Identifying Online Only Delivery Food Outlets in the North of England Using Data from Food Delivery Apps

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ABSTRACT

Background

Local authorities (local government) in England is responsible for promoting a healthy food environment. The food environment includes any opportunity to obtain food which includes physical and virtual environments. However, currently both local and national policy only regulates around restricting types of food available in the physical food environment Over the past decade there has been a substantial rise in the virtual food outlets where customers can only order food online using an app. This creates challenges for promoting a healthy food environment if policy on regulates the physical but not virtual environment. To support public health policy making this research explored prevalence of online only delivery kitchens in four Northern areas in England and if current data collection methods for monitoring the food environment can capture these outlets.

Methods

Data was collected using automated searches on food delivery websites for four areas in the North of England. Data from the Food Standards Agency (FSA) and Google were used for business registration details, location and validation. Prevalence of outlets adjusted by population size, premise type, Positive Predicted Value for comparing accuracy with the FSA data and Sensitivity were estimated.

Results

Newcastle had 118 online only delivery food outlets or 15 per 100,000 people, Gateshead had 116 outlets or 59 per 100,000 people, Middlesbrough had 36 outlets or 9 per 100,000 people , and Lancaster had 107 outlets or 26 per 100,000 people.. Approximately 40% were operating from existing business sites. PPV was 100% in all areas. Sensitivity was 15.9% in Newcastle upon Tyne, 17.4% in Gateshead, , 9.1% in Middlesborough, and 26.2% in Lancaster.

Conclusions

Current policy tools that manage the built environment do not consider the virtual food environment. This may limit their ability to promote a healthy food environment.

Key words

food environment, public health, online food outlets, England

Introduction:

The Health and Social Care Act 2012 gave Local Authorities (local government) in England the statutory duty to support improving population health [1]. The food environment is defined as any opportunity to obtain food which includes the physical food environment, the virtual food environment and socio-cultural and political influences at the micro and macro level which influences our food choices and subsequently our health [2]. Drawing upon a robust evidence base demonstrating a relationship between childhood obesity and the food environment [3, 4], national public health guidance was developed to encourage and support Local Authorities to use the planning system to create environments that are supportive of promoting a healthy weight [5]. Approximately 50% of Local Authorities have adopted planning guidelines restricting planning permission for new takeaways to promote a healthier food environment [6]. There is a growing body of evidence that planning policy can reduce the density and proportion of takeaways [7].

However, over the past decade and accelerated by the Covid-19 pandemic there has been a growth in the virtual food environment via online only food outlets that provide food for home delivery only via an app [8]. These are sometimes called Dark Kitchens or Cloud Kitchens. These types of businesses can operate out of individual homes, industrial units, or from existing food businesses [9].

The virtual food environment raises two important challenges. Firstly, virtual food outlets may not be restricted by current planning guidance which solely applies to physical outlets. This means that these outlets may not be classified by planning policy as takeaways and thus not be restricted by planning guidance used by Local Authorities to promote a healthy food environment. Thus, it is important to understand the prevalence of these types of outlets and where they are operating from (e.g. industrial unit, existing food business). As the food environment relates to any opportunity to obtain food either physically or virtually the proliferation of online only food outlet may increase access to unhealthy food which will negatively impact on population health. This would suggest that policy guidance related to promoting a healthy food environment needs to be revised to consider the virtual food environment.

The second challenge is around monitoring of virtual outlets. Because these types of businesses may run out of existing outlets a priori it is not clear if existing instruments to monitor and evaluate the food environment such as the Food Standard Agency Food Hygiene Rating Scheme Data (FSA FHRS) capture these online only delivery businesses. It is a statutory requirement that new food businesses must register with the FSA 28 days before opening [10] but if virtual food businesses are operating out of existing kitchens or individual homes this may not happen. For physical food outlets, the FSA FHRS has been identified as a high quality dataset to monitor and evaluate the food environment [11]. Having accurate data on the food environment both physical and virtual is essential for public health teams within Local Authorities to be able to support the promotion of a healthy food environment.

Given these potential challenges of the virtual food environment for local authorities, this research aimed to estimate the prevalence of online only food outlets, identify what type of premise they operate out of and if these outlets are captured in the FSA FHRS data in four areas in the North of England namely Gateshead, Lancaster, Middlesbrough, and Newcastle upon Tyne. These four areas are small to medium size towns and cities. All areas have higher than average deprivation with Gateshead, Middlesbrough and Newcastle upon Tyne are all in the 20% most deprived deciles whereas Lancaster is in the bottom third [12]. There is a strong association between deprivation and a higher concentration of unhealthy food outlets [13]. Our chosen local authorities serving more socioeconomically disadvantaged populations are already managing significantly unhealthy food environments. In these areas, online only food outlets may further compound these existing challenges, intensifying exposure to unhealthy foods through delivery-based models that are absent within traditional planning frameworks. Identifying the prevalence of these outlets and any potential gaps in data collection are particularly relevant in areas experiencing higher levels of deprivation, where health inequalities are already notably pronounced. Our findings can be used to help the development of policy by considering the virtual as well as physical food environment to support population health and reduce health inequalities.

