, 54, 60–62, 65, 68, 71, 74]
Asia	11/47 (23%)	[36, 38, 41, 43, 45, 52, 55, 57, 58, 70, 72]
Oceania	8/47 (17%)	[33–35, 40, 50, 56, 64, 73]
North America	7/47 (15%)	[37, 46, 47, 50, 51, 67]
Latin America	6/47 (13%)	[44, 49, 59, 63, 66, 75]
Middle East and North Africa	2/47 (4%)	[48, 69]
Online food delivery platform investigated[b]		
Uber Eats™	13/67 (19.4%)	[33–35, 37, 40, 42, 46, 47, 51, 60, 63, 64, 73]
Menulog™ or Just Eat™	8/67 (11.9%)	[39, 40, 53, 54, 60, 61, 64, 73]
Meituan™	4/67 (6.0%)	[36, 38, 57, 70]
DoorDash™	4/67 (6.0%)	[37, 46, 47, 51]
Deliveroo™	3/67 (4.5%)	[42, 60, 64]
GrubHub™	3/67 (4.5%)	[46, 51, 64]
Virtual/mock delivery app	5/67 (7.5%)	[65–68, 71]
Other (fewer than 3 counts each)	16/67 (23.9%)	[37, 40, 41, 45, 47, 49, 58, 59, 63, 73, 75]
Not specified	11/67 (16.4%)	[43, 44, 48, 50, 52, 55, 56, 62, 69, 72, 74]

[a] Total count is greater than the number of included studies as two studies reported outcomes from more than one geographical region

[b] Total count is greater than the number of included studies as a few studies reported outcomes for more than one OFD platform

Warning labels

In a virtual experiment conducted by Gugliucci and colleagues, participants who were provided with nutritional warnings on OFD websites were less likely to have selected a dish or beverage with excessive content of at least one deleterious nutrient such as saturated fat, sugar, or sodium [66].

Compliance with menu labelling laws

Despite mandatory requirements for menu labelling laws, calorie disclosures were not properly implemented on online menus in Canada [47] and the USA [46]. Moreover, it was identified that there were variations in prevalence of menu labelling across different third-party platforms in both studies.

Impacts on food choices

In a real-world setting in Saudi Arabia, 42% of participants who noticed calorie labelling on menu items

indicated that they would change their order by ordering less food, eating less food, or choosing another restaurant [48]. In virtual settings, these impacts on food choices were more mixed. Whilst two experimental studies showed labelling was effective in dissuading consumers from unhealthier choices through nutritional warning labels [66] and calorie labelling [65], one experimental study showed there was no significant impact on consumers' intention to purchase through OFD [67].

Food promotion
Methods

Ten outcomes were obtained from cross-sectional studies that have analysed the content on OFD platforms during a specified time—for example from 6 pm on a Friday [33–35, 42, 45, 49, 50, 59, 73, 75]. Two studies that have examined how foods and beverages are promoted on OFD platforms have used frameworks to code marketing strategies [63, 64]. Nudging trials [71] and experimental

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Table 3 Map of study outcomes to food environment domain (*n* = 70)

Study author, year	Food composition	Food labelling	Food promotion	Food prices	Food retail
Abdulkader R, 2022 [41]	X			X	
Alkhaldy A, 2023 [48]		X			
Bianchi F, 2023 [71]		X	X	X	
Botelho L, 2023 [63]			X		
Brar K, 2021 [37]	X				X
Cong N, 2022 [38]	X				X
Dai X, 2022 [36]	X				
De Paula Matos J, 2023 [49]	X		X		
Eu E, 2021 [43]	X			X	
Feizizadeh B, 2023 [69]					X
Finlay A, 2023 [65]		X	X	X	
Goffe L, 2020 [39]	X				
Greenthal E, 2023 [46]			X		
Gugliucci V, 2021 [66]		X			
Gunden N, 2020 [67]		X	X		
Horta P, 2021 [75]	X		X	X	
Horta P, 2021 [44]			X		
Horta P, 2022 [59]			X		
Jia S, 2021 [64]			X		
Jitsoonthornchaikul M, 2022 [45]	X		X		
Kalbus A, 2023 [60]					X
Keeble M, 2021 [53]					X
Keeble M, 2021 [54]					X
Keeble M, 2022 [74]			X	X	
Keeble M, 2023 [61]					X
Li L, 2023 [58]					X
Mahawar N, 2022 [35]	X		X	X	
Maimaiti M, 2020 [55]					X
Miles H, 2022 [73]			X		X
Norriss D, 2022 [40]	X				X
Oostenbach L, 2022 [56]					X
Partridge S, 2020 [33]	X		X	X	X
Pinho M, 2020 [62]					X
Poelman M, 2020 [50]			X		X
Ratilla M, 2022 [68]			X		
Ren J, 2020 [72]	X				
Rinaldi C, 2022 [42]	X		X		X
Shi Y, 2021 [57]					X
Talamini G, 2022 [70]					X
Thompson H, 2022 [51]			X	X	
Vanderlee L, 2023 [47]		X			
Wang C, 2021 [34]	X		X	X	
Wu Y, 2022 [52]				X	
Total per food-EPI area	15	6	20	11	18
Total outcomes	70				

