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SLIDE TO ORDER: A FOOD SYSTEMS APPROACH TO MEAL DELIVERY APPs

WHO EUROPEAN OFFICE FOR THE PREVENTION AND
CONTROL OF NONCOMMUNICABLE DISEASES

Abstract

Meal delivery apps (MDAs) are a rapidly growing part of the digital food environment in the WHO European Region. The implications of this multibillion sector on health, nutrition, environment and society at large are not yet well understood. Past research has shown that meals purchased outside of the home can be less healthy than foods prepared at home and may lead to unhealthy dietary patterns, a risk factor for noncommunicable diseases. Emerging evidence also highlights the role of MDAs in extending the physical food environment and providing convenient access to unhealthy food and beverage options with the swipe of a finger. However, MDAs are a part of a wider food system and play a role in mediating between physical and digital food environments. Many existing government policies promoting healthy diets such as nutrition labelling and reformulation; however marketing restrictions may not yet apply to this novel sector. With this in mind, a food systems framework is used to assess the potential relationship between MDAs and health and nutrition outcomes. Recommendations are also made for methods to incentivize healthy and sustainable meals on MDAs.

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Abbreviations

AI	artificial intelligence
API	application programming interface
MDA	meal delivery app
NCD	noncommunicable disease
OOH	out-of-home (foods)

Glossary

Aggregator app. Third-party apps that offer a choice of multiple restaurants.

App. A computer programme or software application designed to run on a mobile device such as a phone or tablet.

Application programming interface. A connection between computers or between computer programs.

Cloud. Servers that are accessed over the Internet, and the software and databases that run on those servers.

Digital food environments. The online settings where flows of services and information influence food and nutrition choices and behaviour.

Digital food swamp. A high concentration of unhealthy food options on an online platform, for example on an MDA.

Food swamp. A physical food environment where there are more fast food, junk food outlets and convenience stores than stores with healthy food options.

Meal delivery app. An app where food and beverages can be ordered and delivered to one's residence or office.

User experience. How a user interacts with and experiences a product, system or service.

Key messages

“Increasingly, our lives are affected by digitalization. This presents both opportunities and threats on health issues such as preventing obesity.”

Hans Kluge,
Regional Director, WHO
Regional Office for Europe
(during the Conference on
future steps to tackle obesity:
digital innovations into policy
and actions, June 2021).

- Use of meal delivery apps (MDAs) is growing in the WHO European Region.
- MDAs are understudied and, in almost all cases, current policy and legal frameworks do not apply to this component of digital food environments.
- MDAs mediate the linkages between physical and digital food environments by connecting meal providers with customers via online platforms.
- MDAs extend physical food environments in a variety of ways, such as providing delivery over longer distances, increasing the availability of foods and beverages and offering convenient meals for consumers.
- Current regulations for physical restaurants, for example regarding the display of nutritional information, do not necessarily apply to MDAs.
- MDAs are mainly used in major urban environments but are spreading to smaller cities and towns.
- A systems approach to MDAs is required to assess the impacts of MDAs on public health.
- Concerted action by food systems stakeholders is needed to ensure that adequate policies and regulations are adapted to the specific features of MDAs, for example regarding providing nutrition information to consumers and making healthier choices the most convenient and affordable options.

Background

Visit nearly any city in the WHO European Region today and you will witness riders on bicycles, motorbikes and cars bustling through the city, ferrying meals to private residences and offices. The brightly coloured insulated bags carrying boxed meals have now become an increasingly common part of urban foods environments. This phenomenon is made possible by delivery platforms supported by an app. These platforms, also known as MDAs, serve as intermediaries between meal providers and customers.

Across the 53 Member States of the WHO European Region, digital technologies are changing business models and providing new revenue and value-producing opportunities (1,2). While still a relatively young sector, MDAs are a part of this trend. Some of the first online meal delivery companies in continental Europe were founded in 2000 (www.takeaway.com) and 2001 (Just Eat) (3). The sector has seen incredible levels of venture capital investment in the last 10 years followed by a period of industry consolidation. There are now seven major platforms worth over €1 billion operating in the Region: Just-Eat/Takeaway, Delivery Hero, Deliveroo, Uber Eats, Glovo, Bolt and Wolt (4). The COVID-19 pandemic has accelerated the online meal delivery market into places where MDAs are relatively new (5). In April 2020 in the Russian Federation, for example, MDAs were downloaded an estimated 2.9 million times, almost twice as often as seen in February 2020 (6). Similarly, MDA downloads surged during lockdowns in France during 2020. Of the MDAs, aggregator apps are the most common; these are third-party apps that offer a choice of multiple restaurants (7).

Since the late 2000s, MDAs that initially entered the market as technology start-ups targeting a single city have grown many times larger and expanded into different countries. In 2020 the European online food delivery market was valued at US\$ 13.80 billion. By 2026 the market in the WHO European Region is anticipated to grow to US\$ 20.27 billion (8). Recent market trends of acquisition and mergers, alongside pressure from investors with money invested in multiple MDAs, have forced MDA platform companies to merge to become multinational public businesses. For example, in early 2021 JustEat, the largest United Kingdom delivery platform, merged with Takeaway.com, the most prominent European operator, to form a single business and technology platform. Deliveroo, another MDA platform company, became publicly listed on the London Stock Exchange in March 2021. According to Deliveroo's Chief of Operations, "COVID-19 has accelerated consumer adoption of these delivery services by about two to three years" (8).

MDAs are an increasingly significant component of digital food environments, which are the online settings where flows of services and information influence food and nutrition choices and behaviour (1). Social media, digital health promotion interventions, digital food marketing and online food retail are also part of the digital food environment.

Although MDAs are part of our modern food system, they are not considered in current nutrition policies and regulations. The public health implications of digital food marketing to children have attracted the attention of both researchers and policy-makers (8), while the potential impacts of MDAs are far less well understood. The available evidence has shown that out-of-home (OOH) foods tend to be less healthy than foods prepared at home. This is generally because the foods bought from OOH outlets are more energy dense and nutrient poor (9,10). OOH foods frequently contain high quantities of sodium, saturated fats, trans-fats and free sugars (11–13). Not only are these meals less healthy but they are also often more readily available and affordable. High consumption of meals from OOH sources has been linked to weight gain (14,15) and an increased risk of type 2 diabetes (16). An association between takeaway meal consumption and obesity has also been reported in adolescents (17). Even if healthy options are available, it is likely that unhealthier, processed and branded foods have greater prominence on MDAs due to the power of the algorithm and advertisement-funded placements on these platforms.

Poor diet, excessive alcohol consumption, overweight and obesity contribute to a large proportion of noncommunicable diseases (NCDs). The WHO European Region is the WHO region most affected by NCD-related morbidity and mortality, at almost 90% of all deaths. The main NCDs, cardiovascular diseases, diabetes, chronic respiratory disease and some cancers, are the main causes of deaths in the Region (18). In 2016 overweight and obesity affected 59% of adults in the Region as well as an increasing proportion of children (18,19).

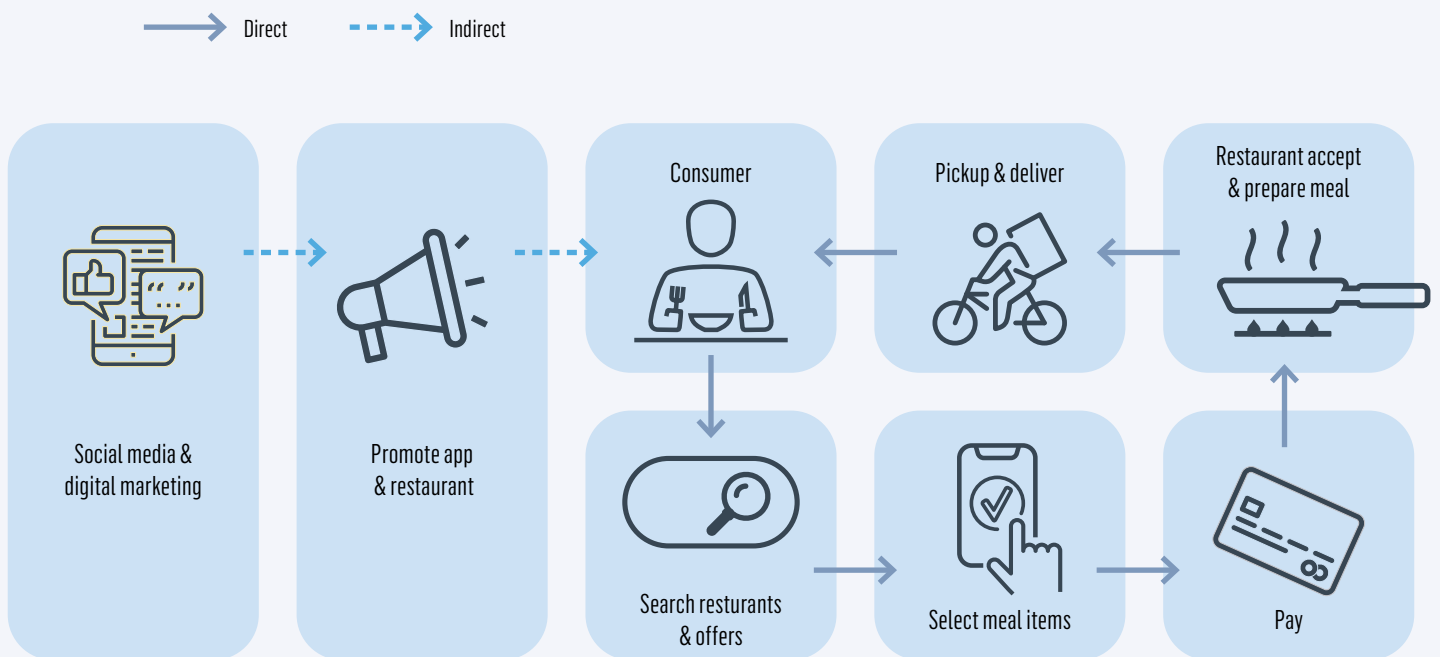
Unhealthy diets are a key modifiable behavioural risk factor for overweight and obesity, as well as the NCDs linked to these factors. Yet few studies have explored the role that MDAs may play in perpetuating and exacerbating unhealthy dietary patterns or potentially encouraging healthier ones. Limited evidence from outside the Region highlights some concerning trends (20–22). Currently, MDAs remain an unaddressed issue in food systems policies and regulations throughout the WHO European Region. From a public health standpoint, the unprecedented growth, and consequent potential, of online food delivery for both positive and negative health outcomes needs to be recognized and better understood.

