Review Article

Online grocery shopping: promise and pitfalls for healthier food and beverage purchases

Stephanie B Jilcott Pitts[1],*, Shu Wen Ng[2], Jonathan L Blitstein[3], Alison Gustafson[4] and Mihai Niculescu[5]

[1]Department of Public Health, Brody School of Medicine, East Carolina University, 600 Moye Blvd, MS 660, Greenville, NC 27834, USA: [2]Department of Nutrition, Gillings School of Global Public Health, Carolina Population Center, University of North Carolina, Chapel Hill, NC, USA: [3]Social Policy, Health, and Economic Research Unit, RTI International, Research Triangle Park, NC, USA: [4]Department of Dietetics and Human Nutrition, School of Human Environmental Sciences, University of Kentucky, Lexington, KY, USA: [5]Marketing Department, School of Business, New Mexico State University, Las Cruces, NM, USA

Abstract

Objectives: (i) To determine the current state of online grocery shopping, including individuals' motivations for shopping for groceries online and types of foods purchased; and (ii) to identify the potential promise and pitfalls that online grocery shopping may offer in relation to food and beverage purchases.
Design: PubMed, ABI/INFORM and Google Scholar were searched to identify published research.
Setting: To be included, studies must have been published between 2007 and 2017 in English, based in the USA or Europe (including the UK), and focused on: (i) motivations for online grocery shopping; (ii) the cognitive/psychosocial domain; and (iii) the community or neighbourhood food environment domain.
Subjects: Our search yielded twenty-four relevant papers.
Results: Findings indicate that online grocery shopping can be a double-edged sword. While it has the potential to increase healthy choices via reduced unhealthy impulse purchases, nutrition labelling strategies, and as a method to overcome food access limitations among individuals with limited access to a brick-and-mortar store, it also has the potential to increase unhealthy choices due to reasons such as consumers' hesitance to purchase fresh produce online.
Conclusions: Additional research is needed to determine the most effective ways to positively engage customers to use online grocery shopping to make healthier choices.

Nutrition researchers and dietitians are increasingly interested in supermarket environments[1–6]. Supermarkets, supercentres and grocery stores are the source of extra energy and sugars in the US diet[7,8]. A majority of low-income individuals using the Supplemental Nutrition Assistance Program (SNAP) spend their benefits at supermarkets and supercentres[9]. While supermarkets are generally regarded as 'healthy' elements of the community food environment[10], within supermarkets consumers are inundated by marketing of both healthy and unhealthy foods and beverages[11]. Cognitive processes, including self-control or 'individuals' capacity to alter, modify, change, or override impulses, desires, and habitual responses'[12], play an important role in how customers respond to marketing of unhealthy items. Customers who

experience lower self-control may more easily succumb to marketing of unhealthy foods and beverages[13], resulting in unhealthy, impulse purchases[14]. Shopping behaviour is complex, and purchasing decisions are the result of both cognitive processes that occur in the store combined with food access issues at the community food environment level[15]. Because of disproportionately low access to healthy foods (the community food environment) among low-income and rural populations[16,17], there have been increasing initiatives to build new supermarkets in under-served areas[18]. However, such efforts have yielded minimal impact on improving dietary behaviours of residents[19–21]. In sum, healthy purchasing decisions can be hampered by barriers within the cognitive or psychosocial domain and physical access barriers within the community food

Corresponding author: Email jilcotts@ecu.edu

environment domain, particularly among lower-income populations including SNAP and Special Supplemental Nutrition Assistance Program for Women, Infants, and Children recipients.

Grocery shopping in the 21st century is changing drastically, and one major element of this change is online grocery shopping[2]. In a Nielsen global survey of more than 30 000 consumers in sixty countries, approximately 10 % said they currently order groceries online and pick them up in-store or at the curbside. In addition, more than half said they would be willing to use these online options in the future, indicating the growing popularity of these online shopping options[22]. In the USA in 2015, online grocery sales were worth approximately $US 7 billion[23]. The Nielsen Global E-commerce and the New Retail Survey polled 30 000 online respondents in sixty countries and found that, worldwide, Millennials (age 21–34 years) and Generation Z (age 15–20 years) are the most frequent users of online grocery shopping (both home delivery and click-and-collect)[22]. Close to one-third (30 %) of Millennials and 28 % of Generation Z respondents to the Nielsen survey said they ordered groceries online for home delivery, compared with 22 % of Generation X (age 35–49 years), 17 % of Baby Boomers (age 50–64 years) and 9 % of Silent Generation (age ≥65 years) respondents. According to Nielsen, 55 % of North American consumers were willing and 12 % already used an online home delivery grocery service; and 57 % were willing and 9 % already used a service where groceries are ordered online and picked up at the store[22]. According to Euromonitor International's Global Consumer Trends Survey, 25 % of Americans shopped for groceries online at least once in 2013, increasing to 38 % in 2016[24].

However, little is known about individuals' motivations for online grocery shopping and the potential promise and pitfalls related to online grocery shopping in terms of promoting healthier eating. Park et al.[25] conducted a focus group discussion among consumers who had some experience with online grocery shopping and categorized participants into 'Hi-Tech Baby Boomers' and 'Older/ Physically Challenged Consumers'. 'Hi-Tech Baby Boomers' shopped for groceries online for convenience, whereas the 'Older/Physically Challenged Consumers' shopped for groceries online because of physical access barriers related to shopping at brick-and-mortar stores[25]. Hiser et al.[26] found that younger, more highly educated consumers would be more likely to be online shoppers compared with older and less educated consumers. In another study, convenience was the primary motivator for shopping online[27]. Other motivating factors included physical constraints, the presence of children, a more peaceful shopping experience, easier monitoring of total spending and more opportunities for planning[27]. Constructs from behavioural theories such as the Theory of Planned Behaviour[28] could also be applied to explaining online shopping behaviour[29], including attitudes towards the behaviour (the positive and negative perceptions of online shopping), subjective norms (perceived social pressure to perform the behaviour) and perceived behavioural control (perceptions of ease or difficulty of performing the behaviour).

Given this prior work, when juxtaposed with in-store shopping, online grocery shopping has the potential to dramatically limit the impact of both the cognitive barriers to healthy food access as well as community access barriers related to healthy food purchase within the supermarket food environment: consumers can shop online at any time and online grocery shopping allows low-income food desert dwellers and customers with limited mobility to order groceries online and have them delivered[30]. While online grocery shopping offers potential solutions to many healthy food access challenges, there are potential pitfalls that need to be better understood. For example, with online shopping, retailers have ready access to customer data on purchasing patterns[31] and thus can target marketing to these customers. Once purchased, items usually remain on an individual's past purchasing 'list' and thus are regularly seen by the customer, which could turn an unhealthy 'once in a while' treat into a pervasive prompt for more frequent purchases. In addition, the ease of online grocery shopping could lead to over-purchasing and, subsequently, overconsumption.

Therefore, the objectives of the current scoping review included: (i) to determine the current state of online grocery shopping, including individuals' motivations for shopping for groceries online and types of foods purchased; and (ii) to identify the potential promise and pitfalls that online grocery shopping offers related to food and beverage purchases. We specifically examined factors related to: (i) motivations for online grocery shopping; (ii) the cognitive/psychosocial domain, including the role of impulse purchases and nutrition information on products; and (iii) the community food environment domain and alleviation of rural and urban food access issues.