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studies [66–68] have assessed the impact of different promotion or marketing strategies in a virtual setting.

Marketing strategies

Images   Use of images was found to be a common marketing strategy in six studies [34, 35, 44, 49, 59, 75]. In three of these studies, images were found to be more frequently used on unhealthful menu items such as ultra-processed beverages, ice cream, candies, and salty-packaged snacks [44] or discretionary meals that are high in energy, sugars, salts, and saturated fats [34, 35]. In one experimental study using a virtual OFD platform, researchers found a positive effect of image type on consumers' intentions to purchase [67]. The display of consumers eating food items, compared to food item only, was associated with purchasing through the virtual OFD platform [67].

Price promotion   Price promotions were another common marketing strategy used by OFD platforms [34, 35, 42, 49, 73, 74]. These included the offer of free delivery [49, 73], price discounts [42, 49, 73], value bundles [34, 35] and loyalty points [73]. Price promotions were also more generally used on menu items that were high in sugars, fats, or salt [42, 44, 59, 75].

Digital salience nudges

Nudging interventions refer to deliberate changes to and designs of people's choice environments—the ways in which options are presented or framed—which can influence behaviours [76]. Digital nudging refers to nudges implemented in digital environments and present multiple advantages for influencing user behaviour compared to analogue settings [77]. In digital settings, user interfaces can be highly adaptable to increase the salience of items and may be more likely to be purchased [77]. For example, studies showed that menu items labelled as 'most popular' were commonly presented at a prominent position on OFD platforms. Three studies which investigated the most popular menu items found that these foods and beverages did not meet dietary guidelines in their respective countries [33–35, 45].

A five-armed randomised controlled trial from the UK established that repositioning of both foods and food outlets in order of lowest energy content to highest energy content on a virtual mock food delivery app had the greatest effect in lowering the energy content of baskets at checkouts [71]. Similarly, another virtual experimental study from the Czech Republic showed that when healthier restaurants were displayed on the ordering page, the

odds of a healthier choice were nearly four times higher than in the low availability condition [68].

Content—what is being promoted?
One study conducted on restaurants in Amsterdam, Melbourne and Chicago, highlighted the use of keywords or category tags associated with a food outlet, as a way to advertise meal options on OFD platforms [50]. In all three cities, burgers, pizza, and Italian were in the top 10 most advertised meals. Keywords such as 'healthy' were advertised less often.

Food prices
Methods
Relevant study outcomes for food prices on OFD platforms were extracted from eight cross-sectional studies [33–35, 41, 43, 51, 52, 59], two 'nudging' experimental studies [65, 71], and one qualitative study [74].

Food prices in relation to healthiness
Two studies found that menu items on OFD platforms that were the least expensive were often poor in nutritional quality [35, 41]. In India, items from fast-food restaurants that were available on the OFD platform had the highest median calorie content (194 kcal), but were priced the lowest with a median price of 100 INR or $1.20 USD [41]. A study from Auckland, New Zealand, found that discretionary mixed meals—dishes that are meat-based or vegetable-based that are energy-dense and nutrient-poor—were significantly less expensive compared to mixed meals that predominantly comprised of the five food groups which align with dietary guidelines [35]. Contrarily, in Sydney, Australia, menu items that were assigned a 'discretionary' food category were found to be slightly more expensive than items of the 'five food groups' [34]. Despite this, discretionary foods were more likely to have a 'value bundle' as a price promotion strategy which would reduce the costs of these foods [34].