This report examines aggregator (third-party) MDAs from a holistic perspective, using a food systems framework to assess the potential impacts of online MDAs on NCDs in the WHO European Region. Recommendations are made based on the results for methods to incentivize healthy and sustainable meals on MDAs. The novelty and value of this report is the collaboration between app developers, computer scientists and public health experts in the effort to make sense of this new phenomenon.

How do MDAs work?

MDAs are platforms that connect customers with restaurants and food outlets. While food can also be ordered on a web-based platform, mobile apps are an increasingly popular form of ordering a meal. The process consists of a customer downloading an app, selecting the food genre or restaurant of their choice, reading through the menu items, selecting an item(s) and finally paying via the app and setting the time for delivery (Fig. 1). Some platforms are developed for a single chain of restaurants, while aggregator platforms offer a selection of restaurants. Aggregator platforms profit through commission on food orders, various charges to the consumer (such as delivery or minimum order fees) and fees from restaurants for services such as advertising or performance marketing, where restaurant brands can pay for search listing prominence and promotional offers.

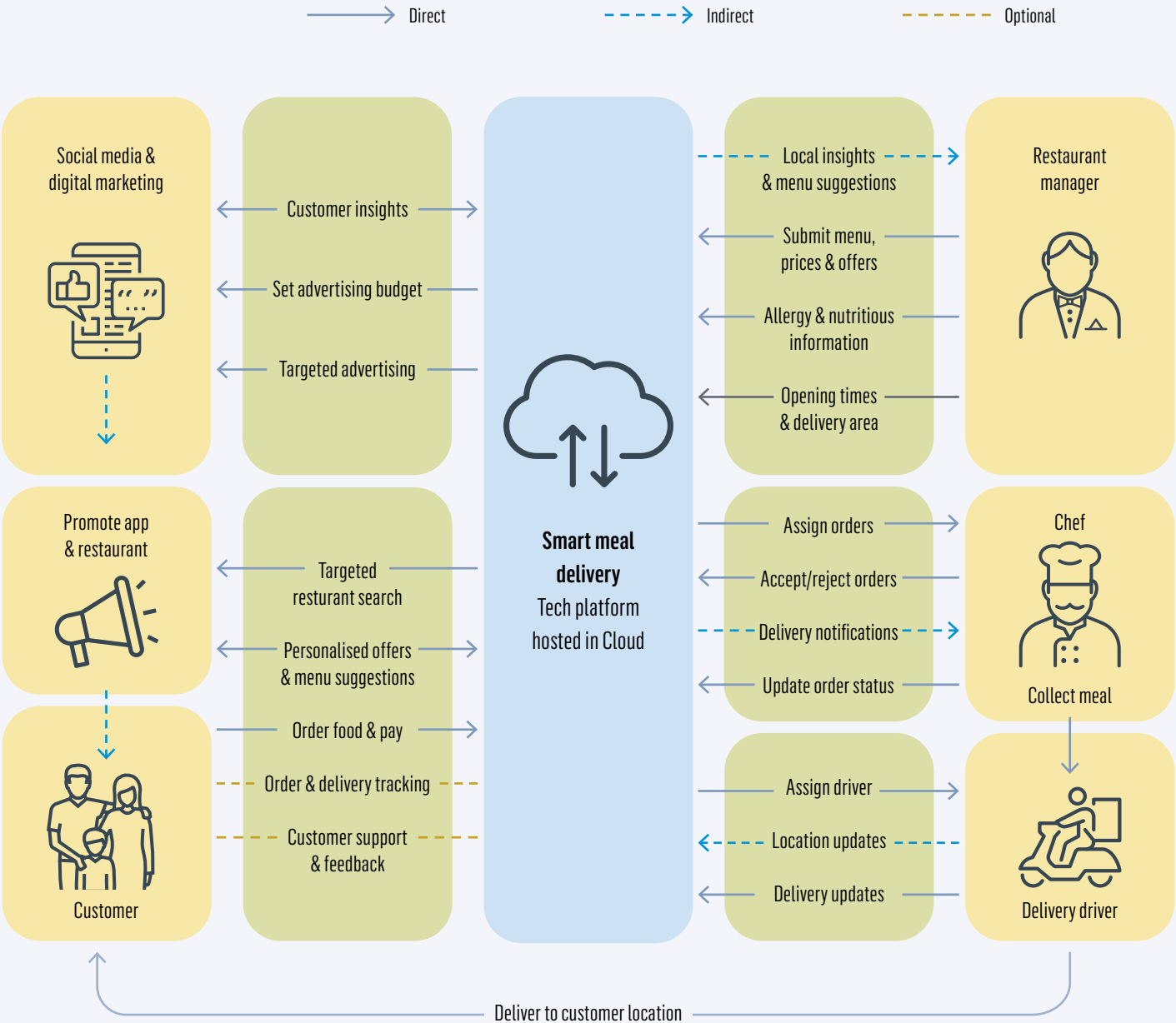
FIG. 1. A SIMPLIFIED REPRESENTATION OF THE MDA PROCESS



An aggregator's mobile app or website is used as the primary interaction between the consumer and aggregator platforms. These types of platform are successful because they invest significantly in highly localized and personalized software, tailoring the user experience to the needs and desires of customers in terms of language and psychological cues to influence decision-making, among other things. This, in turn, helps aggregators to attract new customers and retain existing customers. Aggregator platforms use television, online and social advertising and social media to attract new customers to their website and apps. They encourage customers to use their consumer app rather than the website, thus opening up

opportunities for message notifications and two-way communication between the aggregator and the consumer. Interactive communications mechanisms, such as push notifications and location-based offers, can be used to drive subsequent orders and encourage regular repeat business. Apps also collect a large volume of consumer data, including browsing history, type and time of orders, delivery location and the types of payment card and device used to place the order. These data are used to facilitate future purchases by the consumer, but they also provide aggregators with information necessary for tailored advertisement and meal recommendations generated using artificial intelligence (AI) (**Fig. 2**). These data are held by the aggregator app company and are not publicly available.

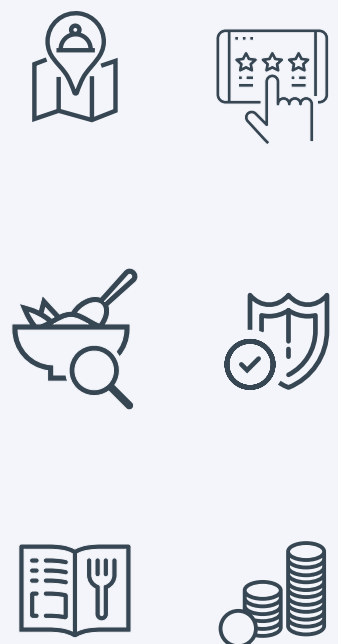
FIG. 2. HIGH-LEVEL INTERACTIONS IN MEAL DELIVERY PLATFORMS



Communication between these apps and the aggregator platform is generally via a secure application programming interface (API). APIs can be public (where the information is available for developers to integrate into their systems, sometimes through anonymous access) or private (where access is protected by a series of authentication and authorization mechanisms, generally by the company creating the API). Having a public API that is well documented with the specifications on how it functions helps other technology companies to write applications that interact with the aggregator platforms; this will generate further increases in orders. Such an API is deemed beneficial for researchers since it can help them to collect restaurant and menu information (**Table 1**).