Methods

We selected the scoping review methodology because online grocery shopping is a relatively new and growing phenomenon in the USA and we wanted to learn more about the ways it could encourage or hinder healthy purchasing decisions. We felt a scoping review methodology was preferable to a systematic review as we wanted to address online shopping from a broader perspective, including studies from a wide variety of disciplines and using both qualitative and quantitative research designs[32,33]. Below we list the Arksey and O'Malley[33] steps and methodology used to our literature review.

Framework stage 1: Identify the research question
Our research question was: 'What is known from the existing literature about online grocery shopping as it

pertains to the (i) cognitive/psychosocial domain, including impulse purchases and provision of nutrition information for grocery products, and (ii) the community food environment domain including alleviation of rural and urban food access issues?'

Framework stages 2 and 3: Identifying relevant studies and study selection

In October and early November 2017, we searched for studies published in English, on or after 2007, and based in the USA or Europe. Papers were eligible if they were: peer-reviewed, published in English between 2007 and 2017; based in the USA or Europe; and focused on motivations for online grocery shopping, the cognitive/psychosocial domain (particularly impulse purchases and nutrition information/marketing on products) or the community food environment domain (alleviating healthy food access problems and barriers). The main reasons for exclusion were that studies were not conducted in the USA or Europe, or not focused on the topic areas of interest.

In PubMed, we used the search terms 'online grocery shopping' or 'internet grocery' which yielded forty-one manuscripts. The first author (S.B.J.P.) screened each title and nine were potentially applicable papers for an abstract screen. The first author screened all abstracts before deciding which should be included in the review. The main reason papers were excluded was because they were not related to the topic (e.g. titles such as 'Use of a text message program to raise type 2 diabetes awareness and promote healthy behavior change' and 'Reference-based pricing: an evidence-based solution for lab services shopping'). After the abstract screen, five were deemed applicable to include in the review. Of the four excluded, two were set outside the USA and Europe[34,35], one was a perspectives piece[2] and one was about online store coupons (not online grocery shopping)[36].

We searched ABI/INFORM for marketing and consumer behaviour studies, using the search term 'grocery shopping online', and limited the search to peer-reviewed papers. This yielded 111 peer-reviewed papers. The first author screened each title and selected sixteen potentially applicable papers for the abstract screen. The main reasons papers were excluded during the title screen were not being based in the USA or Europe, not related to the main research questions (e.g. related to personal privacy as a positive experience of grocery shopping), being about supply chain management topics and not specifically about online grocery shopping (but about online shopping in general). The abstract screen yielded nine papers for inclusion in the review. Of the seven excluded at the abstract screen, four were excluded due to not being based in the USA or Europe[37–40] and three were excluded due to not being about the topic areas of interest[41–43].

Google Scholar 'advanced search' was used to find any potentially relevant papers that would not be indexed in PubMed or ABI/INFORM. The search included the exact phrase 'online grocery shopping' between 2007 and 2017. There were 1510 hits (excluding citations and patents). The first author title-screened each paper and added relevant papers to the list for the abstract screen. There were 104 papers identified for inclusion, of which eleven were identified as duplicates from PubMed or ABI/INFORM, leaving ninety-three papers for the abstract screen. The main reasons for exclusions were unpublished papers (e.g. theses or conference proceedings), not based in the USA or Europe, and not about the topic area. There were eighteen papers selected for the full paper screen and nine were selected for inclusion. One additional paper, published online in early December 2017, was forwarded to the authors by a colleague and content expert, and included in the review[44]. The reasons for exclusions during the full paper screen included papers not being peer-reviewed[45,46] (including two that were chapters in eBooks)[47,48] and not about the topic area[49–51]. See Fig. 1 for a flow diagram of the review process.

A second author (J.B.) conducted an abstract/full paper screen on 20 % of the papers found in each search engine, with authors agreeing on 92 % (22/24) of the reviewed abstracts. Due to the screening process, further two papers were eliminated from the review, as they were focused more on the use of front-of-package nutrition labelling (while using a simulated supermarket)[52,53] rather than the utility of various marketing strategies in the online grocery shopping environment.

Framework stages 4 and 5: Charting the data, and collating, summarizing and reporting the results

Each study was entered into a table describing the study setting, location, population and findings, with special emphasis on findings related to the topic areas of interest as stated above. A final column on the table specified implications related to online grocery shopping's potential pitfalls and promise for encouraging healthy food and beverage purchases. Data were synthesized for each area of interest in the cognitive and physical access domains, drawing out implications for future research, policy and practice.

Results

We reviewed and summarized a total of twenty-four peer-reviewed papers (Table 1). We organized the results related to the following themes: (i) motivations for adoption of online grocery shopping, and types of foods and beverages purchased; (ii) the cognitive/psychosocial domain, including the role of impulse purchases and
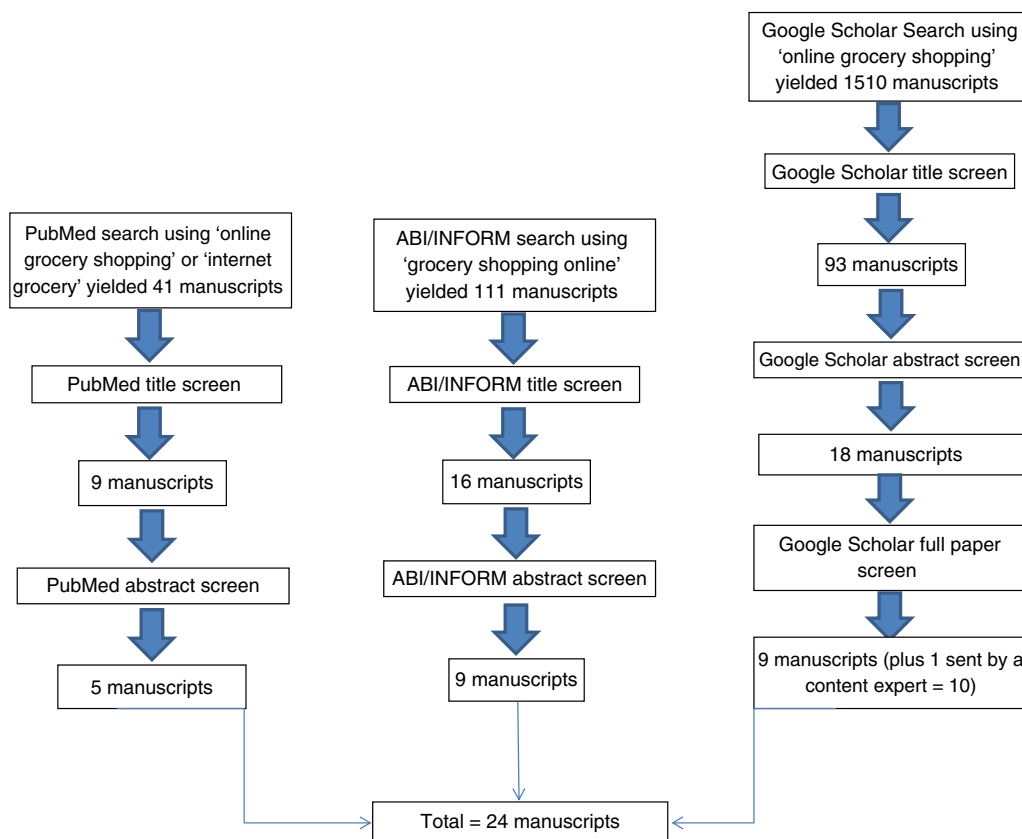
Fig. 1 (colour online) Flow diagram of the study selection process for the present review of online grocery shopping

nutrition information on products; and (iii) the community food environment domain and alleviation of rural and urban food access issues. Below we highlight the main results from across the twenty-four papers by theme.

