Short Communication

Factors associated with ordering food via online meal ordering services

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Abstract

Objective: Online meal ordering services are increasing in popularity in Australia and globally. Meals ordered online for home delivery are typically less healthy than home-made meals, potentially contributing to weight gain. The aim of the present study was to identify the types of consumers who are most likely to engage in online meal ordering.
Design: A cross-sectional survey including items relating to demographic and lifestyle factors was disseminated via a web panel provider.
Setting: Australia.
Participants: A total of 2010 Australian adults aged 18+ years.
Results: More than a quarter of respondents (28 %) engaged in online meal ordering at least once in the previous month. Younger respondents, those with a higher BMI, and those with higher education and income levels were more likely to have done so. Consuming higher levels of sugary drinks and fast-food restaurant patronage were significantly associated with ordering meals online for home delivery.
Conclusions: The outcomes of this study suggest that the use of online meal ordering services is becoming a common practice in Australia, and it is therefore important to implement evidence-based strategies and policies to encourage individuals to make healthy food choices when using these services.

Weekly expenditure on food and non-alcoholic beverages in Australia increased by an average of 16 % between 2009 and 2016[1]. Contributing to this increase is the growing popularity of home-delivered meals, a trend that is also reflected in global food purchase patterns[2–5]. Online meal delivery services are internet or application-based services through which consumers can order and receive ready-to-eat meals[6]. They include a wide range of delivery services, such as those provided by local restaurants and Uber Eats. Market research conducted by Roy Morgan has found that approximately one in five Australians (aged 14+ years) order a meal online at least once every 3 months, and that this prevalence rate has nearly doubled in the last 2 years[4,7].

Individuals who more frequently consume meals that are cooked outside the home are more likely to have poorer diets and to gain weight[8–11]. The trend towards online ordering is therefore problematic if the foods provided are typically unhealthy. A recent study conducted in three cities (Chicago, Amsterdam and Melbourne) suggested that this is indeed the case, with the most commonly advertised meals for home delivery being unhealthy options (e.g. burgers and pizzas)[12].

Most research to date on the use of online meal ordering services has focused on (i) consumers' attitudes towards the services and (ii) the capacity of restaurants to utilise these platforms[13–17]. In addition, some studies have assessed the demographic factors associated with use of online food ordering services, with this work finding that young adults, people residing in cities and people with previous experience ordering goods and services online being the most frequent users[2,7]. There appears to be a lack of information on other user characteristics to identify groups of consumers who are most likely to adopt this form of food purchasing. Examples of such characteristics include fruit,

vegetable, fast-food and soft drink consumption; alcohol and tobacco use; engagement in physical activity; and sleep adequacy. Such information would provide insight into the extent of use of online meal delivery services and identifying groups of consumers that may most benefit from interventions designed to (i) encourage healthier food choices when ordering home-delivered meals and/or (ii) provide targeted information to service users about quick, tasty and healthy meals that can be prepared at home, thereby reducing the attractiveness of externally supplied options. In addition, more detailed profiling of these groups would facilitate tracking of the extent to which providers of unhealthy foods are targeting specific types of consumers. To address this research gap, the present study assessed a broad range of demographic and lifestyle factors to identify those who are most likely to engage in online meal ordering and thus could be the focus of future intervention efforts.

Methods

Study participants

Australian adults aged 18+ years (*n* 2010) completed an online survey disseminated via a web panel provider (Pureprofile). Data collection occurred from 23 July to 15 August 2018. The sample was nationally representative in terms of gender, age, socio-economic status and location (metropolitan *v.* regional).

Measures

Socio-demographics

Age, gender, education level (1 – ≤Year 11 to 7 – ≥postgraduate diploma or above), and annual gross household income (1 – ≤$9999/year to 5 – ≥$125 000/year) were assessed. In addition, respondents were asked to report whether they were the parent of a child younger than 18 years of age.

Physical health factors

Self-reported weight and height were used to calculate BMI (kg/m^2). Self-rated health (1 – poor to 5 – excellent) and sleep adequacy (1 – rarely to 5 – daily) were also assessed.

Physical activity

Respondents reported the total amount of time spent doing moderate and vigorous physical activity in the last week. Those who engaged in ≥150 min/week of moderate and vigorous physical activity were classified as meeting the physical activity guideline[18].