TABLE 1. EXAMPLES OF DATA THAT CAN BE COLLECTED THROUGH AN API

General data type	Examples
Geographical	Location of the restaurant Size of delivery area
Restaurant	Type (e.g. fast food, Indian, Italian, French) Reviews/ratings
Nutritional	Nutritional information (not always available) Portion sizes
Food safety	Food hygiene certificates Allergens Religious food certification (e.g. halal, kosher)
Menu	Types of meals served Menu item name Menu item description Prices



An e-commerce order system is a component of the MDA ecosystem that works like any typical e-commerce application. Once the restaurant is selected, this component is responsible for giving the customer all available information about the restaurant, menu details and available offers. Aggregators increase revenue through the commission of a high-value order; hence a combination of marketing strategies are used in the form of offers, recommendations and "combo" deals to incentivize consumers to maximize purchases each time. This process is heavily dependent on data insights and machine learning-based algorithms (**Fig. 2**). Aggregators heavily invest resources and money on identifying customer requirements and behaviour, recognizing the importance and impact on profitability.

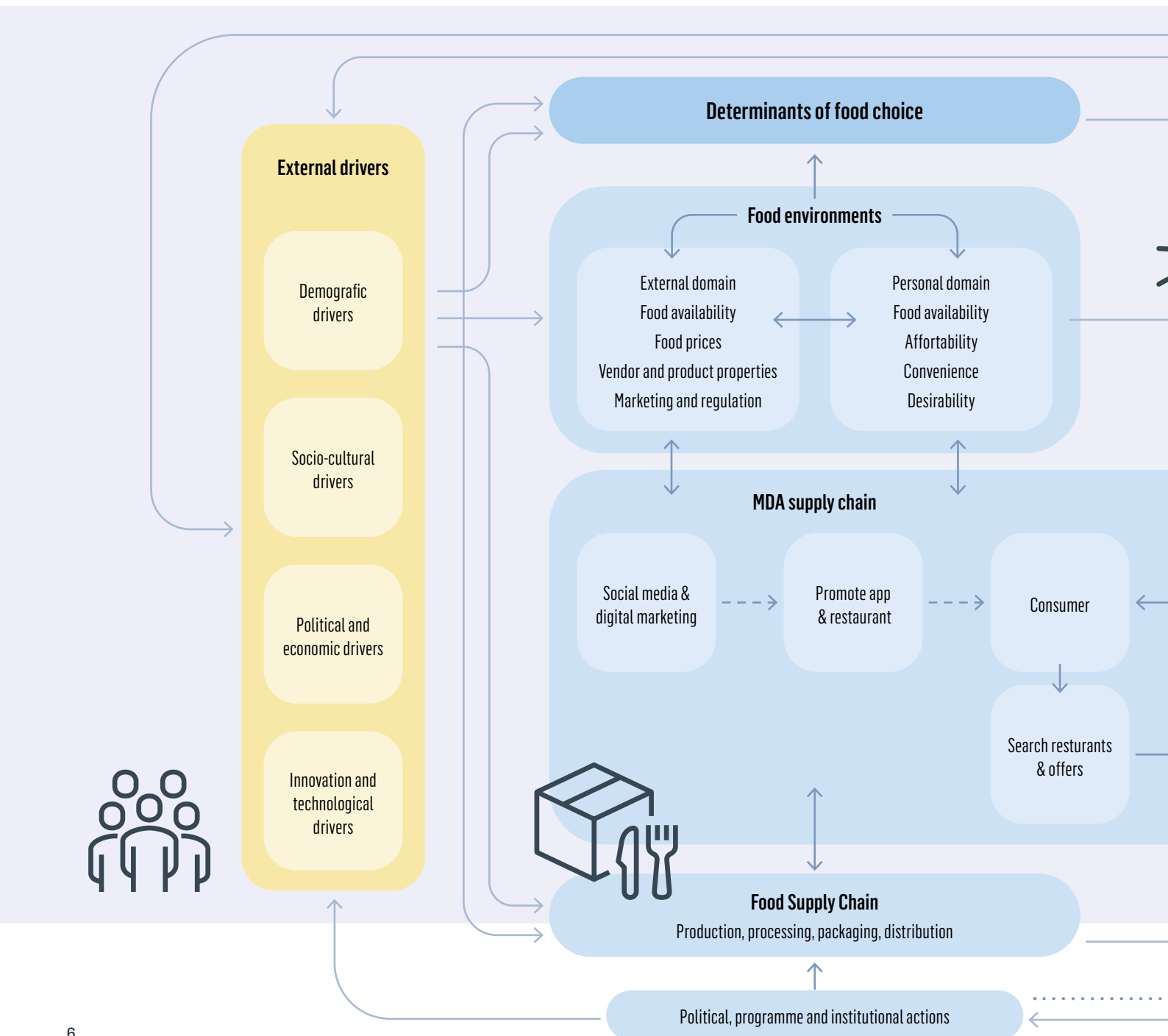
An order delivery system is responsible for sending order information to the restaurant, coordinating and scheduling delivery drivers, notifying the restaurant when to start cooking and when to prepare for pickup, and communicating with customers to let them know when their items will be delivered. Typically, these systems lean towards heavy use of AI and machine learning-based algorithms

to achieve the most efficient cost optimization in hot food delivery to consumers in the agreed time (**Fig. 2**) while maintaining similar food quality standards as in dine-in service.

A conceptual framework for a food systems approach to MDAs

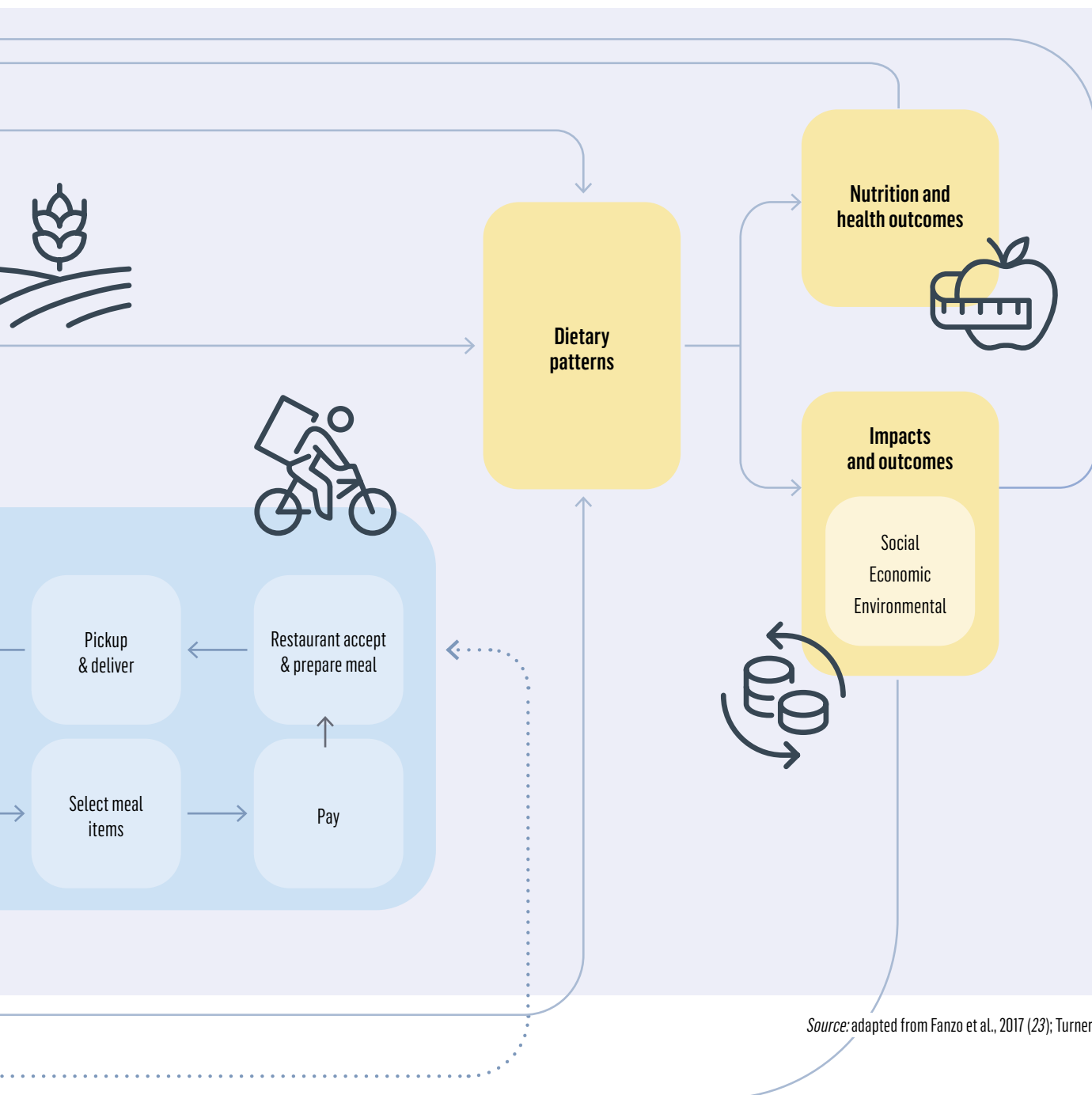
FIG. 3. A CONCEPTUAL FRAMEWORK OF A FOOD SYSTEMS APPROACH TO MDAs. THE SOLID LINES INDICATE FLOWS OF INFORMATION AND THE DOTTED LINES INDICATE POTENTIAL FUTURE FLOWS OF INFORMATION.