A study in Brazil showed that price discounts were mostly offered on unhealthier items such as beverages that were ultra-processed according to the NOVA classification system [59]. At the same time, healthier menu items such as water, vegetables, natural juice, and smoothies only comprised less than 5% of all price discounts offered [59]. One study also observed that compared to sugar-sweetened beverages, water was most likely to have an additional fee on OFD platforms in California, USA [51].

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Differences in pricing of OFD across countries

Main meals In China, most participants reported spending less than 20 Chinese Yuan ($2.77 USD) per order [52]. In Malaysia, most participants reported spending between RM15 to RM19 on orders ($3–$4 USD) [43]. Similarly in India, the median average cost for an OFD order for two people was reported to be 300 INR ($3.60 USD) [41]. In contrast however, the median price for discretionary cereal-based mixed meals such as pizza in New Zealand was $12.60 NZD ($7.56 USD) and for a discretionary meat-based mixed meal such as fried chicken was $16.00 NZD ($9.60 USD) [35].

Delivery Delivery costs were reported in three studies. In Sydney, the median delivery cost was observed to be $5.99 AUD ($3.92 USD) [33], and in Auckland, New Zealand, the median delivery cost was $7.99 NZD ($4.79 USD) [33]. These prices differ greatly to the delivery costs reported from a study in China, which were between 2 and 3 Chinese Yuan ($0.30–$0.64 USD) [52].

Impact of price on consumer choices

A qualitative study revealed that price promotions on food items were found to be highly appealing to users of OFD [74]. Likewise, price and convenience were cited as the predominant factors impacting food choice on OFD apps by users in Malaysia [43]. In a study conducted in China, delivery charge was observed to have had the greatest impact on the likelihood of consumers using OFD [52]. The greatest probability of consumers 'certainly' using OFD is when the delivery charge is within the range of 0 ~ 1.4 Chinese Yuan ($0.19 USD). When delivery charge exceeded 3 Chinese Yuan ($0.64 USD), the probability of consumers choosing 'totally impossible' was the greatest [52].

One 'nudging' study examined the impact of proportional pricing on meal, sandwich, and drink size selection and subsequent money spent on a mock delivery app [65]. It was found that proportional pricing may prompt consumers to select smaller portion sizes—participants who were in the proportional pricing condition had a decreased likelihood of choosing a larger sized beverage from the virtual coffee shop (OR: 0.58) [65].

In another nudging study using a mock delivery app, an intervention where food options were repositioned to give more prominence in a higher screen position to lower-energy but higher-priced foods and restaurants, resulted in reduced energy content and increased basket price [71]. Authors from this study highlighted the

potential of such an intervention widening inequalities as individuals of higher socioeconomic position may have more benefits from reducing the energy content of their baskets [71].

Food retail

Methods

There were 11 cross-sectional studies which have examined aspects of food retail [33, 37, 38, 40, 42, 50, 53–57], 3 longitudinal studies observed changes over time [60–62], 3 studies used spatial analyses and advanced geographical methods [58, 69, 70], and 1 study was a desktop review [73].

Most studies analysed the geographic location of retailers offering OFD, including elements of accessibility, in association with urbanisation, population density, and deprivation level.

Urbanisation, population density, and OFD accessibility

All the studies that examined urbanisation and population density, which included evidence from Iran [69], Netherlands [62], China (Shanghai [57] and Nanjing [58]), Canada [37], and New Zealand [73], showed that accessibility to food options available via OFDs was greatest in central, urban areas with high population density.

In two studies, restaurants offering home delivery were developed in wealthier sub-towns in Iran [69] or areas that were more economically developed in China [58].

Socioeconomic deprivation and OFD accessibility

Region-specific associations between area deprivation and OFD accessibility were observed in a study conducted in England [60]. In the North of England, areas of greatest deprivation had an increased number of delivering outlets compared to the least deprived quintile [60]. In London, higher postcode district deprivation was associated with lower numbers of delivering outlets [60]. This finding for London however contradicted results from another longitudinal study conducted in England which was conducted prior to COVID-19. Researchers found evidence of a positive dose–response relationship between deprivation and number of OFD outlets across *all* postcode districts in England [61].