Motivations for adoption of online grocery shopping

In terms of motivation for beginning online shopping, convenience and saving time were noted as motivations in several studies[54–57]. In addition, life events such as caring for a sick family member or transitioning to a new residence were also reasons for online grocery shopping[54,58,59]. Avoiding crowds in long lines in supermarkets and the ability to multitask while shopping were also reasons for engaging in online grocery shopping[56,58]. In a study among Belgian shoppers, those with higher education in households with young children where both adults were working were more likely to adopt online grocery shopping[60]. Hansen et al. found that constructs of the Theory of Planned Behaviour were related to willingness to purchase groceries online, including social norms and perceived behavioural control[29]. Studies noted that participants rarely switched to online grocery shopping for 100 % of grocery shopping needs and generally conducted in-store grocery shopping with some frequency[55,56,58,61,62].

Barriers to online grocery shopping included the inconvenience of waiting for deliveries, delivery fees, orders not being filled appropriately, and inappropriate or inadequate substitutions[54–56,58,59]. In addition, consumers tend to be less price-sensitive and are less likely to comparison shop when in the online v. in-store environment[62].

Types of foods purchased

Shoppers are hesitant to purchase perishable items via online grocery shopping and preferred to purchase fresh, perishable items in brick-and-mortar stores[58,63]. Items such as bulky detergents, diapers and other household goods were frequently purchased online[57,59]. The 'favourites' list was a helpful resource for some online grocery shoppers[59,63].

Impulse purchases

Impulse purchases are made less frequently in the online v. off-line modality[55–59,63–66]. In an ethnographic study[58], one participant noted his distaste of how supermarkets are designed to maximize impulse purchases and how grocery shopping online was beneficial to avoid such impulse purchases. However, in another study, participants viewed the opportunity to make impulse purchases positively, as a way to get ideas for meals while

Table 1 Overview of literature reviewed related to online grocery shopping and impulse purchases, stimulus control, pester power and community food access

Reference	Setting and population	Purpose	Study design and primary analyses	Main findings
Motivations for adoption of online grocery shopping				
Clark and Wright (2007)[63]	Respondents (n 46) who had conducted grocery shopping online completed the online survey. Participants were residents of the UK	To explore the diversity of online grocery shopping behaviours and identify common features and issues relevant to interaction design	Over sixty closed questions were designed to cover one or more e-Consumer Framework themes (Beliefs, Environment, Economics, Affects, Connections, Logistics, Self-efficacies). Each question was designed to measure either perceived behaviour or attitudes. The survey was distributed online	Over 40 % saw online grocery shopping as more cost-effective than offline shopping, and reported impulse purchasing was lower online. Respondents agreed they missed the experience of picking their own produce, half did not like having their grocery items picked out by other people. The 'My Favourites' and 'Last Order' lists were popular and used frequently
Chu et al. (2010)[62]	Panel data on households from a grocery retailer in Spain; included shoppers (n 2432) who shopped across both channels in the data collection period (12/2002–11/2003)	To examine the moderating effects of household (e.g. shopping frequency) and product (e.g. sensory nature) characteristics on household brand loyalty, size loyalty and price sensitivity across the online and offline grocery shopping modalities	A demand model of purchase incidence and brand choice was estimated to examine associations and compute elasticities between modality and brand loyalty, size loyalty and price sensitivity for four categories: one sensory food product (packed tomatoes), one non-sensory food product (flour), one non-sensory non-food product (liquid laundry detergent) and one non-food sensory product (paper towels)	Households made 43·3 shopping trips during the one-year period, 16·6 % of which were in the online store. Households were more brand-loyal, more size-loyal and had lower price sensitivity in the online v. the offline channel. Light online shoppers were more brand-loyal and less price-sensitive than heavy online shoppers, while in offline stores, the light online shoppers were more price-sensitive than heavy online shoppers
Elms et al. (2016)[58]	Case study of two shoppers ('Joan' and 'Justin') in the Portsmouth/Havant area located on the South coast of England	To understand the interrelationship between where and when consumers shop and what they purchase in online and offline grocery shopping modalities	Face-to-face interviews, accompanied shopping trips, kitchen visits and shopping diaries were used to evaluate differences in purchasing decisions. Interviews were audio-recorded and transcribed	'Joan' began grocery shopping online when her husband became sick and eventually died. She bought bulk items online, but preferred to purchase fruit, vegetables and meat in the store (offline) so that she could hand-pick those items. 'Justin' used online grocery shopping so he could avoid crowded supermarkets. He was disillusioned with in-store marketing techniques used to tempt customers to purchase more than they intended. Online shopping required Justin to plan meals/food needs before shopping. Justin noted unsuitable substitutes provided during online shopping experiences

Table 1 *Continued*

Reference	Setting and population	Purpose	Study design and primary analyses	Main findings
Hand *et al.* (2009)[54]	Qualitative study (#1) included focus groups with current and lapsed online grocery shoppers in Greater London, which included thirty-two adults over 25 years old Quantitative study (#2) included 1128 respondents with a wide variety of ages and occupations	To identify situational factors related to the adoption and discontinuation of online grocery shopping	Qualitative study (#1) and quantitative survey (#2) to extend findings of the qualitative research and to study the role of situational factors in facilitating individuals either starting or stopping/diminishing online grocery shopping. Cluster analysis was used to determine triggers to starting online grocery shopping	The following were all motivators for online shopping in study #1: having a baby, an injury, changing jobs, moving to a different residence. Discontinuing or diminishing online shopping was related to: negative experiences such as delayed deliveries and unacceptable substitutions In study #2, convenience, time savings, inability to shop and avoidance of shopping with children were main reasons for online grocery shopping. Reasons for stopping online grocery shopping included: preferring to shop in stores, finding better deals in stores, delivery charges, problems with deliveries and concerns about product quality
Hansen (2008)[29]	Swedish consumers (*n* 1058) who completed an online survey; 110 had conducted online grocery shopping and 831 had purchased something online but not groceries online	To examine relationships between customers' values, attitudes, social norms, perceived behavioural control and willingness to buy groceries online, with the Theory of Planned Behaviour as a theoretical background	An online survey using self-administered questionnaires sent to households by a market research firm. The questionnaire included multiple items for each of the eight constructs: openness to change, conservation, self-enhancement, self-transcendence, attitude, social norm, perceived behavioural control and willingness to buy groceries online	Personal values affected consumers' attitude towards online grocery shopping: attitude was positively related to willingness to buy groceries online; social norms were also positively related to willingness to buy groceries online; perceived behavioural control was positively related to willingness to buy groceries online and these relationships were moderated by prior online shopping experience
Harris *et al.* (2017)[56]	Shoppers from the UK (*n* 871) who had purchased groceries online and offline	To develop a typology of grocery shoppers based on the perceived advantages and disadvantages of shopping for groceries online and offline (in store)	Mailed survey containing fifteen items to assess perceived advantages and disadvantages of grocery shopping online and eight items relating to the perceived advantages and disadvantages of grocery shopping in stores. Cluster analysis was used to develop typologies of online and offline grocery shoppers	Convenience (speed and flexibility) and ease were advantages of online shopping, while disadvantages included service concerns (missing deliveries or late deliveries), search concerns (not being able to find product information online) and technology concerns (speed and security of the Internet). In-store advantages were the ability to browse for ideas and not plan ahead, and the ability to complete other errands while on the grocery shopping trip. Disadvantages were related to the time-consuming nature of in-store shopping and crowds. Online clusters included converted, concerned convenience seekers, and fearful shoppers, and in-store clusters included supermarket loathers, impulse shoppers, apathetic shoppers, and one stop shoppers