This report explores the potential risks and benefits associated with MDAs for NCDs using an adapted version of the conceptual framework for food systems for diets and nutrition developed for the United Nations High-level Panel of Experts Report on Food Systems and Nutrition 2017 (**Fig. 3**) (23,24). This conceptual framework was an essential tool in understanding the linkages between food systems, diets and nutrition.



In the context of this report, the framework is used to highlight entry points for policy-makers when designing and implementing policies and programmes that have the potential to improve the digital food environment's contribution to nutrition and health outcomes in their national context. This framework complements a growing interest in systems thinking, acknowledging the multiple, systemic and complex causes of NCDs, and the actions that are required on multiple levels to address them (25).

The use of the framework places MDAs in a wide system, the food system. This is significant as MDAs are intermediaries that connect the food service industry (such as restaurants) with customers in their homes and offices. In other words, MDAs facilitate the flow of services and information between the digital food environment and the physical food environment. As such, the relationship between diet and NCDs cannot be fully understood without taking a food systems approach into consideration.



Source: adapted from Fanzo et al., 2017 (23); Turner et al., 2018 (24).

A food systems approach “attempts to understand the natural, technical, economic and social aspects of several interlinked activity areas from primary agriculture including crop and livestock production and their inputs, yields and emissions to logistics, processing, transforming and packaging of food to marketing, consuming and disposing of waste and the linkages between these elements” (26). A food systems approach is used to achieve a comprehensive understanding of interdependencies between key parts of food systems at various scales as well as the desired and undesired outcomes in terms of food, health, environmental and climate impact. One of the desired outcomes of a food systems approach is coherent policy.

The following sections investigate the role that MDAs play in relation to different parts of the food system (as laid out in **Fig. 3**). Following this analysis, interventions are suggested that could improve the nutritional quality and portion sizes of meals, as well as have a positive impacts on public health (27).



Food system drivers influencing MDAs

The most significant drivers influencing the development and reach of MDAs are digitalization of services (28), platformization (29), personalization (30) and urbanization (31). At the same time, the OOH food sector is becoming increasingly significant in terms of food consumption across the WHO European Region. Coupled with digital technology and widespread mobile phone and social media use, the OOH sector has the potential to reach even more customers. The COVID-19 pandemic has further accelerated the use of digital channels to access meals (32).

Advances in AI and machine learning have contributed significantly to the evolution and development of MDAs. Food delivery platforms are steadily embracing AI to manage changing customer behaviour. By integrating AI and machine learning techniques, food delivery companies can improve their operation efficiency (for example by analysing market trends), enhance customer experience (use of chatbots) and enhance user experiences (such as by providing more accurate delivery time estimates) (33). In some parts of the Region, MDAs are owned by or closely related to other app-based services such as taxi services (Uber Eats and Yandex.Eats), multiplying the use of AI and data. For the consumer, improved voice recognition systems powered by AI make online ordering quick and nearly effortless (34).

Enhanced connectivity from 5G networks and the exponential growth of smartphone usage has also contributed to the increased reach of MDAs to end users. This, along with data-driven intelligent marketing and increased use of social media, helps MDAs to reach a broad user base economically and appealingly. Expansion and wide availability of cloud computing platforms such as AWS and Azure allow MDAs more resilience, enabling them higher scalability and worldwide expansion within a short timeline and at a minimum investment and operation cost.

MDAs are a significant part of the evolving digital economy and so-called gig economy where companies contract individuals to carry out small tasks or jobs. By connecting businesses and clients to workers, these online platforms are contributing

to the transforming digital economy. Approximately 11% of the workforce in the European Union (EU) already provides services through a digital labour platform (35). This raises several questions about the risks and benefits associated with the reorganization of work. Food delivery riders are a type of platform worker, typically categorized as self-employed or contracted and providing services mediated by a MDA. The nature of the gig work means that opportunities for workers are often irregular in terms of income, working conditions, social protection, skill utilization, freedom of association and the right to collective bargaining (36).

Food supply chains

MDAs are a part of the food supply chain, which will include all activities that move food from production to consumption, including production, storage, distribution, processing, packaging, retailing and marketing (23). The decisions made by the many actors within the food supply chain have implications on other parts of the food system. In the context of MDAs, the consequences of these decisions can influence the types of food available and accessible and the way the food is produced, distributed and consumed. For example, the use of ultraprocessed foods, such as processed cheese and meat, the addition of salt when cooking or the addition of sugar-sweetened beverages to the final meal ordered may increase the sugar, salt, saturated fat and trans-fat content of the meal consumed. Another example of how decisions made in one part of the food supply chain can affect another part of the food chain are agricultural policies that neglect a so-called nutrition-sensitive approach, resulting in nutritionally poor foods and low diversity in the food supply (37,38). An increasingly large number of restaurants are joining aggregator platforms, giving those platforms increased power in influencing the meals they sell (39).

As **Fig. 1** indicates, MDAs are a new addition to the food supply chain. MDAs have disrupted a part of the food supply chain by providing new models of distribution, retail and marketing. Other changes are possible (**Box 1**).



Robotic deliveries

In the last few years, deliveries made by six-wheeled, autonomous robots have been increasing. More than 1 million food deliveries have been made worldwide, and over 1000 in the greater London area (40). The current robots move at pedestrian speed and have the ability to move around objects and people. They are fully electric and have the ability to travel up to 6 km for a delivery.

Currently, the WHO European Region does not have Region-wide regulation for autonomous robots in public spaces, leaving large variability in regulation between

BOX 1. AN EYE TO THE FUTURE



countries. Both aggregator MDAs and individual enterprises have partnered with these robotic services to facilitate contactless delivery within urban areas. As an individual service provider, these robots could facilitate meal delivery from small and medium enterprises by providing delivery services without a need for a larger delivery infrastructure. The large rise in food delivery services over the COVID-19 pandemic has been accompanied by a rise in robotic delivery services. Many grocery stores, restaurants and delivery companies implemented robotic deliveries when lockdowns were in place, taking advantage of the changing landscape (41). With a normalization in use, and short distance flexibility and range, robotic deliveries could be integrated into the food delivery space as a possible solution to the so-called last-mile delivery problem.

DARK KITCHENS

Dark kitchens (also known as ghost kitchens, cloud kitchens or virtual kitchens) are commercial production spaces that prepare food solely for delivery through aggregator apps. Companies, food businesses or individuals rent out residential or industrial spaces to operate delivery-only restaurants, with no physical location. In some cases, these businesses produce food under multiple restaurant and food brands. While they are an opportunity for independent food businesses to take advantage of a growing online market, they are also platforms with large regulatory loopholes (28). The delivery-only nature of the enterprise provides scope for minimal hygiene and sanitation regulation. Users will place orders from these restaurants often without knowing where, or how, this food is prepared.

The rise in virtual kitchens would not be possible without MDAs. In addition to aggregating online orders, MDAs can aggregate multiple brands. Many of the large food delivery companies have purchased real estate in residential communities to take advantage of the growing online marketplace. Utilizing user data, these commercial kitchen spaces will generate and promote menus to match consumer demand. This model will bring new food delivery choices to many suburban or second-tier cities where restaurant food options are restricted by density.

Food environment



Food environments encompass the interrelated external and internal domains (Table 2). Although this framework was originally conceptualized with mainly physical food environments in mind, these domains and dimensions can also be applied to the digital food environments within which MDAs operate (42).

TABLE 2. DOMAINS AND DIMENSIONS OF FOOD ENVIRONMENTS

Domains and dimensions	Factors shaping these dimensions
External	
Availability	The presence of a vendor or product within a given context: food cannot be accessible if it is not available
Prices	Cost of food products: prices interact with individual purchasing power to determine affordability
Vendor product and properties	Type of food vendor, opening hours and services provided, as well as food quality, safety, level of processing, shelf-life and packaging: collectively, these structural aspects interact with individual factors such as time allocation and preparation facilities to determine convenience
Marketing and regulation	Promotional information, branding, advertising, sponsorship, labelling and policy regulations pertaining to the sale of foods: these aspects interact with people's individual preferences, acceptability, tastes, desires, attitudes, culture, knowledge and skills to shape the desirability of food vendors and products
Personal	
Accessibility	Physical distance, time, space and place, individual activity spaces, daily mobility, mode of transport
Affordability	Individual purchasing power
Convenience	Relative time and effort of preparing, cooking and consuming a food product, time allocation
Desirability	Preferences, acceptability, tastes, desires, attitudes, culture, knowledge and skills

Source: based on Turner et al., 2018 (24).