Smoking

Respondents were asked to report their smoking status. Those who did not smoke regularly (regular smoking defined as consuming at least one cigarette/d or 7/week) were classified as meeting the relevant health recommendation.

Alcohol intake

Average alcohol intake was calculated by combining the items assessing frequency of alcohol consumption (1 – less than once a month to 7 – every day) and the number of standard drinks consumed on a typical drinking occasion (1 – half a drink to 11 – 20+ drinks)[19]. Those consuming an average of ≤2 standard drinks of alcohol per d were classified as meeting the long-term risk guideline[20]. Respondents consuming ≤4 standard drinks on a single occasion in the past 12 months were classified as meeting the short-term risk guideline[20].

Food preparation and consumption behaviours

Respondents' usual intake of fruit and vegetables was assessed. Those consuming ≥5 servings of vegetables/d and ≥2 servings of fruit/d were classified as meeting the respective intake guidelines[21]. Respondents reported the extent to which they enjoy cooking, consider themselves to be a good cook and feel confident to cook a nutritious meal (5-point scale from 1 – strongly disagree to 5 – strongly agree). Further items assessed the number of days respondents consumed sugary drinks ('During the past 7 d, on how many days did you drink a can, bottle, or glass of a sugary drink such as soft drinks (like Coke/lemonade), energy drinks (like Red Bull), fruit drinks, sports drinks (like Gatorade), and cordial?') and ate at a fast-food restaurant in the week prior to the survey ('During the past 7 days, on how many days did you eat at a fast food outlet?'). Any special dietary requirements due to health or weight loss concerns were also assessed.

Online meal delivery services

Respondents were asked how often they had ordered meals online in the previous month. For analysis purposes, responses were dichotomised (0 – did not order meals online in the month prior to the survey *v.* 1 – ordered a meal online at least once in the month prior to the survey).

Statistical analyses

A series of univariate logistic regression analyses was conducted to assess the relationship between each predictor variable and the use of online meal ordering services at least once in the previous month. Variables found to be significant (*P* < 0·05) were included in a multivariate logistic regression model. Analyses were conducted using Stata version 16.1[22].

Results

Just over one in four (28 %) respondents ordered a meal via an online service in the month prior to the survey, with 10 % ordering on average once a week. The mean frequency of ordering meals online across the entire sample was once/month, increasing to once/week among those who had ordered in the previous month (*n* 556). Descriptive

Table 1 Descriptive characteristics of the study sample and factors measured (*n* 2010)

Categorical variables	*n*	%
Gender – males	991	49
Had a child <18 years	593	30
BMI – overweight/obese (≥25 kg/m^2)	886	56
Met fruit intake guidelines (≥2 servings/d)	1036	54
Met vegetable intake guidelines (≥5 servings/d)	222	11
Met MVPA guidelines (≥150 min/week)	834	41
Drink alcohol at long-term risk level (>2 standard drinks/d)	147	7
Smoking regularly	322	16
Drink alcohol at short-term risk level (>4 standard drinks/d)	730	36
Frequency of online meal delivery service use in previous month		
None	1454	72
1–3 times a month	363	18
≥4 times a month	193	10
Continuous variables	Mean	SD
Age (in years)	46·60	17·37
Education (1 – ≤Year 11 to 7 – ≥postgraduate diploma)	4·19	2·04
Annual household income (1 – ≤9999/year to 5 – ≥$125 000/year)	3·52	1·05
Fast-food intake (d/week)	1·03	1·36
Sugary drinks intake (d/week)	1·77	2·26
Sleep adequacy (1 – rarely to 5 – daily)	3·19	1·41
Self-rated health (1 – poor to 5 – excellent)	3·00	0·93
Enjoy preparing food (1 – strongly disagree to 5 – strongly agree)	3·64	1·05
Level of confidence preparing food (1 – strongly disagree to 5 – strongly agree)	3·45	1·05
Level of confidence preparing a nutritious meal (1 – strongly disagree to 5 – strongly agree)	3·93	0·88
Had dietary requirements related to health and/or weight loss reasons – Yes	536	27

MVPA, moderate and vigorous physical activity.

characteristics of the study population and measures are presented in Table 1.