Table 1 *Continued*

Reference	Setting and population	Purpose	Study design and primary analyses	Main findings
Melis *et al.* (2015)[61]	Panel data from households in the UK from January 2007 until December 2008. More than 10 000 panel members visited the online channel of one of the four multichannel retailers studied; 3234 met eligibility requirements and were included in analyses	To identify the underlying motivations for online grocery store choice and examine how motivations change when multichannel shoppers gain online grocery shopping experience	Household category share, household brand share, price, assortment size, assortment composition, price integration, assortment integration, offline store preference, online loyalty and experience were evaluated; a multinomial logic model was used to analyse online store choice	A majority (64 %) of customers shopped at the online store belonging to the same chain as one of their preferred offline stores. Customers were more likely to select online stores based on assortment composition (e.g. when more popular/favourite brands are available in the online store). As consumers gained more online grocery shopping experience, they were less likely to select the same online store as offline store
Ramachandran *et al.* (2011)[55]	Respondents who were students and working professionals in the UK (*n* 261); majority (76·1 %) were female, aged 25 years or younger (62·0 %)	To examine motivations and attitudes for and against online grocery shopping	Self-administered online questionnaire using a 5-point Likert scale, to assess attitudes towards offline and online grocery shopping and methods to improve online grocery shopping. Data were analysed using principal component analysis	Respondents (73·3 %) mainly still preferred shopping for groceries in stores, even though they were confident using the Internet for shopping. Respondents shopped on impulse and without prior planning, and were motivated to shop for groceries based on convenience factors and needing items quickly. Reasons for online shopping included: to choose from a wider selection; have the latest products and services; be on the leading edge of technology; get better prices; save time; make less effort; order groceries from distant places; buy groceries at any time; and shop anywhere. Reasons against online shopping were: products purchased online are not as good as described on the web; sites not easy to look through; questions about the products could not be answered before purchase; delivery times are not convenient; delivery takes too long; and delivery fees
Robinson *et al.* (2007)[59]	All participants (*n* 32) lived in Greater London, were over 25 years old, and represented a variety of ages and life stages	To understand the motivations and perceptions of UK grocery shoppers regarding motivations for adopting online grocery shopping	Four 90 min focus groups were held with eight people in each group. Focus group discussions elucidated motivators for online grocery shopping. Transcripts and tapes were analysed by an analyst using Qualrus software	A major motivation for purchasing groceries online was the ability to shop online at any time and have bulky items delivered. Life events (e.g. getting or changing jobs, having a baby) prompted participants to either begin or end online grocery shopping. For some, moving to an area where the habitual supermarket did not have a physical presence had triggered shopping in the online version of the store. Most respondents had chosen their Internet delivery service from the supermarket where they normally shopped because they liked and were familiar with the products sold. The loyalty card was a switching barrier, because items purchased offline using the loyalty card automatically appeared in the online 'favourites' list. Convenience (saving time, not having to take children in the store) was a motivator. Participants noted that less

Table 1 Continued

Reference	Setting and population	Purpose	Study design and primary analyses	Main findings
				impulse shopping made online shopping more economical. Customers often shopped for bulk items online and fresh items in the store. Unsatisfactory deliveries and incorrect orders were the main disadvantages
Van Droogenbroeck and Van Hove (2017)[60]	Customers (n 468) of Belgian supermarket chain Colruyt; 58·8 % were Collect & Go (online shoppers) customers, 65·0 % were female and the median age was 42 years	To examine the associations between personal and household-level variables (e.g. presence of children, working situation of adults in the household) and adoption of online grocery shopping	Researchers conducted a survey to assess both personal and household-level variables, distributed at pick up for the online shopping Collect & Go, and in the store. The dependent variable was adoption of online grocery shopping (yes/no); thus, binary logistic regression analysis was used	Individuals with a higher education, households with young children and those with both adults working full-time were more likely to adopt online grocery shopping
Impulse purchases Gorin et al. (2007)[66]	Overweight adults (n 28), 21–65 years of age, in the Northeastern USA. Mean age was 47·9 (SD 9·5) years, mean BMI was 31·7 (SD 3·6) kg/m^2. Most were female (89·3 %), Caucasian (89·3 %) and married (60·7 %)	To examine the feasibility and impact of changing the household food environments of participants in an 8-week behavioural weight-loss programme through use of a commercially available grocery home delivery service	Twenty-eight participants were assigned to standard behavioural therapy (SBT) or SBT + home delivery of groceries. Authors examined differences between high- v. low-fat foods in the home with repeated-measures ANOVA. Among those in the SBT + Home group, the relationship between changes in weight and number of home deliveries was examined using partial correlation	The home delivery service assisted participants in making fewer impulse purchases and there were fewer high-fat foods in the home. There was weight loss in both groups, but no difference in weight loss between the two conditions; however, within the SBT + Home participants, there was a trend for the number of home deliveries to be correlated with weight loss ($r = 0.71$, $P = 0.08$)
Huyghe et al. (2017)[65]	Study 1 included customers (n 4313) of a European retailer that operates both brick-and-mortar and online stores. For Studies 2–4, participants were students at a university in Western Europe (Study 2: n 141, 65·2 % female, mean age 21·4 years; Study 3: n 165, 47·9 % female, mean age 20·5 years; Study 4: n 125, 60·0 % female, mean age 22·3 years)	To examine whether customers purchased fewer vices (unhealthy products) when shopping for groceries online v. offline	The authors used four different studies to examine the potential effects of shopping modality on purchase of vices, generally defined as candy bars, chocolate, chips, salty snacks and sweets. Multilevel analysis was used to examine hypothesized effects of online v. offline grocery shopping on the purchase of vices	Customers spent relatively less on vices when they ordered online rather than shopping offline (Study 1). This finding was replicated in the additional studies, and authors speculate that this may have been due to the online modality not being able to present food products in three dimensions resulting in reduced product vividness
Milkman et al. (2010)[64]	Grocery orders placed between 1 January and 31 December 2005 from a large North American online grocery store serving urban customers. The average order amount was $US 154·71 and the average grocery order consisted of fifty-eight items	To use customer-level data to examine differences in grocery purchases people make in the near v. more distant future, especially in regard to 'should' (planned, healthy) v. 'want' (impulse) items	Data included item, price, date or order, and date of delivery. Least-squares regression was used to estimate the relationship between amount spent on groceries and how far in advance of delivery the order was completed. A one-way	Customers made fewer 'want' (e.g. impulse) purchases the further in advance of delivery they completed an online grocery order; orders completed one day in advance of delivery included a slightly lower proportion of 'want' goods and a slightly higher proportion of 'should' goods than orders placed two days in advance of delivery. Customers also spent