A study which examined three international cities also showed differing results in access to OFD options and socioeconomic deprivation [50]. Whilst Amsterdam, Netherlands, and Melbourne, Australia, showed some indication of a relationship between increasing deprivation with OFD accessibility, Chicago, USA, showed no difference in delivery options between the most and least disadvantaged neighbourhoods [50].

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Another longitudinal study which investigated changes in the food environment across the whole of the Netherlands found that there was an increase in outlets offering OFD in neighbourhoods of both lowest (IRR = 2.15, 95%CI = 1.90–2.44) and highest (IRR = 3.00, 95%CI = 2.32–3.97) socioeconomic status. This increase was more pronounced or greater, in areas of higher socioeconomic status [62].

A cross-sectional study conducted in Sydney, Australia, and Auckland, New Zealand, also showed some differences between cities. In Sydney, whilst 60% of food outlets were located in the most advantaged suburbs, food outlets were found to be more evenly distributed across deprivation quintiles in Auckland [33].

OFD accessibility and associations with use
One study from England used linked data to analyse associations between OFD accessibility and the use of OFD platforms. It was established that compared to those with the lowest number of accessible food outlets on an OFDS, those with a greater number of accessible outlets had 71% greater odds of OFDS use (OR: 1.71, 95%CI: 1.09, 2.68) [54].

A study in Melbourne, Australia, investigated associations between the use of OFD platforms with whether an individual had access to a '20-min neighbourhood' (20-MN), which is a part of a state-level strategy to accommodate urban growth and ensure liveable neighbourhoods [56]. It was hypothesised that those that do not live in a 20-min neighbourhood would order home delivery for takeaway foods more frequently. Despite this, the authors of this study did not find a significant difference in use of OFD platforms between those living in 20MN vs Non-20MN neighbourhoods [56].

Delivery distances
A few studies reported on the mean or median delivery distances between food retailers and delivery locations which was defined by postcode. Median delivery distance in Sydney was 3 km and 3.2 km in Auckland [33]. In Ontario, Canada, the mean delivery distance was 3.7 km and ranged between 0.3 and 9.4 k m [37]. A study conducted in Iran found restaurants developed widespread business by extending their service area by up to 15 km from their physical location [69].

Dark or 'ghost' kitchens
Two studies identified dark kitchens as a unique aspect of OFD platforms as these outlets only sell meals through delivery and do not offer any dine-in services [42, 70]. One of these studies which was conducted in England found 3 dark kitchens which rented its space to 116 food businesses [78]. Another study found that most of the businesses which used the dark kitchen space were virtual restaurants (21%), selling fast-food (47%), or dessert (21%) through online delivery platforms [42]. In China, it was found that dark kitchens may potentially reduce a restaurant's dependence on location and use more vertical space in high-rise office spaces [70].

Potential nutrition-related policy options
Only three nutrition-related policies that have specifically mentioned or designated responsibility to OFD platforms

Table 4 Existing policies or regulations in international jurisdictions that either apply specifically to OFD platforms or contain specific provisions related to OFD platforms

Food-EPI policy domain	Existing international policies or guidelines	Existing policy objective or scope with relevance to online food delivery
Food labelling	England: The Calorie Labelling (Out of Home Sector) Regulations 2021 [79]	Mandatory Effective date: 6 April 2022 Summary: Large businesses that have more than 250 employees must provide calorie information including businesses responsible for the website or mobile application ('remote' provider)
Food composition	Singapore: Healthier Dining Programme [81]	Voluntary Effective date: 2015 Summary: Food and beverage businesses including dark kitchens or businesses that only operate on OFD applications, are encouraged to provide healthier meals for customers—reducing calories, using wholegrains and healthier cooking oils
Food promotion	EU: The Digital Services Act (DSA) [80]	Mandatory Effective date: 17 February 2024 Summary: Digital services including online marketplaces and very large online platforms are prohibited from using dark patterns online to ensure more transparency around advertising. Services are not allowed to design, organise, or operate their online interfaces in a way that deceives, manipulates or impair the ability of users to make free and informed decisions

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were identified from the policy scan (Table 4A). The Calorie Labelling (Out of Home Sector) Regulations 2021 introduced in England affects businesses responsible for the website or mobile application ('remote' providers) to ensure that calorie information is displayed [79]. In terms of food promotion, the European Union (EU) has initiated the 'Digital Services Act' to encourage more transparency around advertising through platforms and bans certain types of targeted advertising [80]. In Singapore, the voluntary 'Healthier Dining Programme' [81] allows food and beverage companies that operate solely on digital platforms to apply to get menu items endorsed by the Health Promotion Board in Singapore by offering three or more healthier food or beverage options which adhere to the guidelines.