Availability and accessibility

MDAs increase the accessibility of a broader range of foods by extending the reach of food service outlets in the built environment. For example, preliminary research in Denmark found that each McDonald's fast food outlet could significantly increase its geographical coverage when meals were sold through MDAs, effectively covering the entire country (43). A study from Canada also found that online meal delivery services can substantially increase access to foods prepared away from home

within a 9 km radius (22).

MDAs may also extend the geographical reach of food swamps, the physical food environments where the number of fast food outlets, junk food outlets and convenience stores outnumber stores with healthy food options. Similarly, digital food swamps are created if one MDA carries a preponderance of unhealthy food options. Although the phenomenon of digital food swamps has not yet been investigated, research from the United States of America found that food swamps in physical food environments have a statistically significant effect on the rate of adults living with obesity (44). The same study found that the food swamp effect was stronger in areas with greater income inequality and where residents were less mobile. Similar findings have emerged in the United Kingdom, where a positive correlation between the density of fast food outlets and area-level deprivation was found (45). A study specifically analysing MDAs found that a greater number of fast food options were available in the most disadvantaged neighbourhoods (46). One aspect of this is the expansion of food delivery platforms to smaller, more geographically remote towns and cities (4).

Aggregator MDAs expand choice by offering a wide range of cuisines from many different restaurants. However, this does not mean that all potential meals are equally as popular. In a three-city study (including one European city, Amsterdam), burgers, pizza and Italian food were in the top 10 most-advertised meals (46). Until recently, the options on MDAs were mainly main meals. However, many now include snacks, lunch and breakfast options (4).

MDAs may increase the possibility of broader exposure to unhealthy food and beverages with high energy density, sodium, saturated fat and free sugars, and a lack of dietary fibre, vitamins and minerals. In a Brazilian study, ultraprocessed beverages and ultraprocessed ready-to-eat meals make up the vast majority of what is on offer in MDAs (47). Another study in Australia and New Zealand found that 86% of all popular menu items provided on MDAs were energy-dense, nutrient-poor discretionary foods (20). However, there have not as yet been any studies investigating the nutritional content of the most frequently ordered meals in the WHO European Region.

The channels through which consumers purchase food are also diversifying. While not the main focus of this report, online food environments also have meal delivery boxes, some of which can bring healthy ingredients to households. MDAs are also starting to make deliveries from supermarkets and convenience stores in addition to the grocery-specific delivery apps that focus on the rapid delivery of groceries.



Prices and affordability

The prices of meals on MDAs are generally set by restaurants and they often increase prices to cover the service fees charged by the delivery platform. A 2021 survey in the United Kingdom found that ordering using food delivery apps was, on average, 23% more expensive than ordering directly; this was linked to additional delivery surcharges and the service fees that the restaurants pay to the meal

delivery platform (48).

In a 2021 survey of 8602 respondents in nine WHO European Region Member States, 55% said that delivery costs were the most important criterion when choosing an online shop. Similar findings have been made in studies related to online grocery shopping (49). However, this survey did not look specifically at the willingness to pay for meal delivery services, which may be highly influenced by convenience and availability (see below).

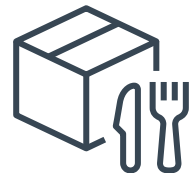
A recent systematic review mapping the digital food environment found that only 6% of studies included the affordability dimension of food purchases (49). Only one of these studies focused on affordability within MDAs, the rest on online grocery deliveries. All the studies included in the review focused on consumer perceptions of food affordability as one of many factors influencing willingness to purchase from an online food delivery platform. As of 2021, no study has directly examined the affordability of MDAs. More data are needed to understand the influence of price and affordability of food on consumer behaviour with MDAs.

Vendor product and properties, and convenience

MDAs act as bridges between restaurants and consumers. As MDAs control the interface of consumer–vendor interactions, vendor products and properties are not as consistent or as regulated as they would be in the physical food environment. If a consumer has not physically visited the restaurant, it is highly unlikely that they would know what ingredients or products the restaurant is using, the nutritional quality of products or ingredients, the hygiene status of the restaurant or how the food is prepared.

Due to the unregulated nature of MDAs, there is a lack of nutritional information for a large proportion of meals sold on MDAs, particularly from smaller independent outlets. This means that consumers may be influenced by marketing or images of foods and unknowingly purchase foods that are energy dense and higher in saturated fat, free sugars and salt. In addition, there is often relatively little information available on portion size. Consumers may overorder or consume larger than recommended portion sizes, encouraging overconsumption and excess energy intake, which contributes to weight gain. Regulating and increasing the information available to consumers is not only an opportunity for meal delivery platforms but for the wider OOH meal sector.

In the EU, the General Food Law contains rules on food safety and food quality, which apply to all food business operators in all its Member States (50). Food business operators are also responsible for complying with specific national regulations (50). In unannounced inspections, public food inspectors check how well the enterprises adhere to the regulations. Generally, restaurants are required to show documentation of their food safety inspection reports to the public, including information about employee hygiene and food handling as well as the cleanliness of the establishment. However, because of the lack of governmental monitoring, this information is not commonly provided to the consumer when they order from an MDA.



There is evidence that a substantial proportion of foodborne illnesses and outbreaks are associated with eating in restaurants (51). However, whether ordering food from a MDA increases this risk is not currently known. An additional issue is that meals ordered via MDAs may be saved and consumed later. Lag time between preparation and consumption, prolonged storage at temperatures favouring microbiological growth and improper reheating of the food may introduce food safety risks (52).

In general, there is a lack of information on how food is prepared by the vendors on MDAs. Depending on the platform and the country, foods containing specific allergens and meals for specific diets (such as vegetarian, vegan or halal) are sometimes indicated on MDAs but not always. Often these certifications require regulation of food preparation that may not be available on MDAs. Information on food preparation can be critical to the health and well-being of consumers and should be consistently available across these platforms.



Marketing, regulation and desirability

When a user searches for a restaurant, an aggregator platform will use intelligent proprietary algorithms to decide which restaurants or foods to show to the consumer, or to display in higher ranks on the restaurant search results. The aggregator platform generates a customer profile for each platform user by combining factors such as order history, app usage, location data and the type of device used (laptop, Android phone, iPhone, etc.). Machine learning-based algorithms are used to combine these collected data with advertising and social media data to enrich the customer profile. The customer profile is built with those parameters used for targeted advertising in social media, push notifications and e-mail campaigns. Restaurants can pay extra to be ranked higher in search results, and branded restaurant chains may have exclusive agreements to be shown in higher ranking. Restaurants pay further premium commission to the aggregator to secure a higher priority based on the availability of delivery drivers and their business to establish the food options for the user. Food delivery platforms spend significant amounts of money on advertising (4). A preliminary study on digital food marketing in Norway found that 23% of food and drink advertisements directed towards children were for food delivery services (53). The majority of advertisements in the sample promoted food and drink brands and products that were unhealthy according to the WHO Regional Office for Europe's Nutrient Profile Model and were not permitted to be marketed to children. According to a systematic review, evidence to date shows that acute exposure to food advertising increases food intake in children but not in adults (54).

Evidence from Denmark highlights how MDAs use promotion codes that give special discounts or offers as parts of campaigns or collaborations with social media influencers. These discounts often result in obtaining in-app credit that can be redeemed for a discount on a future purchase (43). The study also found that push notifications are a common feature of MDAs. These notifications can contain offers, competitions or news regarding new food outlets that have joined the platform. The notifications can still appear when the MDA has been closed on the user's phone without making an order or when the app has not been in use for

some time. Online meal delivery companies in Denmark were found to have strong social media presences and frequently collaborate with influencers to promote their brands.

MDAs have also positioned themselves as partners to individual (independent) restaurants. They aim to offer the restaurant a total technology platform package, including point of sale systems, Internet connectivity and other common restaurant software and hardware systems. This enables a large pool of data to be collected by the MDA, allowing analysis by aggregator platforms that provide localized marketing insights on the restaurant, such as a top-selling dish within a suburb or a food item most searched for. The aggregator platforms' marketing teams also assist restaurants in increasing promotions and their social media presence.

In April of 2021, the European Commission released a proposal for a regulation laying down harmonized rules and proposed guidelines on the use of AI in the EU (55). These proposed guidelines are reflective of a larger move to regulate the availability and use of user data. Currently, there are no existing guidelines to regulate algorithms used by aggregator platforms to establish which restaurants and menu options are given higher visibility. Hence, there is a high chance for restaurants selling unhealthy food to be ranked higher in priority and made more visible on the platform, while restaurants selling healthier dishes get less visibility. Past purchase behaviour will also influence menu recommendations. For example, if a person orders unhealthy food once, he or she is more likely to be presented with unhealthy food options in the future. As a result, unless the restaurant selling healthy food is known to the customer and they specifically search for that restaurant, it might not be visible in the first few screens of the search results.

Determinants of food choice

While hunger is a crucial driver of eating, there are several factors that influence food choice and dietary patterns (56):

- biological determinants (hunger, appetite, and taste)
- economic determinants (income)
- physical determinants (such as access, education, cooking skills)
- social determinants (social class, culture, family, peers and meal patterns)
- psychological determinants (stress, mood)
- attitudes, beliefs and knowledge about food.