Univariate logistic analyses revealed that the following factors were significantly associated with the use of online meal delivery services: age, gender, income, education, BMI, being a parent, meeting fruit intake guideline, meeting the moderate and vigorous physical activity guideline, frequency of fast-food intake, frequency of sugary drinks intake, meeting the short-term alcohol intake guideline, self-rated health, sleep adequacy, enjoying preparing food and cooking confidence. The subsequent multivariate logistic regression model showed that younger respondents, those with a higher BMI, and those with higher levels of education and income were more likely to use these services at least once a month (see Table 2). Additionally, the likelihood of using these services at least monthly was higher among those who reported consuming fast-food and sugary drinks more frequently.

Discussion

Just over a quarter of respondents used online meal ordering services at least once in the previous month, and one in ten used them weekly. In line with prior research, younger and overweight or obese respondents, and those with higher education and income levels were found to be more likely to use these services[2,4,7,23,24]. Consistent with previous research showing that home-delivered meals tend to be unhealthy[12], the present study found that the use of home delivery services was greater among those consuming soft drinks and eating at fast-food restaurants more often.

In combination with previous work, the results suggest that the use of online meal ordering services may be becoming a mainstream activity in Australia and globally[4,7], a trend that appears to have since intensified with the COVID-19 pandemic[25]. While public health practitioners and policy-makers have introduced some strategies to help control the proliferation of fast-food establishments and assist the public to make healthier food choices in Australia and other countries[26–28], online services present new challenges. For example, customers have access to product labelling in supermarkets and energy labelling on menus in some fast-food outlets, but in most Australian states there is no requirement on food delivery services to provide nutrition information. This has also been reported in UK[29]. It will become increasing important to address this deficit as more people choose to consume home-delivered meals.

Recent research provides some indication of how online purchase environments can be altered to encourage healthier selections. The strategies identified in online grocery shopping contexts include explicitly drawing attention to healthier choices, increasing the ratio of available healthier options relative to unhealthier options and providing filters that enable shoppers to refine their searches according to specific nutrition-related criteria[30,31]. It remains to be seen whether such strategies would be effective in the online meal ordering context, and

Table 2 Factors associated with the use of online or app-based meal delivery services

	OR	SE	95 % CI for OR	P
Age	0·93	0·01	0·92, 0·94	<0·001
Gender – males	1·09	0·17	0·81, 1·48	0·553
Income	1·21	0·09	1·04, 1·41	0·013
Education	1·10	0·04	1·02, 1·19	0·013
Had a child <18 years	1·11	0·17	0·82, 1·49	0·497
BMI – overweight/obese	1·42	0·23	1·04, 1·94	0·025
Met fruit intake guidelines	1·19	0·18	0·89, 1·60	0·232
Met vegetable intake guidelines	–	–	–	–
Met MVPA guidelines	1·15	0·17	0·85, 1·54	0·362
Fast-food intake	1·60	0·10	1·41, 1·82	<0·001
Sugary drinks intake	1·09	0·04	1·02, 1·16	0·003
Drink alcohol at long-term risk level	–	–	–	–
Drink alcohol at short-term risk level	1·34	0·11	1·00, 1·79	0·051
Smoking	–	–	–	–
Adequate sleep	0·87	0·13	0·65, 1·17	0·372
Self-rated health	1·12	0·10	0·94, 1·34	0·201
Enjoy preparing food	1·02	0·09	0·86, 1·20	0·858
Level of confidence preparing food	1·10	0·10	0·93, 1·31	0·271
Level of confidence preparing a nutritious meal	–	–	–	–
Had dietary requirements related to health or weight loss reasons	–	–	–	–

MVPA, moderate and vigorous physical activity.
'–' indicates a non-significant association for univariate logistic regression analyses.

particularly among those population segments identified in this and previous research as being most likely to engage in this form of food purchase.

Given the difficulties associated with requiring food providers to modify their product ranges and labelling practices, advocacy can play an important role in bringing to bear the pressure required to encourage positive changes in marketing practices. This encouragement could take the form of 'name and congratulate/shame' reporting that publicises the providers with the best and worst nutritional profiles for their meal offerings[32]. Providing incentives in the form of recognition or endorsement has been found to improve the range of healthier ready-to-eat meals sold by food outlets[33]. In some instances, mandatory restrictions may be feasible due to the vulnerability of specific population segments. The findings of the present study are consistent with those from research conducted elsewhere indicating that online ordering is especially prevalent among younger people[2,23,24], making this group a priority segment for the development and implementation of appropriate interventions. For example, international evidence highlights the importance of introducing regulatory frameworks that limit the penetration of online ordering systems in settings where young people congregate, especially schools[23].