We also identified several nutrition-related policies which target traditional local food environment settings and have the potential to adapt these to include or address the health impacts of OFD platforms (Table 5). Most of these policies have targeted food labelling, food promotion, and food composition. There was a lack of both existing and potential policies for food prices or food retail.

Discussion

Key findings

OFD platforms have been identified as a potential concern for population health and well-being that may require the creation and implementation of protective measures through policy and regulation. This systematic mapping review synthesised the current evidence to inform potential food environment policies for OFD platforms, under five main policy domains. Of the 70 relevant outcomes from the 43 included studies, 29% can largely inform nutrition-related policies for food promotion, 26% for food composition, and 21% for food retail aspects of OFD platforms. Globally, existing regulation of OFD platforms remains scarce, highlighting an important regulatory gap. Effective policy options may promote increased access to healthy and affordable meals on OFD platforms. This may be a promising opportunity to bridge inequities in food accessibility, particularly for vulnerable groups such as those with a physical disability or low income.

Do OFD platforms need specific nutrition policies?

OFD platforms have emerged as a disruptor to food environments and have yet to be widely included in existing nutrition-related policies. Results from the policy scan revealed only three existing nutrition-related policies that currently regulate or specifically apply to OFD platforms [79–81], with one of these only a voluntary guideline. We found several other international

examples of existing policies that apply more broadly to takeaway foods and food outlets and have the potential to be amended to include OFD platforms. These were largely food labelling policies such as mandatory kilojoule labelling on menus from fast-food franchises that had yet to include OFD platforms as a type of food retailer subject to regulation. Studies included in the review showed that OFD platforms adhered poorly to existing menu labelling laws in Canada [47], USA [46], and recent research from Australia [99]. In addition, the policy scan indicated that current food promotion policies may need more refinement to specifically define OFD platforms as a 'digital platform' that advertise unhealthy foods and beverages to children. Policies which currently target food composition may improve the nutritional quality of foods offered on OFD platforms; however, most of the existing policies are voluntary initiatives.

In other Food-EPI policy areas, such as food retail, the applicability of existing policies to OFD platforms is complex and new types of policies may be required. For example, any existing zoning regulation would need to consider the impact of food delivery services and its link to dark kitchens, as these could deliver unhealthy foods within 400-m or 800-m restriction zone as defined in current policies [100]. Semi-structured interviews with policy experts in New Zealand suggested that density regulation would be impractical or less relevant, considering the wide coverage of on-demand delivery services [101]. Development plans may also need to consider how the existence of dark kitchens affect use of land and provision of services and amenities in a given area. Planning guidelines and zoning regulations must also be 'future-proof' to account for further innovations in food delivery. For instance, drone delivery is increasingly being tested in Australia [102] and is becoming more established in countries such as China [103] and the USA [104]. These are important factors for policymakers to consider in urban planning or designing policies around urbanisation of cities as evidence gathered in this review suggest that urbanised cities have the highest food delivery serviceability.

Similarly, new policies targeting food prices may need to be created as no existing or potential policies were identified. As the evidence from the mapping review component showed, effective fiscal measures could target the delivery costs of using OFD platforms. Findings from this review also showed that aspects of food promotion and food prices could be considered together when designing feasible policy options. Limiting the number of price promotions offered on OFD platforms could subsequently increase costs and thereby discourage frequent use of these services. At the same time, higher costs of

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Table 5 Policies that apply to out-of-home foods and restaurants in traditional local food environments with no specific application to OFD platforms but have the potential for future amendments to consider the impact of OFD platforms