Table 1 Continued

Reference	Setting and population	Purpose	Study design and primary analyses	Main findings
			ANOVA was used to compare ratings variation between grocery categories ('want' v. 'should' goods) to ratings variation within grocery categories	more money when ordering in the more immediate future
Nutrition information on products Benn et al. (2015)[67]	Individuals (n 40; twenty-six females) aged 19–54 years participated, between July and August 2012, from two large universities in the UK	To investigate what information shoppers seek when purchasing groceries online	Customers were seated at a Tobii T120 eye-tracker and were asked to do their weekly grocery shop using the Tesco online grocery shopping website. Ten participants also completed a playback video wherein they were given their eye-tracking results and could comment on them. Eye-tracking was quantified using 'fixations'. A repeated-measures ANOVA with region of interest (e.g. product picture, description, etc.) as the independent variable, and the number of fixations as the dependent variable, was used to examine differences between regions of interest	Most participants used navigation to find products. Over half of the fixations were on navigation pages. Participants looked at pictures and product title information more than information on specials or deals, basket contents, and product prices. Eighty per cent used the search bar. Some participants made purchases out of habit, others made purchases based on what was offered on sale and thus made novel purchases. Participants wanted to touch and feel fresh items before purchasing them. Participants noted that online shopping may limit impulse purchases because one has to search for products instead of walking past products in the store. About one-third (35 %) looked at nutrition information and fewer than 10 % of fixations were on nutrition information
Breugelmans and Campo (2011)[68]	Sales data for 120 weeks across ten different categories in a European online grocery store	To examine whether in-store displays are effective at increasing brand/category market share in an online grocery store and to test effectiveness of three different in-store display types: (i) store entrance (first screen); (ii) aisle; and (iii) shelf-tag displays	To test whether in-store displays increased sales in a virtual shopping context, hierarchical brand market share and category sales models were estimated. Differences were examined across three major online display types	In-store displays in the online grocery environment increased brand sales and a first-screen position outperformed displays that focused on making the product stand out in the shopping zone
Breugelmans et al. (2007)[69]	Online and offline shoppers in the Netherlands	To examine how a food product's shelf position affects customer choices in an online grocery context	Respondents used a fictitious virtual store and made 'purchases' for six weeks, in two product categories (margarine and cereal). Participants were randomly assigned to: (i) limited assortment; (ii) assortment extended by flavour; (iii) assortment extended by brand. Mixed multinomial logit models were used to examine associations between shelf position and purchase likelihood	First-screen products online are more likely to be selected. Customers are more likely to purchase food items that are closer in proximity to focal items. Purchases are more likely to occur if the shelf is perceived as well-organized

Table 1 *Continued*

Reference	Setting and population	Purpose	Study design and primary analyses	Main findings
Campo and Breugelmans (2015)[57]	Loyalty card data from customers of a large European grocery chain who made at least two online and two offline store visits during the study period	To examine behaviour online and in-store, and to understand the underlying mechanisms that determine how shoppers make purchase decisions within the online and offline (in-store) channels	The dependent variable was share in category spending in the online channel. Consumer, marketing mix (e.g. price, assortment size, promotion) and transaction costs (e.g. sensory item, bulk/heavy item) were used as independent variables	Nearly two-thirds (65 %) of participants were less inclined to buy items online when the online store offered a smaller assortment. Customers bought substantially fewer impulse categories in the online modality. Customers were less inclined to buy sensory products online. All customers purchased substantially more bulk products online
Epstein et al. (2016)[70]	Women (n 781) in a large online experimental supermarket in the USA. Thirty-one per cent were minority, 29% were on food assistance, and mean BMI was approx. 30 kg/m²	To examine the effects of nutrient profiling and differential pricing based on the nutrient profile on the overall diet quality, energy and macronutrients of the foods purchased in an online supermarket	Nutrient profiling was based on nutritional information provided by NuVal® LLC or the US Department of Agriculture's National Nutrient Database. Prices for the highest 20 % of nutrient profiling scores were subsidized 25 % and those with the lowest 20 % were taxed 25 %. Participants were randomly assigned to one of four shopping conditions: (i) nutrient profiling; (ii) taxes/subsidies; (iii) nutrient profiling and taxes/subsidies; and (iv) no manipulation. Two-by-two factorial ANOVA models were used with NuVal® and price as between-group variables	Providing nutrient profiling improved overall diet quality of foods purchased. NuVal® scores increased from 38·6 to 41·1. Price changes were associated with an increase in protein purchased, an increase in energy cost per dollar. There were no additional benefits of price changes and nutrient profiling combined beyond price changes or nutrient profiling alone
Forwood et al. (2016)[71]	Participants (n 1610) were adults from the UK randomized to one of five groups. A total of 720 completed all measures, with a mean age of 44·4 years, 62·2 % female, and 57·6 % overweight or obese (BMI ≥ 25 kg/m²)	To assess the impact of offering low-energy-density swaps for higher-energy-density foods/beverages in an online supermarket and to test the effects on when the swap was offered and if the swap occurred with or without consent	Participants were randomly assigned to a no swap control condition or to one of the four interventions: (i) consented swaps at selection; (ii) consented swaps at checkout; (iii) imposed swaps at selection; or (iv) imposed swaps at checkout. Each swap included two lower-energy-density items from the same category as the customers' chosen food. Energy density of the food basket at checkout was the dependent variable	Intervention participants were offered a mean of 4·1 swaps. Offering lower-energy-density swaps within specific product categories did not significantly lower the energy density of the foods purchased. There was an association between a higher number of swaps accepted and a reduction in the energy density of food purchased. Likelihood of customers selecting the swap was higher when swaps were offered at the point of selection compared with checkout. Offering the swaps was acceptable to customers

Table 1 *Continued*

Reference	Setting and population	Purpose	Study design and primary analyses	Main findings
Alleviation of rural and urban food access issues				
Appelhans *et al.* (2013)[30]	Participants (*n* 34) resided in a Chicago food desert: 77 % female, 38 % African American, 32 % Latino, 21 % non-Hispanic White, 9 % multiethnic; mean age was 36·9 years and mean BMI was 32·9 kg/m^2	To explore the feasibility and acceptability of an Internet grocery service to improve food access among individuals residing in Chicago food deserts in 2011–2012	Participants completed two study visits. First, participants completed surveys and then used a computer at the research facility to purchase groceries online via www. Peapod.com. They were provided with a \$US 80 voucher for groceries and delivery fees. Food purchases were quantified as the number of items and total pre-tax food expenditures in eleven categories. Univariate statistics were used to analyse data	The largest proportion of food expenditures (36 %) was for meat, fish, poultry, and egg- and dairy-based dishes, followed by fruits, vegetables, and caloric non-dairy beverages (e.g. soft drinks, juice). Non-caloric beverages, sweets, desserts and candy were purchased infrequently. The most frequently reported factors motivating continued use of the Internet grocery service were prices that were less than or equal to those in the supermarket, and delivery within one day of ordering
Gorkovenko *et al.* (2017)[72]	Older adults from the UK used ShopComm to shop online. Seven older adults aged 72–87 years took part in a focus group and follow-up session, and stakeholders who had experience working with older adults took part in in-depth interviews	To explore how older adults perceive the benefits and barriers to online and in-store shopping	Focus groups were used to obtain experiences of older adults regarding online shopping. After the ShopComm prototype was designed, feedback from older adults was solicited regarding ShopComm	Older adults initially had little or no understanding of the process of purchasing items online. Benefits of online shopping included saving time and money. Participants were hesitant to shop online because they did not like giving away their banking details online. They liked the idea of using a fingerprint scanner to verify the identity of the shopper, and liked the idea of filters to allow shoppers to select their favourite shops
Lagisetty *et al.* (2017)[73]	Assessed stakeholder views on the feasibility, sustainability and efficacy of the Virtual Supermarket Program (VSP) through a survey of ninety-three VSP customers and semi-structured interviews with fourteen key stakeholders. The majority of the ninety-three survey respondents (92 %) were African American, 85 % were female, and mean age was 70·3 years	To identify key barriers to food access among low-income Baltimore City neighbourhoods; to determine if the VSP addressed barriers to food access	Cross-sectional surveys were conducted through in-person and telephone surveys at six VSP hubs that were active 1 July 2015–30 June 2016. Univariate statistics were used to analyse survey data. Themes from stakeholder interviews were identified using qualitative content analysis	The four main themes were: (i) the VSP addressed transportation barriers (78 % said the VSP made healthy food more available); (ii) the VSP improved food purchasing behaviour (nearly half said they purchased more fruit (47 %) and vegetables (50 %)) and fostered a sense of community; (iii) the importance of accepting SNAP benefits in addition to cash and credit cards; and (iv) policy changes are needed continue to allow processing of SNAP benefits online