MDAs are also modifying eating patterns in ways consumers, food companies, industry analysts, researchers and policy-makers are only just beginning to understand. There are several scenarios under which someone may choose to order a meal via an MDA. These may include a social occasion (such as spending time with friends or family), irregular hours (after a late night out or working late), time constraints (such as providing care for someone), as a treat or out of convenience (57). According to three studies, young adults with higher disposable income and higher education tend to be the most prevalent users of MDAs, as are those with



a high body mass index (7,58,59).

There is a clear dearth of studies focusing specifically on the economic, physical, social and psychological determinants of food choice from MDAs. Most data are held by the MDA companies and are not currently available for research purposes.



Dietary patterns

Dietary patterns comprise the overall diet rather than the individual nutrients or foods (60). As such, dietary patterns represent a broader picture of food and nutrient consumption and also interact with food systems. They are not only an outcome of existing food systems but also a driver of change for future food systems (23).

Dietary patterns in the WHO European Region have been changing rapidly in recent decades. With globalization, urbanization and income growth, people are experiencing new food environments. This means that food choices are expanded and dietary patterns are diversified in both positive and negative directions (23).

Sustainable healthy diets are defined by WHO and the Food and Agriculture Organization of the United Nations as dietary patterns that promote all dimensions of individuals' health and well-being; have low environmental pressure and impact; are accessible, affordable, safe and equitable; and are culturally acceptable. The aims of sustainable healthy diets are to achieve optimal growth and development of all individuals and support functioning and physical, mental and social well-being across the life course and for present and future generations; contribute to preventing all forms of malnutrition (undernutrition, micronutrient deficiency, overweight and obesity); reduce the risk of diet-related NCDs; and support the preservation of biodiversity and planetary health. Sustainable healthy diets must combine all the dimensions of sustainability to avoid unintended consequences (61).

There is potential for MDAs to contribute to sustainable healthy diets. However, the evidence reviewed for this report indicates that the most common dietary patterns in the WHO European Region as well as elsewhere in the world are neither healthy nor sustainable.



Outcomes

Health and nutrition outcomes

There is no evidence of the actual impact of increased use of MDAs on public health. While MDAs are not directly influencing the health and nutrition outcomes of the populations they serve, they play an indirect role by providing access to food and meals. For this reason, it is important to draw on the existing evidence investigating the linkages between NCDs, the OOH meal sector (45) and consumption of ultraprocessed food (62,63). In addition, evidence has demonstrated that social media and digital marketing can influence food choices, preferences and consumption (49).

The few published studies providing evidence in this area are all drawn from small sample sizes; however the emerging evidence supports calls for surveillance and future research to investigate the relationship between MDAs and population dietary

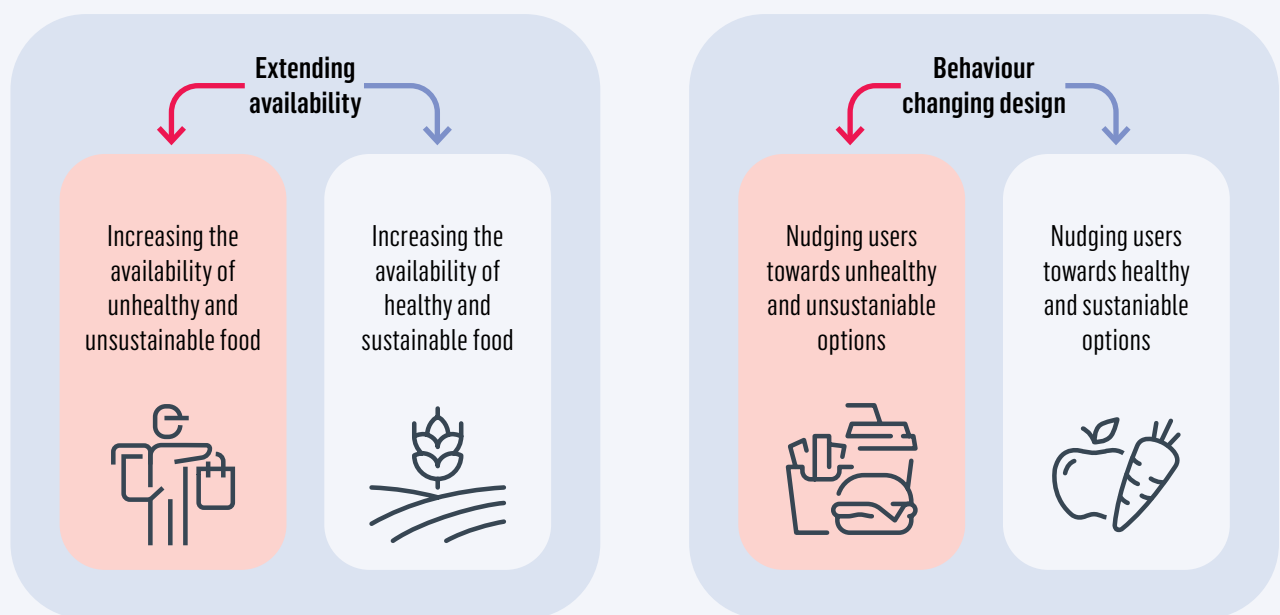
health (22). For example, a Canadian study of 759 menu items on MDAs found that the meals did not meet recommendations for healthy eating (22). According to another study of 4323 delivery options in three cities, most food types available for delivery were not considered healthy (46). This suggests that consumers of MDA foods are less likely to have a balanced diet and more likely to consume unhealthy levels of saturated fat, trans-fats, free sugars and salt, all of which contribute to elevated NCD risk.

Particular attention should be paid to portion sizes and nutrition labelling. Research from the United Kingdom found that portions of food or drink that people eat out or eat as takeaway meals contain, on average, twice as many calories as equivalent retailer own brand or manufacturers' branded products (64).

In addition, evidence from the United Kingdom in 2020 showed a year-on-year increase of over £950 million in the OOH delivery sector (65). Given that the average calorie content of products from the OOH sector has increased by 1.7% since 2017, and remains higher than their retail counterparts, this suggests that a large proportion of the population may be overconsuming (66). This contributes to weight gain, which, in turn, can result in obesity and raised NCD risk.

There are effectively two possible paths for the development of health and nutrition outcomes from MDA operator choices (43): either to continue to increase the availability of unhealthy food or to move towards creating equal and healthy digital food environments, thus extending food availability for the better (**Fig. 4**). There are a number of online platforms that do promote the sale of healthy and sustainable food and meals (**Box 2**).

FIG. 4. POSSIBLE AVENUES FOR THE DEVELOPMENT OF MDAs



Note: red arrows depict possible developments with a negative impact on NCDs.

Source: adapted from Skovgaard et al., 2021 (43).

BOX 2. PROMOTING HEALTHY AND SUSTAINABLE MEALS THROUGH APPs

PROMOTING HEALTHY AND SUSTAINABLE MEALS THROUGH APPs

While not the main focus of this report, there are many examples of online platforms that promote the sale of healthy and sustainable food and meals (1) as well as numerous fitness and nutrition apps that facilitate healthier diets. These platforms can also promote informed nutritional choices, with apps displaying dietary guidelines and government recommendations. Digital platforms are also used to promote sustainable decision-making by providing recipes to reduce food waste and linking consumers to low-impact producers. For example, there is an app in Denmark that connects small-scale fisherfolk and private consumers. Fresh fish is delivered directly to households at prices that are generally lower than purchasing from a fishmonger.

Apps to avoid creating food waste within the EU are increasing. These apps utilize the digital food environment to minimize wasted food and provide resources to consumers. Consumers can scan food products from a receipt and then track which foods were wasted or used. The app provides an interface to categorize and organize these food products and will provide reminders about food at home through push notifications (67). An alternative food waste app serves as a supplies manager, going as far as preparing meal plans and shopping lists in order to minimize food waste. Other subscription services deliver boxes of fresh fruit and vegetables to private households with prepared ingredients portioned out for a set menu. These apps cater to the convenience of minimizing time spent planning meals and buying food, while still having the consumer participate in food preparation.

Innovations within the digital food environment are an opportunity to deliver public health nutrition interventions. A systematic review of dietary behavioural interventions embedded within online food ordering systems showed a positive impact on purchases of healthier foods and beverages, with an overall reduction in energy content, fat, saturated fat and sodium content. The most common intervention employed made information visible and was implemented through food labelling, nutrient labelling or traffic light systems (68). It is important to recognize that the impact of these interventions employed within online food ordering systems is largely dependent on the effectiveness of the classifications employed.



Social, economic, and environmental outcomes

A food systems approach encourages looking outside public health and nutrition outcomes towards the social, economic and environmental outcomes of MDAs. This report focuses on outcomes related to labour and new employment models, the economic efficiency of delivery models, road safety and the environmental impacts associated with the ingredients used in meals and their packaging materials.