Food-EPI policy domain	Existing international policies or guidelines	Existing policy objective or scope with relevance to online food delivery
Food labelling	Saudi Arabia: Saudi Food Nutrition Labelling Policy [82]	Mandatory Effective date: 1 January 2019 Summary: All restaurants and coffee shops must disclose the calories of their selling items on menus, in all forms, whether physical or online
	Canada, Ontario: The Healthy Menu Choices Act [83]	Mandatory Effective date: 1 January 2017 Summary: Food service premises that are part of a chain of 20 or more in Ontario are required to display calories for standard food items on menus, labels and display tags. Menus include online menus or menu applications
	USA, New York: New York City Health Code Article 81.50 Posting of Calorie Information [84]	Mandatory Effective date: 1 December 2016 Summary: Establishments that are part of a chain with more than 15 locations in the US must display calorie labelling on menus and menu boards including electronic menus, menus on internet or electronic screens
	Australia (5 jurisdictions including New South Wales, Victoria, Queensland, Australian Capital Territory, South Australia): Menu labelling laws or '2011 Principles' [85]	Mandatory Effective date: Various dates between 2011 and 2018 Summary: Standard food outlets with more than 20 locations in a state or 7 locations in a territory, or > 50 nationally, must provide kilojoule labelling at point-of-sale
	United States, Philadelphia: Philadelphia Healthy Chinese Take-Out Initiative [86]	Voluntary Effective date: March 2010 Summary: Chefs from 206 Chinese take-out restaurants in Philadelphia were trained and taught strategies to reduce sodium in prepared dishes
	England: Local Authority Healthier Catering schemes or awards [87]	Voluntary Effective date: 2010 Summary: Food outlets in local councils are encouraged to switch to healthier ingredients, menus, and cooking practices. Examples include reduction in salt, fat, sugar, serving smaller portions, providing calorie information
	Portugal: Stamp of Excellence "Bread with less salt, same flavour" [88]	Voluntary Effective date: 2018 Summary: Portuguese bakeries encouraged to reach the 2021 target set for reformulation of salt content (1.1/100 g)
Food composition	Canada, British Columbia: The Public Health Impediments (BC Trans Fat) Regulation [89]	Mandatory Effective date: 2009 Summary: Food service outlets are not permitted to use margarines and oils with a trans-fat content > 2% and other food with a trans-fat content of > 5%
	Malta: Commission Regulation (EU) 2019/649 [90]	Mandatory Effective date: 24 April 2019 Summary: Foods intended for final consumer should not exceed 2 g/100 g of trans-fat

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Table 5 (continued)

Food-EPI policy domain	Existing international policies or guidelines	Existing policy objective or scope with relevance to online food delivery
Food retail	England: National Planning Policy Framework and Planning Practice Guidance for Healthy and Safe Communities [91–93]	Voluntary Effective date: 2023 Summary: Government planning guidance to encourage healthier 'out of home' food provision. For example, local planning authorities have used guidance and supplementary planning documents to restrict takeaways and other food retail outlets in specific areas (e.g. within walking distance of schools)
	Scotland: National Planning Framework 4 [94]	Voluntary Effective date: 2023 Summary: Sets out spatial principles, regional priorities and new rules for local development plans in relation to hot food providers and should identify where proposals for healthy food and drink outlets can be supported
	USA, Detroit: Zoning Ordinance [95]	Mandatory Effective date: 1998 Summary: Requires a distance of at least 500 feet between elementary, junior and senior high schools, and restaurants including take-out, fast-food and drive-through restaurants

Table 5 (continued)

Food-EPI policy domain	Existing international policies or guidelines	Existing policy objective or scope with relevance to online food delivery
Food promotion	EU: The Digital Services Act (DSA) [80]	Mandatory Effective date: 17 February 2024 Summary: Digital services including online marketplaces and very large online platforms are prohibited from using dark patterns online to ensure more transparency around advertising. Services are not allowed to design, organise, or operate their online interfaces in a way that deceives, manipulates or impair ability of users to make free and informed decisions
	Chile: The Law on Nutritional Composition of Food and its Advertising (Ley 20.606) [96]	Mandatory Effective date: 27 June 2016 Summary: TV programmes and websites directed to children under the age of 14 must restrict their advertising of foods that contain high energy, salt, sugar and fat content
	Portugal: Law 30/2019 amending the Portuguese Advertising Code [97]	Mandatory Effective date: 1 October 2019 Summary: Advertising ban of food and beverages that contain high energy, fat, sugar, salt content directed to children under 16 years. Applies to websites, webpages, apps and social media profiles with content intended for this age group
	Brazil: Resolution 163 of the National Council for the Rights of Children and Adolescents [98]	Mandatory Effective date: 13 March 2014 Summary: Prohibits any abusive publicity of food via any form of market communication (TV, radio, internet, apps) intended to persuade children (up to 11 years) and adolescents (12 to 18 years), to consume a product or service using strategies that appeal to children
	Peru: The Law Promoting Healthy Eating for Children and Adolescents (Ley No 30021) [96]	Mandatory Effective date: May 2013 Summary: Restrictions for advertising of foods and drinks high in sugar, salt and saturated fat, aimed at children and adolescents under the age of 16 years through any medium