Table 1 Continued

Reference	Setting and population	Purpose	Study design and primary analyses	Main findings
Lennon et al. (2009)[74]	Rural consumers (n 879) in eleven states in the USA completed surveys. There were 62·8 % female respondents, 95·0 % had a high school diploma or more education, and 28·5 % had less than $US 25 000 household income	To examine rural consumers' online shopping for food and fibre products as related to satisfaction with local retailing and shopping outside their counties	Structural equation modelling and ANOVA were used to examine associations between online shopping and shopping outside the county of residence among 847 participants who completed surveys in 2000 and 2003	Over half (54 5 %) had access to the Internet. In 2003, food items were more commonly purchased (compared with clothing and furnishings) by disabled and homebound respondents. Dissatisfaction with local retailing in 2000 was associated with shopping outside the county. Shopping outside the county was positively related to online shopping
Martinez et al. (2018)[44]	A total of thirty-five participants attended one of six focus group discussions and there were 348 participants recruited for the randomized controlled trial. Mean age of the focus group participants was 48 years, 71 % were female and 66 % were Black/African American	To examine SNAP participants' use of the first online supermarket accepting EBT payment, to examine differences between online purchases using EBT and other payment methods, and to examine data from focus groups among potential customers	Only three participants randomized to the online shopping group made online grocery purchases; thus, data from the randomized controlled trial could not be analysed. Overall sales data were analysed to compare the average amount spent per order on five main food categories. Focus groups were analysed using multistage thematic analysis	During the first nine months of the pilot programme, fifty-three customers placed 174 orders paying with EBT. Those who used EBT spent more on sweets and salty snacks and less on fruits, and there were no differences for vegetables and dairy products. Focus group participants expressed concern/distrust of online personal shopper selecting their food and beverage items and were concerned about quality and freshness. Participants said they would be motivated to purchase food online when EBT was accepted, when there were fast and free deliveries, and sales and coupons available

SNAP, Supplemental Nutrition Assistance Program; EBT, electronic benefit transfer.

Table 2 Summary of potential promise and pitfalls of online grocery shopping to promote healthy food purchases among low-income US residents along the cognitive/psychosocial and community food environment domains

Domain	Potential promise	Potential pitfalls
Cognitive/psychosocial	• Increased healthy habit and meal planning through use of a list function online[59,63] and fewer impulse purchases[65,66,73] • In the online grocery environment, shoppers tend to make more 'should' and 'virtue' choices compared with in-store shopping which leads to more 'want' and 'vice' food choices[64,65] • First-screen displays are most important in prompting customer purchases[68] • Consumers may rely more on front-of-package labelling and marketing, and thus healthy options could be emphasized more clearly in the online environment[67] • More pester power could be expected in a brick-and-mortar store (when children present) than when shopping online (an individual activity) • Offering less-energy-dense foods at point of purchase in online grocery shopping could reduce the energy density of the purchases overall[71] • For the customers who are more concerned about purchasing sensory products online, free trials could be offered to reduce perceived risk[57]	• Customers are more brand-loyal and less price-sensitive in the online market[62], making it necessary for policy makers to ensure price comparisons are easier to make online • Customers are not as likely to purchase perishable items online[44,58,63] • Primacy effects related to products on the first screens are important to examine[69] and may be subject to slotting fees now or in the future[11] • Does not save time and travel-related costs if the click-and-collect model is used • If unhealthy products are purchased, they will also be on the list of past purchases, thus increasing habits for less healthy items
Community food environment	• Customers can potentially save money and time[54–56] • Online venues are used when individuals want to avoid driving long distances to use their preferred supermarket[58] • Delivery option addresses limited access in rural and urban food deserts, as well as for injured, disabled or elderly[54] • Able to stock up on healthy non-perishable items easily[57,59]	• Low-income individuals have a hard time getting a credit card and currently cannot pay with SNAP or WIC benefits[30,44,73] • Need for car or reliable transportation if 'click-and-collect' model • Shopping/delivery fees may be too high for low-income consumers, and some grocers may also have a minimum amount of groceries that customers must purchase to be able to order groceries online[55] • Rural and low-income residents may have intermittent Internet access • Able to stock up on unhealthy non-perishable items easily[57,59]

SNAP, Supplemental Nutrition Assistance Program; WIC, Special Supplemental Nutrition Assistance Program for Women, Infants, and Children.

due to technical error, we used similar but not identical search terms across different search engines. All searches included the terms 'online', 'grocery' and 'shopping', but the order of terms was changed. Strengths include a very inclusive search strategy, inclusion of marketing and public health nutrition literature, and a systematic method of characterizing studies.

Conclusions and implications

Reducing unhealthy impulse purchases through online grocery shopping could promote better dietary practices and health[64,65]. Providing labelling and online shopping in-store displays[68,70] to promote healthier foods online might be one way public health nutrition and marketing and retailers could intersect to both promote health and increase purchase of produce and other fresh items online. As few of the studies we reviewed focused on low-income consumers specifically, online grocery shopping should be studied further particularly among lower-income consumers, to determine how federal food assistance policies can be shaped to promote healthy purchases in the online grocery shopping environment. If online grocery shopping can contribute to healthier food and beverage purchase and consumption, it could be one mechanism to promote healthful purchases among low-income participants. Currently, the US Department of Agriculture is piloting SNAP/EBT online grocery purchase at seven retailers (Amazon, FreshDirect, Safeway, ShopRite, Hy-Vee, Hart's Local Grocers, Dash's Market) in eight states (Iowa, Maryland, New Jersey, New York, Oregon, Pennsylvania, Washington)[76]. It will be interesting to observe how consumers respond to this opportunity and the healthfulness of their resultant purchases.

We did not review the literature related to home delivery services that provide the ingredients and recipes to make one meal (meal kits), which could potentially be leveraged to promote healthier consumption among low-income and disadvantaged consumers but were considered outside the scope of our narrative review. Given that these meal kits often involve perishable ingredients, such services could provide insights on how to encourage purchase and consumption of perishable and healthier groceries and how to best keep perishable foods looking attractive and fresh.

In conclusion, the present scoping review summarizes some key considerations and questions for future research as well as promising and innovative practice to maximize the promise of online grocery shopping, while minimizing the risks, to successfully promote improved nutrition among all sectors of society.