The 2021 report by the International Labour Organization on the role of digital labour platforms showed that the majority of platform workers are men under the



age of 35 and highly educated (36). Women make up only 10% of the workforce. Many platform workers stated this was their primary form of income and worked an average 59 hours per week. Digital work positions are also important opportunities for migrants.

Platform workers in food delivery may work unsociable hours and not be entitled to adequate breaks, with little or no supporting national legislation (69,70). Gig economy workers often lack training, safety equipment and worker compensation (35,36). Financial rewards are used to guarantee sufficient riders during busy shifts and to encourage them to complete orders quickly. Digital delivery platforms utilize algorithms to rate their workers, a process that is in some part determined by their acceptance or rejection of work. The International Labour Organization survey found that many workers felt they were unable to reject work due to the possible negative effect on their rating (36). Reduced ratings have an effect on future access to work, may incur financial penalties and can even lead to dismissal via account deactivation.

Prevailing employment law may be a challenge in terms of cost optimization. A recent Supreme Court ruling in the United Kingdom giving Uber drivers employee status could impact all modern gig economy-based services (69). The new ruling entitles many platform workers to standard employee rights such as minimum wage and paid leave. It will be interesting to observe how governments and policy-makers resolve this issue in the post-COVID-19 era. Furthermore, this will be a significant obstacle for aggregators when moving into rural markets.

One of the main challenges that MDAs face is the last-mile delivery problem: deliveries need to be made within a very short period of time but this has to be balanced with economic efficiency. The last-mile delivery problem has three aspects. The first is technical; in order to achieve both short delivery times and reduce unwanted movements, AI and machine learning algorithms can be utilized to predict the best combination of delivery time, driver allocation and driver tracking. The rollout of 5G technology, enhancement of AI, machine learning tools and cloud computing (especially edge computing), together with emerging technologies such as drones and autonomous vehicles, will help MDAs to address the technical aspect of the last-mile problem.

Most aggregator platforms operate their delivery arm of business at a loss. They are heavily dependent on the hypothesis that improving technology and order volume will eventually make deliveries financially profitable. However, with the financial catastrophe caused by the COVID-19 pandemic, the long-term impact on investor confidence will need to be monitored. The fact that aggregator platforms are not yet profitable has had a negative impact on public health and nutrition, as branded restaurants serving unhealthy food and large vendors promoting unhealthy foods tend to have the strongest financial reserves to cope with the cost of delivering at a loss. These companies can more easily capture a significant market share and increase service catchment area through aggregator platforms. For example, preliminary research in Denmark found that the McDonalds' fast food chain could

significantly increase its geographical coverage when meals were sold through MDAs, allowing coverage of the entire country (43).

Road safety is also another concern among riders. In 2020, numerous deaths were reported in Australia when MDA riders were hit by vehicles while delivering food. This led to the development of a task force that has the power to investigate food delivery companies (71). As a Guardian journalist wrote when reporting this development: "I can't bear the thought of someone dying delivering me a McFlurry" (71).

Environmental impacts associated with food delivery include the significant generation of waste (72). In the EU, an estimated 2025 million takeaway containers are used annually (73). Another study from London quantified carbon dioxide emissions from meal delivery services, adding to the growing concerns around the transport intensity of these activities. A meal delivered by car was found to be responsible for approximately 1300 times the distance travelled and 200 times the greenhouse gas emissions of a heavy goods vehicle per tonne delivered (74).

As with the lack of information about the nutritional content of food order via MDAs, information about the environmental impacts of the meal is currently not provided by major platforms. Sustainable food labelling is a significant aspect of the EU's Farm to Fork Strategy (75). The impact that this will have on MDAs is not yet known. However, there is a unique opportunity to bring this sector into policy discussions and create the means to monitor and improve the information provided and food offered.



Political, programme and institutional actions

The digitalization of services has gained traction since the late 2000s. This is a megatrend that is unavoidable and will increasingly become a part of our interactions with food well into the future. To design and implement effective policies, policy-makers must first understand how MDAs influence health and nutrition outcomes. A ban on MDAs is not feasible, realistic or desirable. Therefore, public health authorities will need to understand how to regulate the kind of information displayed on MDAs and to use this trend to promote healthy and sustainable dietary choices. MDA companies should also have their roles and responsibilities clearly defined and be clear that they are accountable for what they promote and do. Based on the evidence found for this report, there are no public health regulations in any of the 53 Member States of the WHO European Region that specifically address MDAs.

One crucial entry point to creating healthy digital food environments is understanding what policies and guidelines already exist in the built food environment. For example, a restaurant's adherence to health and food safety regulations (such as Hazard Analysis and Critical Control Point measures) has the potential to become more transparent on food delivery apps. Adherence to voluntary targets such as salt reduction should also be more transparent.

Investigating digital food environments is one of the seven strategic workstreams

under the healthy and sustainable diets programming at the WHO European Office for the Prevention and Control of Noncommunicable Diseases (NCDs Office) (76). More specifically, ongoing research at the NCDs Office in conjunction with partners at the University of Kingston, London, is developing a data platform that would allow Member States to assess the types of meal sold on MDAs as well as their nutritional quality and geographical reach (see **Table 1**). The overall objective of this research is to contribute to the currently limited pool of evidence specific to MDAs. This, in turn, can help Member States to make more informed decisions on potential interventions (Box 3), as well as if and how to regulate the MDA platforms.

ENTRY POINTS: WHERE MIGHT WE INTERVENE?

A systems approach to MDAs allows for the development of systemic and long-lasting recommendations and interventions to improve population nutrition, sustainability, safety and productivity. Entry points to change are not solutions but are key elements that utilize existing mechanisms to solve complex problems and improve a system. These are the various points of intervention where political, programmatic and institutional changes can be made to tackle the challenges at hand. Some of the main entry points for MDAs include nutrition, environment, physical activity, road safety, food safety and the workforce. These entry points are opportunities to improve the health and sustainability of digital food environments in the WHO European Region. A systems approach can assist in assessing the landscape or so-called big picture, while allowing national and local governments to concentrate on a particular area, collect data, propose interventions and develop appropriate policies.

The following entry points may be relevant for national and municipal governments (**Fig. 5**).

Nutrition. MDAs present an opportunity to deliver interventions to improve public health nutrition. As diet is a major modifiable risk factor for NCDs, MDAs should be utilized to promote healthy eating habits and decrease the consumption of unhealthy foods.

Alcohol consumption. Apps are often designed to encourage people to add alcoholic beverages to their meal. Alcohol that is delivered to private residences and workplaces may often be cheaper to purchase than would be the case in on-site sales settings, and this increased affordability can lead to increased consumption and harm.

Environment. There are environmental concerns related to use of MDAs such as an increase in waste, air pollution and electricity use. Understanding the impacts MDAs can have on the environment will enable the development of systemic changes that will allow for sustainable solutions.

Physical activity. MDAs are centred on convenience, taking away the effort involved in food preparation and cleaning up. They remove aspects of food culture that encourage physical activity and instead increase sedentary behaviour.

BOX 3. ENTRY POINTS: WHERE MIGHT WE INTERVENE?





Road safety. MDA delivery drivers are all impacted by traffic and road safety conditions regardless of the transport used. As they are paid on commission, speed of delivery is key to maximizing earnings, which is contrary to the safety of drivers and other road users.