OFD platforms may further disadvantage individuals and groups at lower income levels who may potentially use price promotions to purchase healthier foods online. Future pricing policies relating to OFD platforms will therefore need to carefully consider the impact on various socioeconomic groups.

Platform vs food outlet—where should responsibility be delegated?

The World Health Organization, in their 'Slide to Order' report, envisaged the inevitability of the development of new OFD companies and recommended companies to prioritise health as a focus from their inception [105]. As such, it is important to consider delegating the responsibility of OFD platforms in nutrition-related policies. Evidence from studies for food promotion policies suggests that platforms themselves have a potential role to play in promoting more healthful choices online [68, 71]. Although the evidence is limited, the positioning of menu items appeared to have a significant effect on consumers' choices in virtual experiments using a simulated delivery app [68, 71]. Thus, reordering menu items and food outlets from lowest to highest kilojoule or calorie count may prove to be an effective policy option. These 'digital nudging' techniques have been shown to be effective in a range of other settings as well—for example, in virtual supermarkets [106] and in school canteens [107]. Moreover, The World Health Organization Representative Office in China has tested the effectiveness of health messages and changes to the choice architecture on a popular OFD app. Findings showed that when consumers were presented with a sub-menu that had 'reduced salt' options, they were able to choose healthier options with less salt compared to the control group [108].

Food labelling policies may also need to delegate accountability to third-party delivery platforms as studies show that energy labelling is often missing or incomplete [46, 47, 99]. Systematic reviews and meta-analyses have found that nutrition labelling [109, 110] and menu labelling [111] are effective policies and can reduce the total energy of foods that are purchased and consumed. From the policy scan, only England appeared to have regulations that explicitly and specifically designated accountability to the OFD platform to ensure menu labelling was present for all standard food outlets [79]. Food labelling may be the easiest regulation to target for OFD platforms, considering the nutrition labelling information for large food outlets already exists. This would therefore be a matter of transferring the information accurately online with thorough monitoring and enforcement and would provide consumers with a more consistent nutrition information environment across settings.

Improving the physical food environment to improve online environments

Results from the mapping review and policy scan revealed that food composition policies focus mainly on improving physical food environments in-person, by setting standards for nutritional quality of out-of-home foods. Improvements to the physical, offline food environment will result in parallel improvements in online food environments, and vice versa, as these environments are often overlapping. Several existing policy guidelines showed collaboration between food outlets and local government authorities to improve or endorse healthier menu items. A study from China conducted in 2020 observed substantial consumer demand for salt-reduced meals from the 'Eleme' food delivery app—with 40.6% of all order requests asking for reduced salt [112]. It was shown that over 90% of restaurants were willing to respond to these consumer requests and laboratory analyses revealed that these dishes were indeed lower in salt than regular meals [112]. This study shows a potential role for the delivery platform itself in enabling an option for requests to be made and for food retailers to observe and complete these requests. Thus, this highlights important potential for collaborative efforts between food retailers, the food delivery platform, and policymakers to improve the nutritional content of menu items. Clear definitions of what constitutes 'healthier' options in the restaurant sector with associated nutrient profiling methods would also support reformulation efforts.

Leveraging existing and impending regulation in other sectors

Leveraging existing or impending regulation in other sectors may also be a consideration for policymakers. In Australia, the 'Closing Loopholes' bill was introduced in early 2024 to protect and uphold the rights of gig economy workers. Despite this bill being primarily a workplace law, there may be subsequent effects on consumers of food delivery apps and their food choices. It is speculated that this bill will likely increase delivery costs and could deter use of a meal delivery app [113]. There is also potential however for some costs to be absorbed by large food retailers with small independent food businesses the most vulnerable to such changes [113]. It is therefore unknown whether long-term, these smaller retailers continue to partner with third-party delivery services and if they leave, whether that results in a further saturation of large franchise restaurants on OFD platforms mostly offering unhealthy fast-food options. Reduced accessibility to smaller independent food businesses may also increase the power that large franchises and multinational companies already hold in the current food system [12, 114].