Globally, high- and middle-income countries are all experiencing a proliferation in online only food delivery outlets [14]. Thus, our findings will be relevant to policy makers who

regulate the food environment internationally by considering the potential health and health inequality implications to the food environment of the growth of the virtual food environment.

Methods

We followed the STROBE checklist for cross-sectional studies to ensure that our study was transparent and reproducible and identifies potential weaknesses of our approach

Data

This study uses data from Deliveroo, Uber Eats, and Just Eat[1] websites as well as information from Census 2021 [15] and the FSA Food Hygiene Rating Scheme Data [16]. Deliveroo, Uber Eats and Just Eat are the three largest delivery platforms in the UK by market share [17]. By taking data from these apps, we are expecting to capture most of the online food delivery market.

Accessing Data

Figure 1 presents a flow chart of the data acquisition and cleaning process. This study employed a combination of manual and automated data scraping from the three largest delivery apps in the UK Deliveroo, Uber Eats, and Just Eat: and field validation using Google Maps to gather data on online only delivery food outlets operating in four Northern areas in the UK. Python code which is available via: https://github.com/Hannah-Groves/Dark-kitchens-project/ was used to extract data on restaurant names, addresses, types of cuisine, delivery times, prices, and food hygiene ratings. The code was run when most takeaways are expected to be open (in the evenings Wednesday-Saturday from 6-11pm). Outlets are only present on the app when they are open for customers, thus we chose times when the highest number of outlets were likely to be open. We tested the codes at other times such as the afternoon and on Mondays and Tuesdays. Therefore, it is important to note that running the code at a different day and time may yield different results.

[1] Deliveroo: Deliveroo - Takeaway Food Delivery from Local Restaurants & Shops
Uber Eats: Uber Eats | Food delivery and takeaway | Order online from restaurants near you
Just Eat: Order takeaway online from 30,000+ food delivery restaurants | Just Eat (just-eat.co.uk)

The scraped data was then cleaned and organised using Excel. This involved removing duplicates, correcting inconsistencies, and categorising the data to ease interpretation. To validate the accuracy of the data collected from food delivery websites, each address was examined using Google Maps and Street View. This process locating each food place on the map and using a 360-degree view of the address to check for customer-facing shop fronts. This manual verification process helped identify any discrepancies or errors in the automated data collection. When errors were encountered (e.g. incorrect address format or details), the collected address was corrected and substituted with the accurate format and information. We found 17 address errors out of a total of 1,640.

Outcome Variables

In our analysis we focus on a range of outcome measures related to our two research aims of identifying the prevalence of online only food delivery outlets and where they are operating from and the second research question of if existing data sources to monitor food outlets are capturing online only food delivery outlets. To explore the prevalence of online only food delivery outlets the outcome measures we will look at are: 1) count of online only delivery food outlets that delivered to the four areas identified via delivery food apps; 2) count and percentage of online only delivery food outlets that are operating out of customer facing food outlets currently operating as take aways (where food is primarily offered for consumption off the premises) and customer facing food outlets currently operating as either restaurants or pubs; and 3) count of online only delivery food outlets standardised per 100,000 in the population for the four areas. The mean for number of online only food outlets was standardised per 100,000 of the population so that the results can be comparable across the four areas used in the analysis. To explore if and how current data collection mechanisms are identifying online only food delivery outlets we will look at: 1) counts of online only food delivery outlets in each of the four areas that are recorded in the FSA FHRS datasets and 2) *Positive Predicted Value* of discrepancies between FSA FHRS data and food delivery apps and *Sensitivity* which shows percentage of online delivery food outlets of total food businesses in each of the four areas.

Analysis

Descriptive analysis was performed. We estimated the counts and means for the outcome variables. We estimated the Positive Predicted Value (PPV) and Sensitivity the formulas are below:

PPV=True Positive/(True Positive + False Positive) (1)

Sensitivity= True Positive/(True Positive + False Negative) (2)

Where True Positive is the number of outlets present in both the food delivery app and the FSA FHRS data. False Positive is the number of outlets present in the food delivery app but absent in the FSA FHRS data, and False Negative is the number of outlets present in the FHRS data but absent in the food delivery app data (number of food businesses in each area). PPV represent the probability that the online only food delivery outlet will be present in the dataset. Sensitivity measures the likelihood of being able to identify all online only food delivery outlets. Both PPV and Sensitivity are presented as percentages. Higher percentages indicate higher accuracy.