Study strengths and limitations

The present study provides unique insights into which population subgroups are using online meal ordering services in a national sample of Australian adults. Although the data were collected prior to the COVID-19 pandemic, the results are timely given the substantially increased reliance on food deliveries during this period and the potential for this trend to continue into the future.

The primary limitation of this study was its cross-sectional design, which prevents determination of causal relationships between the assessed food consumption behaviours and the use of online meal ordering services. A second limitation was the use of a web panel for recruitment, which may have resulted in a sample that was skewed on relevant non-assessed variables (e.g. technology readiness). Future research may use different recruitment methods and a prospective design to provide additional information on factors predicting the use of online meal ordering services. Third, the data were self-reported and therefore potentially subject to social desirability bias. The final limitation was that this study was conducted in one country, Australia, and the results may not apply to the situations in other countries. Additional research could be undertaken in other national contexts to assess the extent of potential generalisability.

Conclusion

Online meal ordering is increasing in popularity in Australia, which is likely to have implications for diet quality at the population level. The present study found use of online ordering services to be greatest among younger people, those with higher levels of education and income, those of higher BMI, and those consuming more fast food and sugary drinks. Overall, the results highlight the need for evidence-based public health nutrition interventions and policies to be introduced in this space to ensure the increasing number of people using online meal ordering services have access to the nutrition information they need to make informed choices.