Acknowledgements

References

1. Escaron AL, Meinen AM, Nitzke SA *et al.* (2013) Supermarket and grocery store-based interventions to promote healthful food choices and eating practices: a systematic review. *Prev Chronic Dis* **10**, E50.
2. Peregrin T (2015) Understanding millennial grocery shoppers' behavior and the role of the registered dietitian nutritionist. *J Acad Nutr Diet* **115**, 1380–1383.
3. Glanz K, Bader MD & Iyer S (2012) Retail grocery store marketing strategies and obesity: an integrative review. *Am J Prev Med* **42**, 503–512.
4. Glanz K, Johnson L, Yaroch AL *et al.* (2016) Measures of retail food store environments and sales: review and implications for healthy eating initiatives. *J Nutr Educ Behav* **48**, 280–288.e1.
5. Felgate M & Fearne A (2015) Analyzing the impact of supermarket promotions: a case study using Tesco Clubcard data in the UK. In *The Sustainable Global Marketplace: Proceedings of the 2011 Academy of Marketing Science (AMS) Annual Conference*, pp. 471–475. Cham: Springer International Publishing.
6. Surkan PJ, Tabrizi MJ, Lee RM *et al.* (2016) Eat Right–Live Well! supermarket intervention impact on sales of healthy foods in a low-income neighborhood. *J Nutr Educ Behav* **48**, 112–121.
7. Drewnowski A & Rehm CD (2013) Energy intakes of US children and adults by food purchase location and by specific food source. *Nutr J* **12**, 59.
8. Drewnowski A & Rehm CD (2014) Consumption of added sugars among US children and adults by food purchase location and food source. *Am J Clin Nutr* **100**, 901–907.
9. Castner L & Henke J (2011) *Benefit Redemption Patterns in the Supplemental Nutrition Assistance Program.* Alexandria, VA: US Department of Agriculture, Food and Nutrition Service, Office of Research and Analysis.
10. Babey SH, Diamant AL, Hastert TA *et al.* (2008) *Designed for Disease: The Link Between Local Food Environments and Obesity and Diabetes.* Los Angeles, CA: UCLA Center for Health Policy Research.
11. Rivlin G (2016) *Rigged: Supermarket Shelves for Sale.* Washington, DC: Center for Science in the Public Interest.
12. Baumeister RF (2002) Ego depletion and self-control failure: an energy model of the self's executive function. *Self Identity* **1**, 129–136.
13. Vohs KD, Baumeister RF, Schmeichel BJ *et al.* (2018) Making choices impairs subsequent self-control: a limited-resource account of decision making, self-regulation, and active initiative. In *Self-Regulation and Self-Control: Selected Works of Roy F. Baumeister*, 1st ed., pp. 45–77. London: Routledge.
14. Salmon SJ, De Vet E, Adriaanse MA *et al.* (2015) Social proof in the supermarket: promoting healthy choices under low self-control conditions. *Food Qual Prefer* **45**, 113–120.
15. Baumeister RF, Sparks EA, Stillman TF *et al.* (2008) Free will in consumer behavior: self-control, ego depletion, and choice. *J Consum Psychol* **18**, 4–13.
16. Morton LW & Blanchard TC (2007) Starved for access: life in rural America's food deserts. *Rural Realities* **1**, 1–10.
17. Larson NI, Story MT & Nelson MC (2009) Neighborhood environments: disparities in access to healthy foods in the US. *Am J Prev Med* **36**, 74–81.
18. Holzman DC (2010) White House proposes healthy food financing initiative. *Environ Health Perspect* **118**, A156.
19. Dubowitz T, Ghosh-Dastidar M, Cohen DA *et al.* (2015) Diet and perceptions change with supermarket introduction in a food desert, but not because of supermarket use. *Health Aff (Millwood)* **34**, 1858–1868.
20. Elbel B, Mijanovich T, Kiszko K *et al.* (2017) The introduction of a supermarket via tax-credits in a low-income area: the influence on purchasing and consumption. *Am J Health Promot* **31**, 59–66.
21. Elbel B, Moran A, Dixon LB *et al.* (2015) Assessment of a government-subsidized supermarket in a high-need area on household food availability and children's dietary intakes. *Public Health Nutr* **18**, 2881–2890.
22. The Nielson Company (2015) The future of grocery e-commerce, digital technology and changing shopping preferences around the world. http://www.nielsen.com/content/dam/nielsenglobal/vn/docs/Reports/2015/Nielsen%20Global%20E-Commerce%20and%20The%20New%20Retail%20Report%20APRIL%202015%20(Digital).pdf (accessed July 2018).
23. statistica, The Statistics Portal (2018) US consumers: online grocery shopping – statistics & facts. http://www.statista.com/topics/1915/us-consumers-online-grocery-shopping/ (accessed July 2018).
24. Grant M (2017) The race to bring groceries online in the US. https://blog.euromonitor.com/2017/04/the-race-to-bring-groceries-online-in-the-us.html (accessed September 2018).
25. Park K, Perosio D, German GA *et al.* (1998) *What's in Store for Home Shopping?* Ithaca, NY: Cornell University Food Industry Management Program.
26. Hiser J, Nayga RM & Capps O (1999) An exploratory analysis of familiarity and willingness to use online food shopping services in a local area of Texas. *J Food Distrib Res* **30**, 78–90.
27. Morganosky MA & Cude BJ (2000) Consumer response to online grocery shopping. *Int J Retail Distrib Manag* **28**, 17–26.
28. Ajzen I (1991) The theory of planned behavior. *Organ Behav Hum Decis Process* **50**, 179–211.

29. Hansen T (2008) Consumer values, the theory of planned behaviour and online grocery shopping. *Int J Consum Stud* **32**, 128–137.

30. Appelhans BM, Lynch EB, Martin MA *et al.* (2013) Feasibility and acceptability of Internet grocery service in an urban food desert, Chicago, 2011–2012. *Prev Chronic Dis* **10**, E67.

31. Yuan M, Pavlidis Y, Jain M *et al.* (2016) Walmart online grocery personalization: behavioral insights and basket recommendations. In *Advances in Conceptual Modeling: Proceedings of the 35th International Conference on Conceptual Modeling, Gifu, Japan, 14–17 November 2016*, pp. 49–64 [S Link and JC Trujillo, editors]. Cham: Springer International Publishing.

32. Dijkers M (2015) What is a scoping review? *KT Update* **4**, 1–4; available at http://ktdrr.org/products/update/v4n1/dijkers_ktupdate_v4n1_12-15.pdf

33. Arksey H & O'Malley L (2005) Scoping studies: towards a methodological framework. *Int J Soc Res Methodol* **8**, 19–32.

34. Dixon H, Scully M, Wakefield M *et al.* (2011) Parent's responses to nutrient claims and sports celebrity endorsements on energy-dense and nutrient-poor foods: an experimental study. *Public Health Nutr* **14**, 1071–1079.

35. Machín L, Arrúa A, Giménez A *et al.* (2018) Can nutritional information modify purchase of ultra-processed products? Results from a simulated online shopping experiment. *Public Health Nutr* **21**, 49–57.

36. Lopez A & Seligman HK (2014) Online grocery store coupons and unhealthy foods, United States. *Prev Chronic Dis* **11**, 130–211.

37. Sreeram A, Kesharwani A & Desai S (2017) Factors affecting satisfaction and loyalty in online grocery shopping: an integrated model. *J Indian Bus Res* **9**, 107–132.

38. Anesbury Z, Nenycz-Thiel M, Dawes J *et al.* (2016) How do shoppers behave online? An observational study of online grocery shopping. *J Consum Behav* **15**, 261–270.

39. Moreira AB, Chauvel MA & Moreira da Silva RC (2013) The decision-making process to purchase from online supermarkets: a qualitative research with customers from 'Zona Sul Atende'. *J Inf Syst Technol Manag* **10**, 81–98.