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Furthermore, in early 2024, the federal government in Australia called for a public consultation to design a feasibility study on options to limit unhealthy food marketing to children [115]. Impending regulation around unhealthy food marketing to children therefore may be applicable to OFD platforms and is an opportunity for policy change to be made. As shown in the policy scan component of this study, many countries especially in the Latin American region have existing policies in place to restrict junk food marketing to children on websites, apps, and platforms [96–98]. Further action could be initiated by redefining and updating 'unhealthy brands' or 'digital platforms' in current definitions to include OFD platforms as the evidence accrued in this review demonstrates the excessive promotion and abundance of unhealthy foods on these platforms.

Food safety, including the disclosure of allergen information through OFD platforms, is also a potential consideration for improved regulation. Deaths resulting from undisclosed information of menu items containing allergens that were ordered via a third-party delivery service [116] has prompted further scrutiny of food safety and allergen management. These cases highlight a great responsibility in which OFD platforms must ensure all relevant information is provided and procedures for rigorous assessment of partnered restaurants and their adherence to food safety standards are arranged and implemented.

Strengths and limitations

In terms of strengths, this study presents a comprehensive overview of the existing evidence from seven databases, covering key relevant policy areas. This review also identified gaps in the evidence base and synthesised relevant international policy examples that can be used as starting points for further policy action. Given the growing body of the literature on OFD platforms, this is a timely review that aims to provide direction for future research that is policy relevant. For example, complex issues such as the effect of OFD platforms on different socioeconomic groups must be explored further and need further policy attention.

There are limitations in this study that should be noted. Firstly, the search of relevant international policy examples may be incomplete due to the manual process and predominant use of one database (NOURSHING [30]). Nevertheless, the purpose of this component of the mapping review was to provide a preliminary overview of the policy environment for policymakers or academics to consider in pursuit of feasible policy options.

In addition, due to the broad nature of a mapping review, a critical appraisal of studies was not performed. As such, caution is warranted in the interpretation of the study results due to potential risk of bias present in the included studies. Despite this limitation, this mapping review has captured the emerging nutrition-related policy implications of OFD platforms in a timely manner.

Conclusions

OFD platforms are set to reach over 2.8 billion users globally by the next decade. Several policy avenues could be considered which may mitigate overexposure and increased accessibility to unhealthful foods offered on these platforms and could provide opportunities to increase access to healthy and healthier food options. Moreover, through their relationships with a large number of restaurants and food providers, there may be an opportunity for OFD platforms to positively influence the broader food environment. Creating a suite of suitable and effective policy options with monitoring and review mechanisms is needed to adapt to this rapidly changing food environment. This review demonstrated that whilst most of the current evidence can support new policies for food promotion, food retail, and food composition, the most feasible short-term strategy for regulation may be food labelling which has existing policies that can be adapted to include OFD platforms. Responsibility of OFD platforms to implement must be clearly outlined and designated in all relevant policies, and it is important to consider digital environments in regulation from other sectors that can be leveraged for population health benefits.

Abbreviations

INFORMAS	International Network for Food and Obesity and Non-communicable Disease Research, Monitoring and Action Support
Food-EPI	Healthy Food Environment Policy Index
NCD	Non-communicable disease
OFD	Online food delivery

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12916-024-03747-8.

Additional file 1: Tables S1 – S2. Table S1: Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist. Table S2: Full Medline Search Strategy.

Authors' contributions

S.J. – Conceptualization, Literature search, Title, abstract and full-text screening, Data extraction, Writing – Original Draft, Writing – Review & Editing. A.R.T – Title, abstract and full-text screening, Writing – Review & Editing. S.R.P and A.A.G – Supervision, Writing – Review & Editing. P.F., M.A-F., L.V. and G.S. – Writing – Review & Editing. All authors have read and approved the final manuscript.

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Declarations

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Not applicable.

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Competing interests
The authors declare no competing interests.

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