Results

Table 1 presents descriptive statistics for the five outcome variables. Firstly, we will discuss the findings in relation to prevalence and where online only food outlets are operating from. Newcastle upon Tyne had 118 outlets available on the food delivery app, followed by Gateshead with 116, Middlesbrough had 36 outlets and Lancaster had 28. Adjusting online only food delivery outlets by population size, Newcastle upon Tyne had 15 online only delivery food outlets per 100,000 people, Gateshead 59 per 100,000 people. Middlesbrough had 9 per 100,000 people. Lancaster had 27 per 100,000 people. In Newcastle upon Tyne, 48 or 40% of online only delivery food outlets operated from multi-business sites (using the same address, premises and/or kitchen facilities), Gateshead had 43 or 37% of all online only food delivery outlets operated from multi-business sites and Middlesbrough had 16 or 44% of all online only food delivery outlets were multi-business sites. Lancaster had 12 or 42% of all online only food delivery outlets operated from multi-business sites.

Next, we will report findings to understand if current reporting mechanisms are identifying In the FSA FHRS data, there were 624 food businesses in the FSA FHRS data

in Newcastle upon Tyne, 551 food businesses in the in Gateshead, 358 in Middlesbrough and 107 in Lancaster. Comparing the data on food delivery apps with data on food outlets available from the FSA FHRS data we find a PPV of 100% in all four areas. Gateshead had a Sensitivity of 17.4%, Lancaster had a Sensitivity of 26.2%, Middlesbrough had a Sensitivity of 9.1% and Newcastle upon Tyne with a Sensitivity of 15.9%. Sensitivity measure captures the percentage of food businesses that are delivery only in the wider food environment for each of the four areas. This suggests that between 10% to 26% of food businesses are operating in the virtual food environment.

Discussion

The study explored the prevalence of online only food delivery outlets, identified what type of premise they operate out of and if these outlets are captured in existing data to monitor the food environment (FSA FHRS) for four Northern areas in the UK: Gateshead, Newcastle upon Tyne, Middlesborough, and Lancaster. Advances in e-commerce technology has facilitated growth of the online food delivery market [8]. Online delivery services increase the availability of unhealthy food contributing to an unhealthy food environment [18]. In our study, the highest prevalence of online only food delivery outlets was found in Gateshead and Newcastle upon Tyne with Lancaster having the second highest prevalence per capita. Online only food delivery outlets comprise between 10-26% of food businesses. Approximately 40% of these outlets are operating out of existing food businesses. Current reporting mechanisms for monitoring the food environment are capturing these outlets

There is a lack of research on the virtual food environment from a public health perspective. There are some studies from England looking at some aspects of this business delivery model. One study from England found that online only food outlets account for 14% of the virtual food environment which is consistent with our findings [19]. Another study from England focused on the operational models of online only good outlets and why businesses choose this model [20]. This type of evidence is useful for considering why businesses choose this model.

Currently, local government can use their planning powers to restrict new hot food takeaways (fast food) [21]. However, this planning power does not cover businesses

operating in the virtual sphere which may also operate beyond local authority borders. One of our study area's Gateshead has used its planning powers to restrict all new hot food takeaways (fast food). This policy has been shown to reduce the proportion and density of hot food takeaways in the food environment [7]. Yet, Gateshead has the highest number of online only food outlets as these businesses are not restricted by planning guidance. This suggests that since there is no legislation available to restrict online only food outlets these types of food businesses may impact on local government's ability to promote a healthy environment. This could have implications for population health, health inequalities and obesity rates going forward.

Policy Recommendations

This study provides information on the prevalence, type of premises operating out of, and identification in existing datasets of online only delivery food outlets for four areas in the North of England. This is an under researched area and the results highlight potential challenges around a lack of current legislative tools to limit and restrict the virtual food environment. This may negatively impact on local and national government's ability to promote a healthy food environment. Future research and policy need to consider if and how online only food delivery outlets are classified for planning purposes. Another policy recommendation is changing the geographical boundaries for making planning decisions such as regional planning authorities like combined mayoral authorities to help promote a healthy food environment given the rise of the virtual food environment which operate on different geographies

Limitations of this study

The data from food delivery apps on online only delivery food outlets is dynamic and changes by time of day. It is not clear on the rate of entry or exit to the market for this type of business. Thus, our findings are a snapshot in time. Some of the delivery only online food outlets also provide a pickup service at a physical restaurant, currently we have included these in our study. Our findings are then an upper bound of available outlets in the virtual space as it includes some outlets that have a physical location. However, our results highlight gaps with current planning tools that warrant further exploration and consideration in both research and policy making. Our analysis is limited to four areas

in Northern England. Future research is required in other regions and areas in both the UK and internationally.