Acknowledgements

References

1. Australian Bureau of Statistics (2017) Household Expenditure Survey, Australia: summary of Results, 2015–2016. https://www.abs.gov.au/ausstats/abs@.nsf/Latestproducts/6530.0Main%20Features12015–16?opendocument&tabname=Summary&prodno=6530.0&issue=2015–6&num=&view= (accessed May 2020).
2. Maimaiti M, Zhao X, Jia M *et al.* (2018) How we eat determines what we become: opportunities and challenges brought by food delivery industry in a changing world in China. *Eur J Clin Nutr* **72**, 1282–1286.
3. Pigatto G, Machado JGCF, Negreti AS *et al.* (2017) Have you chosen your request? Analysis of online food delivery companies in Brazil. *Br Food J* **119**, 639–665.
4. Roy Morgan Research (2018) Metrotechs and Millennials have taken to Uber Eats, Menulog, Deliveroo, Foodora and more. http://www.roymorgan.com/findings/7602-food-delivery-services-march-2018–201805240625 (accessed May 2020).
5. Statista (2020b) Online Food Delivery – worldwide. https://www.statista.com/outlook/374/100/online-food-elivery/worldwide#marketrevenue (accessed May 2020).
6. Ray A, Dhir A, Bala PK *et al.* (2019) Why do people use food delivery apps (FDA)? A uses and gratification theory perspective. *J Retail Consum Serv* **51**, 221–230.
7. Roy Morgan Research (2020) Meal delivery services double usage in only 18 months. http://www.roymorgan.com/findings/8270-food-delivery-services-september-2019–202002030451 (accessed May 2020).
8. Drewnowski A (2018) Nutrient density: addressing the challenge of obesity. *Br J Nutr* **120**, Suppl. 1, S8–S14.
9. Taher AK, Evans N & Evans CE (2019) The cross-sectional relationships between consumption of takeaway food, eating meals outside the home and diet quality in British adolescents. *Public Health Nutr* **22**, 63–73.
10. Seguin RA, Aggarwal A, Vermeylen F *et al.* (2016) Consumption frequency of foods away from home linked with higher body mass index and lower fruit and vegetable intake among adults: a cross-sectional study. *J Environ Public Health* **2016**, 3074241.
11. Tiwari A, Aggarwal A, Tang W *et al.* (2017) Cooking at home: a strategy to comply with US dietary guidelines at no extra cost. *Am J Prev Med* **52**, 616–624.
12. Poelman MP, Thornton L & Zenk SN (2020) A cross-sectional comparison of meal delivery options in three international cities. *Eur J Clin Nutr* **74**, 1465–1473.
13. Cho M, Bonn MA & Li J (2019) Differences in perceptions about food delivery apps between single-person and multi-person households. *Int J Hosp Manag* **77**, 108–116.
14. Correa JC, Garzón W, Brooker P *et al.* (2019) Evaluation of collaborative consumption of food delivery services through web mining techniques. *J Retail Consum Serv* **46**, 45–50.
15. Kapoor AP & Vij M (2018) Technology at the dinner table: ordering food online through mobile apps. *J Retail Consum Serv* **43**, 342–351.
16. Kimes SE & Laque P (2011) Online, mobile, and text food ordering in the U.S. restaurant industry. Cornell Hospitality Report 11. https://scholarship.sha.cornell.edu/cgi/viewcontent.cgi?article=1070&context=chrpubs (accessed May 2020).
17. Yeo VCS, Goh SK & Rezaei S (2017) Consumer experiences, attitude and behavioral intention toward online food delivery (OFD) services. *J Retail Consum Serv* **35**, 150–162.
18. Australian Government Department of Health (2014) Australia's Physical Activity and Sedentary Behaviour Guidelines. Canberra, Australia: Australian Government Department of Health; available at http://www.health.gov.au/internet/main/publishing.nsf/content/health-pubhlth-strategphys-act-guidelines/ (accessed May 2020).
19. Australian Institute of Health and Welfare (2017) National Drug Strategy Household Survey (NDSHS) 2016: Detailed Findings. Canberra: AIHW; available at https://www.aihw.gov.au/getmedia/15db8c15–7062–4cde-bfa4–3c2079f30af3/aihw-phe-214.pdf.aspx?inline=true (accessed May 2020).
20. National Health and Medical Research Council (2009) Australian Guidelines to Reduce Health Risks from Drinking Alcohol. Canberra, Australia: NHMRC; available at https://www.nhmrc.gov.au/about-us/publications/australian-guidelines-reduce-health-risks-drinking-alcohol#block-views-block-file-attachments-content-block-1 (accessed May 2020).
21. National Health and Medical Research Council (2013) Australian Dietary Guidelines. Canberra, Australia: NHMRC; available at http://www.nutritionaustralia.org/national/resource/australian-dietary-guidelines-2013/ (accessed May 2020).
22. StataCorp (2020) *Stata Statistical Software: Release 16.1.* College Station, TX: StataCorp LLC.
23. Stephens J, Miller H & Militello L (2020) Food delivery apps and the negative health impacts for Americans. *Front Nutr* **7**, 14.
24. Keeble M, Adams J, Sacks G *et al.* (2020) Use of online food delivery services to order food prepared away-from-home and associated sociodemographic characteristics: a cross-sectional, multi-country analysis. *Int J Environ Res Public Health* **17**, 5190.
25. Statista (2020a) Change in consumer spending per person during COVID-19 pandemic in Australia in April 2020, by selected goods and services. https://www.statista.com/statistics/1114292/australia-change-in-consumption-per-person-during-coronavirus-by-selected-good-and-services (accessed June 2020).
26. Keeble M, Burgoine T, White M *et al.* (2019) How does local government use the planning system to regulate hot food takeaway outlets? A census of current practice in England using document review. *Health Place* **57**, 171–178.
27. Caraher M, O'Keefe E, Lloyd S *et al.* (2013) The planning system and fast food outlets in London: lessons for health promotion practice. *Rev Port Sau Pub* **31**, 49–57.
28. Morley B, Scully M, Martin J *et al.* (2013) What types of nutrition menu labelling lead consumers to select less

energy-dense fast food? An experimental study. *Appetite* **67**, 8–15.

29. d'Angelo C, Gloinson ER, Draper A *et al.* (2020) Food consumption in the UK: trends, attitudes and drivers. https://www.rand.org/pubs/research_reports/RR4379.html (accessed June 2020).

30. Marty L, Cook B, Piernas C *et al.* (2020) Effects of labelling and increasing the proportion of lower-energy density products on online food shopping: a randomised control trial in high-and low-socioeconomic position participants. *Nutrients* **12**, 3618.

31. Olzenak K, French S, Sherwood N *et al.* (2020) How online grocery stores support consumer nutrition information needs. *J Nutr Educ Behav* **52**, 952–957.

32. Howes K, Shahid M, Jones A *et al.* (2019) *FoodSwitch: State of the Fast Food Supply.* Sydney, Australia: The George Institute for Global Health.

33. Hillier-Brown FC, Summerbell CD, Moore HJ *et al.* (2017) The impact of interventions to promote healthier ready-to-eat meals (to eat in, to take away or to be delivered) sold by specific food outlets open to the general public: a systematic review. *Obes Rev* **18**, 227–246.