40. Bhardwaj B & Sharma D (2017) E-Loyalty among rural customers: examining the role of trust, convenience, and frequency of use. *Indian J Commerce Manag Stud* **8**, 58.

41. Fiore SG & Kelly S (2007) Surveying the use of sound in online stores: practices, possibilities and pitfalls for user experience. *Int J Retail Distrib Manag* **35**, 600–611.

42. De Kervenoael R, Hallsworth A & Elms J (2014) Household pre-purchase practices and online grocery shopping. *J Consum Behav* **13**, 364–372.

43. Mortimer G, Fazal e Hasan S, Andrews L *et al.* (2016) Online grocery shopping: the impact of shopping frequency on perceived risk. *Int Rev Retail Distrib Consum Res* **26**, 202–223.

44. Martinez O, Tagliaferro B, Rodriguez N *et al.* (2018) EBT payment for online grocery orders: a mixed-methods study to understand its uptake among SNAP recipients and the barriers to and motivators for its use. *J Nutr Educ Behav* **50**, 396–402.

45. Cebollada J (2010) *What Drives Household Choice of Online and Offline Grocery Channels? Working Paper.* Singapore: NUS Business School.

46. Chintagunta P, Chu J & Cebollada J (2009) *What Drives Channel Choice in Grocery Shopping? Working Paper.* Singapore: NUS Business School.

47. Wriedt DS (2011) Online grocery shopping: determinants of online impulse buying behavior. In *Das Internet der Zukunft*, pp. 269–283. Wiesbaden: Springer Gabler.

48. Zhu Q & Semeijn J (2015) Antecedents of customer behavioral intentions for online grocery shopping in Western Europe. *Eur Retail Res* **27**, pp. 1–19.

49. Arce-Urriza M & Cebollada J (2014) *Comparison of Household Shopping Behavior across Online and Offline Channels:*

Moderating Effects of Household and Product Characteristics. Working Paper. Singapore: NUS Business School.

50. Wolfson JA, Graham DJ & Bleich SN (2017) Attention to physical activity-equivalent calorie information on nutrition facts labels: an eye-tracking investigation. *J Nutr Educ Behav* **49**, 35–42.

51. Zhang J & Breugelmans E (2012) The impact of an item-based loyalty program on consumer purchase behavior. *J Mark Res* **49**, 50–65.

52. Ducrot P, Julia C, Méjean C *et al.* (2016) Impact of different front-of-pack nutrition labels on consumer purchasing intentions: a randomized controlled trial. *Am J Prev Med* **50**, 627–636.

53. Graham DJ & Jeffery RW (2012) Predictors of nutrition label viewing during food purchase decision making: an eye tracking investigation. *Public Health Nutr* **15**, 189–197.

54. Hand C, Dall'Olmo Riley F, Harris P *et al.* (2009) Online grocery shopping: the influence of situational factors. *Eur J Mark* **43**, 1205–1219.

55. Ramachandran K, Karthick K & Kumar MS (2011) Online shopping in the UK. *Int Bus Econ Res J* **10**, 23–36.

56. Harris P, Harris P, Dall'Olmo RF *et al.* (2017) Online and store patronage: a typology of grocery shoppers. *Int J Retail Distrib Manag* **45**, 419–445.

57. Campo K & Breugelmans E (2015) Buying groceries in brick and click stores: category allocation decisions and the moderating effect of online buying experience. *J Interact Mark* **31**, 63–78.

58. Elms J, De Kervenoael R & Hallsworth A (2016) Internet or store? An ethnographic study of consumers' internet and store-based grocery shopping practices. *J Retail Consum Serv* **32**, 234–243.

59. Robinson H, Dall'Olmo R, Rettie R *et al.* (2007) The role of situational variables in online grocery shopping in the UK. *Mark Rev* **7**, 89–106.

60. Van Droogenbroeck E & Van Hove L (2017) Adoption of online grocery shopping: personal or household characteristics? *J Internet Commerce* **16**, 255–286.

61. Melis K, Campo K, Breugelmans E *et al.* (2015) The impact of the multi-channel retail mix on online store choice: does online experience matter? *J Retail* **91**, 272–288.

62. Chu J, Arce-Urriza M, Cebollada-Calvo J *et al.* (2010) An empirical analysis of shopping behavior across online and offline channels for grocery products: the moderating effects of household and product characteristics. *J Interact Mark* **24**, 251–268.

63. Clark L & Wright P (2007) Off their trolley – understanding online grocery shopping behaviour. In *Home Informatics and Telematics: ICT for the Next Billion*, pp. 157–170 [A Venkatesh, T Gonsalves, A Monk *et al.*, editors]. Boston, MA: Springer.

64. Milkman KL, Rogers T & Bazerman MH (2010) I'll have the ice cream soon and the vegetables later: a study of online grocery purchases and order lead time. *Mark Lett* **21**, 17–35.

65. Huyghe E, Verstraeten J, Geuens M *et al.* (2017) Clicks as a healthy alternative to bricks: how online grocery shopping reduces vice purchases. *J Mark Res* **54**, 61–74.

66. Gorin AA, Raynor HA, Niemeier HM *et al.* (2007) Home grocery delivery improves the household food environments of behavioral weight loss participants: results of an 8-week pilot study. *Int J Behav Nutr Phys Act* **4**, 1.

67. Benn Y, Webb TL, Chang BP *et al.* (2015) What information do consumers consider, and how do they look for it, when shopping for groceries online? *Appetite* **89**, 265–273.

68. Breugelmans E & Campo K (2011) Effectiveness of in-store displays in a virtual store environment. *J Retail* **87**, 75–89.

69. Breugelmans E, Campo K & Gijsbrechts E (2007) Shelf sequence and proximity effects on online grocery choices. *Mark Lett* **18**, 117–133.

70. Epstein LH, Finkelstein EA, Katz DL *et al.* (2016) Effects of nutrient profiling and price changes based on NuVal® scores on food purchasing in an online experimental supermarket. *Public Health Nutr* **19**, 2157–2164.

71. Forwood SE, Ahern AL, Marteau TM *et al.* (2015) Offering within-category food swaps to reduce energy density of food purchases: a study using an experimental online supermarket. *Int J Behav Nutr Phys Act* **12**, 85.

72. Gorkovenko K, Tigwell GW, Norrie CS *et al.* (2017) Shop-Comm: community-supported online shopping for older adults. *Stud Health Technol Inform* **242**, 175–182.

73. Lagisetty P, Flamm L, Rak S *et al.* (2017) A multi-stakeholder evaluation of the Baltimore City virtual supermarket program. *BMC Public Health* **17**, 837.

74. Lennon SJ, Ha Y, Johnson KK *et al.* (2009) Rural consumers' online shopping for food and fiber products as a form of outshopping. *Clothing Textiles Res J* **27**, 3–30.

75. Freud A (2017) Commentary: Will consumers buy groceries online? https://www.mediapost.com/publications/article/299119/will-consumers-buy-groceries-online.html?utm_source = newsletter&utm_medium = email&utm_content = headline &utm_campaign = 102180&hashid = gvLbu9jPisIyAkWs68 5bXVYVYq8 (accessed July 2018).

76. US Department of Agriculture (2017) USDA announces retailer volunteers for SNAP online purchasing pilot. https://www.usda.gov/media/press-releases/2017/01/05/usda-announces-retailer-volunteers-snap-online-purchasing-pilot (accessed July 2018).