Conclusion:

Our analysis of four Northern cities and towns in England found that online only food delivery outlets comprise between 10-26% of the food environment. Current planning policy does not provide any mechanisms to restrict these types of outlets. This may have implications for public health if people have greater exposure to unhealthy food via the virtual food environment.

Declarations

Ethics approval and consent to participate: This study did not use personal data and therefore does not require ethical approval or consent to participate.

Consent for publication: Not applicable

Availability of data and materials: The datasets generated from this project came from : Deliveroo - Takeaway Food Delivery from Local Restaurants & Shops; Uber Eats | Food delivery and takeaway | Order online from restaurants near you; Order takeaway online from 30,000+ food delivery restaurants | Just Eat (just-eat.co.uk). Meta data to extract the information used in the study can be found here: https://github.com/Hannah-Groves/Dark-kitchens-project.git

Competing interests: None

Funding: This research was funded by the National Institute for Health and Care Research (NIHR160406). HB and DC are supported by the NIHR Applied Research Collaboration for the North West Coast (NIHR200182) (HB and DC).

Authors' contributions: AAL, HJM, EB, SL, CO'M, ET, MC, TT and HB conceptualised the study design and acquired the research funding. CB and DC helped to codevelop the data analysis plan. HG extracted the data and undertook the analysis. HB and DC supervised HG. HG with support from HB drafted the manuscript. All authors read and approved the final manuscript

Acknowledgements: Not Applicable

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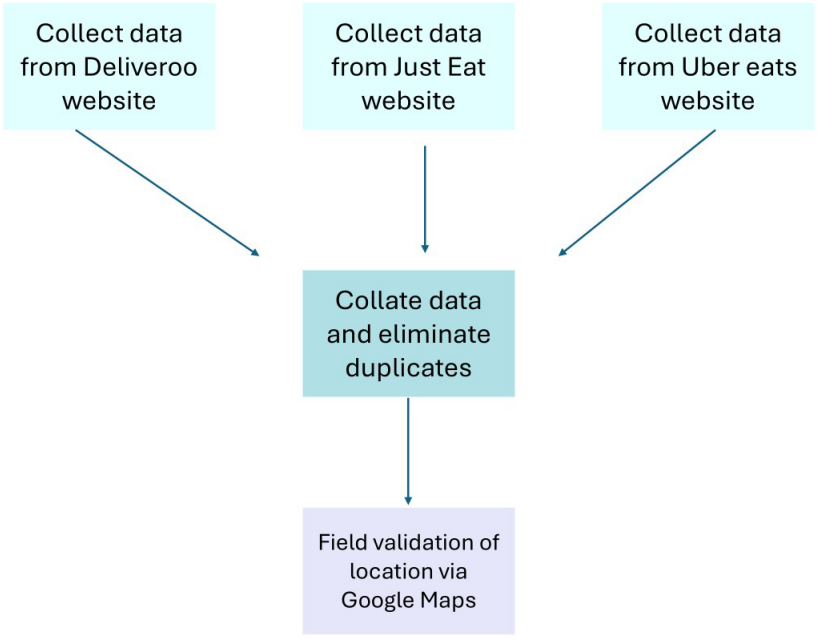
Figure 1: *Data Acquisition and Cleaning Process*



Alt text: There are five boxes in total three on the top, one in the middle, and one on the bottom The top three boxes contain the text Collect Data from Just Eat Website, Collet data from Deliveroo website and Collect Data from Uber Eats website. There are three arrows pointing from the top three boxes down to the middle box. The middle box contains the text Collate Data and Remove Duplicates. There is an arrow from this box to the box on the bottom which contains the text Field Validation of location via Google Maps.

Table 1: *Descriptive Statistics of online only food delivery outlets in the 4 northern areas*

	GATESHEAD	LANCASTER	MIDDLESBROUGH	NEWCASTLE UPON TYNE
Number of outlets on food delivery apps*	116	28	36	118
Number of establishments providing or selling food in FSA FHRS+	551	107	358	624
Number of online only food outlets in FSA FHRS data	116	28	36	118
PPV	100%	100%	100%	100%
Sensitivity	17.4%	26.2%	9.1%	15.9%
Number (%) of outlets at multi-business sites	43 (37%)	12 (42%)	16 (44%)	48 (40%)
Number of outlets per 100k people	59	27	9	15

Notes: *Food Delivery Apps searched include Deliveroo, UberEATS, and Just Eat

+ This includes all food businesses that are eligible for an inspection by the Food Standards Agency.