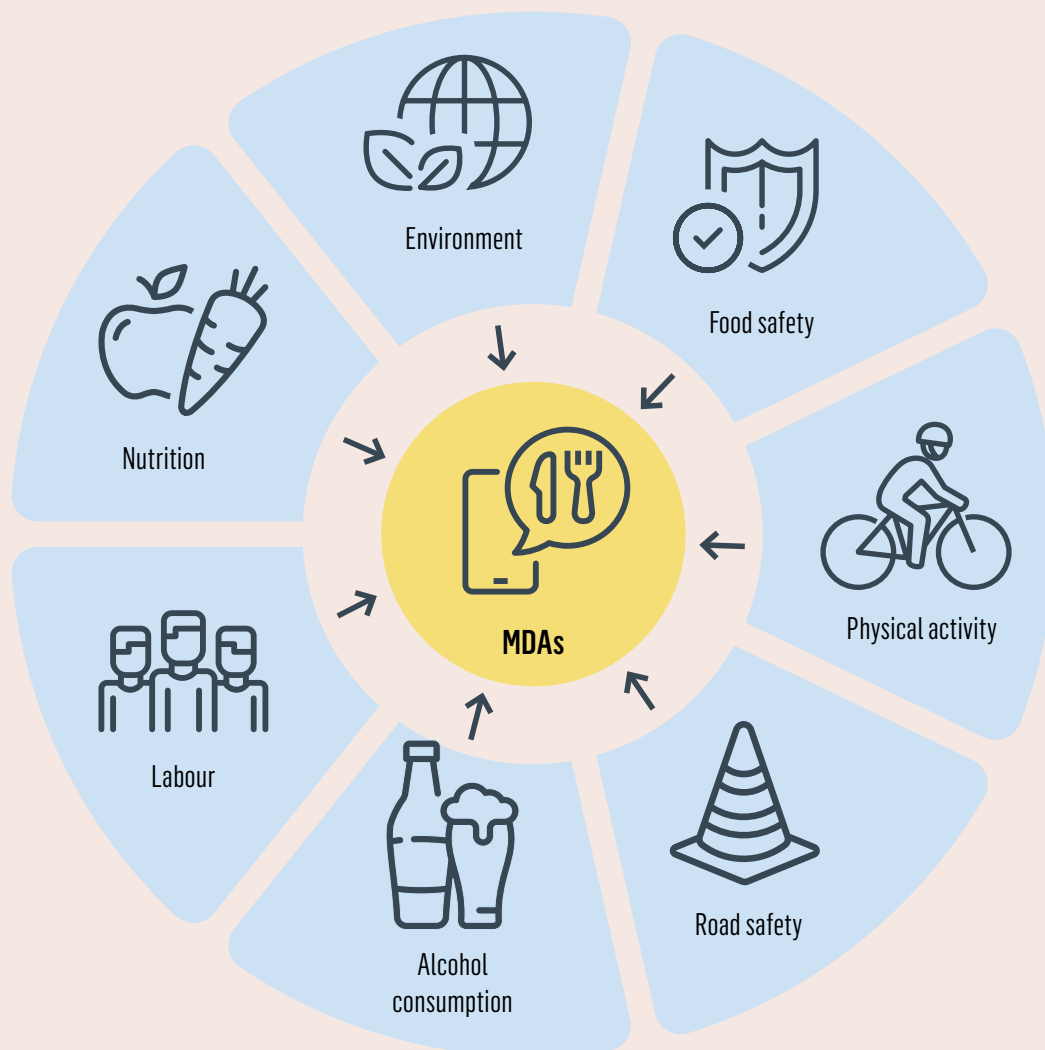


Food safety. Risk management is a shared responsibility across all stakeholders along the food chain. With the increasing use of MDAs, food safety risks associated with food storage, delivery and transportation need special attention.



Labour. MDAs have been a large part of the emergence of the so-called gig economy, where companies contract individuals to carry out small tasks or jobs such as delivery. Contractors involved in the gig economy often have no rights to the minimum wage, paid holidays or sick leave.

FIG. 5. POTENTIAL ENTRY POINTS TO IMPROVE THE HEALTH AND SUSTAINABILITY OF DIGITAL FOOD ENVIRONMENTS



Recommendations

There are many possible actions that can be taken to improve the food environments in which MDAs are positioned. These can be considered as no-regrets actions, innovative actions and paradigm shifts (**Table 3**) (77). No-regrets actions are leverage intervention points that can be activated with minimal risk of unintended consequences. These actions, however, are not transformative in nature. A good example is extension of mandatory menu labelling within restaurants to take in food delivery platforms. Mandatory menu labelling may encourage reformulation of items served by restaurants, leading to public health benefits that could be increased with inclusion of apps. A study of popular chain restaurants in the United Kingdom found that menu labelling was associated with serving items with less fat and salt (78). Innovative actions are leverage points that might begin to change feedback loops and the structures or incentives within a system. System changes are actions with the greatest potential leverage. These actions represent changes in behaviour, goals and paradigms. The objective of the recommendations for each of the three types of leverage is to encourage healthier digital food environments.

TABLE 3. ACTIONS FOR IMPROVING THE NUTRITION AND HEALTH OUTCOMES OF MDAs

Stakeholder category	Possible measures
No-regrets actions	
Government	Ensure that restaurants that are required to display nutrition information also include this information on MDAs
	Monitor food delivery platforms to ensure that the menu-labelling rules applying to restaurants are also included on the app when mandatory and encourage restaurants to use them when voluntary; mandatory menu labelling may encourage reformulation of items served by restaurants, leading to public health benefits
	Invest in food literacy actions that can help users to discern between healthy and unhealthy food items on online menus
	Educate both start-up companies and established companies on data provision and access and encourage them to following voluntary commitments on healthy eating; this could be supported by recognizing organizations that provide nutrition information about their product, introduce a rating score and publish rankings on the web and social media
	Require companies with a certain number of employees to provide accurate, fast and easy access to food nutrition information via an API
	Enable easy access for the general public to nutritional information via user-friendly means such as targeted mobile apps
	Prioritize a strongly committed effort at the national level to continuously collect and analyse data to identify the trends and changes of the OOH food industry before any further study on this sector or making policy changes
	Encourage the use of healthy labelling schemes in ready meals sold through MDAs

Research	Conduct national level studies that investigate the impacts of MDAs on public health
	Monitor the evolution of MDA services and the quality of meals provided
	Provide independent evaluation of government policies and business operations regarding MDAs
Private sector	Enable accurate, fast and easy access to food nutrition information via an API allowing access to aggregator platforms and food technology companies
	Provide public access to anonymized data that can enable independent assessment of potential public health benefits and risks of their business operations
Investors	Invest in start-up companies that are developing food delivery models that improve access, affordability and desirability of healthy and environmentally sustainable meals
Innovative actions	
Government	Pilot interventions with food delivery companies to test user responses to increased nutritional information and food labelling
	Bridge gaps between innovation and health by encouraging public health experts to engage with and mentor start-up companies that have new ideas for food delivery services; expert input during conceptualization and refinement stages for a new company may be especially helpful in ensuring that a health and nutrition perspective is considered in the business model
	Provide incentives for MDAs to provide convenient, affordable and sustainable meals
	Create regulatory and technical solutions to mandate display of verified menu information with nutrients and health advice; create a mechanism to monitor adhering to this regulation
	Require aggregator platforms to share the large volumes of data that they have collected, which is currently private for commercial sensitivity and data privacy regulations, to support research analyses
Private sector	Provide information on how the consumption profile of a specific person may impact their health and how to provide them with suggestions of healthier options
	Define, design, test and standardize an innovative restaurant and menu data exchange protocol that includes nutrient, health and carbon footprint information
	Reward and encourage consumers to choose healthier food items by using rewards points and offers, vouchers, badges and social media offers
	Target recommendations on healthy eating by utilizing profiling from social media and gaming platforms as additions to apps to ensure that children and young people are informed of the dangers of unhealthy food (e.g. the GAMification for a Better Life platform developed as part of the EU-supported Project Gable EU could further be developed to inform people of the dangers of unhealthy food)

Paradigm shifts	
Government	Encourage policy coherence through the systematic promotion of mutually reinforcing policy actions across government departments and agencies creating synergies towards achieving the agreed objectives; ensure coherence between health, innovation, food and environmental policies
	Create a cross-ministerial taskforce (e.g. those governing innovation and technology) to address outstanding concerns
Private sector	Encourage small and medium technology enterprises with access to nutrient data to partner together with food platforms to target the OOH sector and create a healthy, sustainable and informed environment for the well-being of consumers

Research methodology using user experience, based on app usage analytics, online order app recordings, interviewing and observing focus groups in simulation environments is a good area that policy-makers and researchers could focus on to understand app usage and explore possibilities to collaborate with aggregators to introduce nutritious and healthy food choices.

Acquisitions and merger of MDAs have resulted in the dominance of fewer, larger MDAs within the OOH food market in the WHO European Region. This continuous market aggregation is a positive trend from the nutrition and healthy food perspective, as influencing a small number of meal delivery platforms would allow a maximum impact on national or regional levels. By comparison, working directly with a large number of restaurants would be a major undertaking. All major aggregator platforms are publicly listed in major stock markets. This is a catalyst for them to be interested in public opinion and to promote healthy and sustainable food, which eventually draws interest from both end users and investors. Policy-makers should identify this as an opportunity to positively influence the sector for promoting nutritional and healthy food.

Major challenges identified are the lack of available data such as restaurant information, menu information and advertising, the lack of standardization of the available data, variations in the languages used for collected data and unverified information.

Conclusions

“On the path towards digitalization, promoting healthy food – off and online – will be vital. Innovative policies will be needed to address digital challenges.”

Hans Kluge, Regional Director, WHO Regional Office for Europe (during the Conference on future steps to tackle obesity: digital innovations into policy and actions, June 2021).

As a part of the food system, MDAs can contribute to the perpetuation of unhealthy and environmentally unsustainable food choices, with potential negative health implications. There is a minimal pool of peer-reviewed studies on MDAs to draw from currently, yet the trajectory appears to lack any prioritization of the nutrition and potential health outcomes of the products they sell.

Despite the lack of a good evidence base, innovators, policy-makers and public health experts alike will need to join forces to devise new strategies and incentives that lead to healthier and more environmentally sustainable meal options. A systems approach to addressing the impacts of MDAs on health and nutrition outcomes will be required. Left unaddressed, MDAs can play a significant role in increasing the accessibility of energy-dense and nutrient-poor food and beverages high in salt, unsaturated fats, trans-fats and added sugars. This, in turn, could add to increased NCD risk and health burden. As such, there is a clear need for further evidence as well as strong, effective policies in this area. Such policies could encourage MDAs to become a driving force to improve diets and reduce NCD risk across the WHO European Region.

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The WHO Regional Office for Europe

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