

## ORIGINAL ARTICLE

# Informing a roadmap for cross-sectoral collaboration on portion size management as a national strategy to improve population nutrition – a Delphi study

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## Summary

### Background

Addressing food portion sizes is a key untapped opportunity to help tackle obesity. This study sought to inform the agenda of a national movement involving diverse sectors to manage portion sizes in packaged foods, restaurants, cafeterias and prepared foods in grocery stores.

### Methods

A Delphi study was conducted with representatives from public health, private-sector food companies and academia that formed a panel of experts ( $n = 32$ ). Three iterative rounds of surveys were administered over 3 months. The surveys gathered opinions on psychological mindsets affecting portion size choice, eating habits, portion perception and distortion, passive overconsumption and challenges and advantages of this tool to improve population nutrition. The survey also inquired about visions for a future food environment. After every round, responses were analysed and questions narrowed to reach group consensus on specific items in the subsequent round.

### Results

Although many experts fear that portion size interventions might be perceived as paternalistic, 91% of respondents agreed stealth interventions were preferable. Seventy-three per cent of experts believed that the most impactful portion size intervention was product reformulation while smaller packages were the most effective intervention according to only 28% of experts. The majority of the panel (59%) also believed that creating an artificial stopping point in packages was the best strategy to reduce food consumption. Finally, the study found that one of the most complex aspects of establishing a multi-sector collaboration for obesity prevention was to ascertain trust in the private sector's ability to balance profit versus social responsibility. [Corrections added on 21 March 2019, after first online publication: The percentage of experts who believed that small packages were the most effective intervention has been changed from "16%" to "28%".]

### Conclusion

This study informs the agenda of a cross-sectoral, coordinated movement to tackle obesity through a combination of changing social norms, individual behaviours and industry practices around portion size. Although cross-sectoral collaboration for non-communicable disease prevention is encouraged by different organizations, strategic efforts to define a common agenda on portion size have been limited thus far. This research highlights important strategies in portion size interventions and steps needed for the success of such a movement, as part of a wider effort across sectors and stakeholders to halt and reverse obesity rates in the USA.

**Keywords:** Delphi survey, nutrition, portion size, public-private partnership.

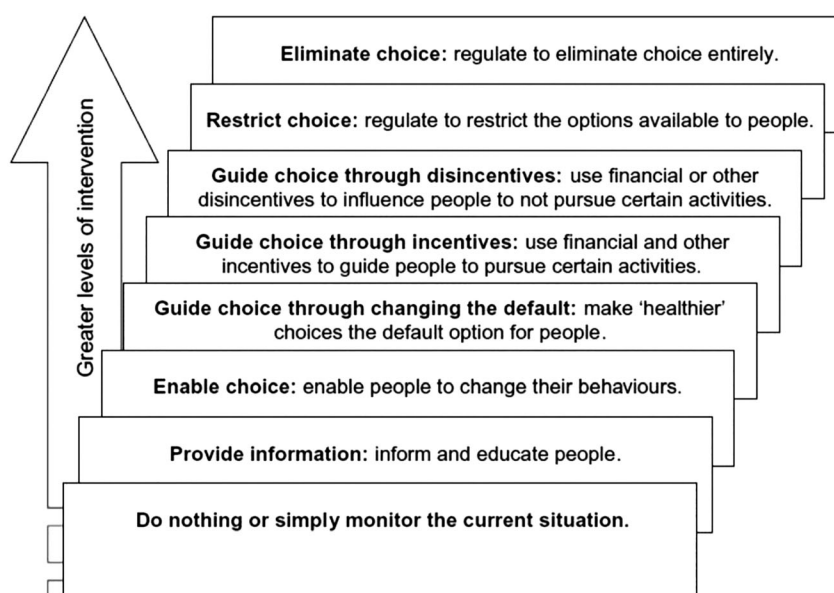
Today, more than one-third (39.8%) of American adults and 18.5% of youth are obese (1). One of the key environmental drivers of energy intake and weight gain is larger-than-appropriate portion sizes, although portion size control strategies have been mostly lacking to date in public health efforts focused on obesity (2–4). Different studies have shown how portions at fast food outlets, chain restaurants and convenience stores have increased dramatically in the past 30–40 years (5). Fast food items are estimated to be up to five times larger than those of three to four decades ago, and most portion sizes in the typical American diet exceed the government-recommended serving size (5,6). For example, a study showed that a typical muffin in the USA is 333% larger than the US Department of Agriculture recommendation and a serving of pasta 480% larger (7). Portion size increases affect not only out-of-home eating but also in-home consumption. The negative health impact has been noted in both adults and children (8–10). In the USA, exposure to large portion sizes is so pervasive that it has distorted consumption norms and expectations around appropriate meal size (2).

Clinical studies, in both natural and controlled settings, have showed an association between the increase in portion sizes and energy intake (11–15). In one study, adults who were served four different portions of macaroni and cheese on different days consumed 30% more energy (676 kJ) when offered the largest portion (1,000 g) compared with the smallest portion (500 g) (14). In another study, researchers offered men and women on five different occasions a snack that consisted of 28, 42, 85, 128 or 170 g of potato chips in a plain, unlabelled foil bag. When participants were served the 170-g package, women ate 18% (200 kJ) more and men ate 37% (511 kJ) more than when served the 85-g package. Moreover, the study found that although individuals reported feeling fuller with a larger snack, subsequent portion sizes were not adjusted to compensate for the increased calorie intake and sense of satiety (16). Zlatevska *et al.* established through a meta-analytic review that a doubling of portion size leads to a 35% increase in consumption on average across different food types and in a range of contexts (17). Another study from Young and Nestle shows how portion sizes are consistently larger than in the past and explicitly states the ‘need for greater attention to food portion size as a factor in energy intake and weight management’ (5). Finally, research in the USA and elsewhere has shown that predisposition to eat a greater amount of energy in response to large portions occurs in both children and adults regardless of current weight status, sex and degree of dietary restraint or disinhibited eating behaviour (15,18–20).

Interventions on portion size have been shown to reduce food intake, weight loss and/or prevention of weight gain (21–23). Although there still a limited number of studies investigating the effect of portion size, more research has been conducted in this area lately. Portion size interventions can be categorized according to the ladder of interventions of the British Nuffield Council on Bioethics that ranges from simple information dissemination to choice elimination (24) (Figure 1). For example, recent changes to the Nutrition Facts label include a more prominent display of the calorie content and serving size of a portion (25). There have also been efforts by industry to reduce the package of food products (e.g. 7.5 fl. oz. soda cans). Regulatory strategies include New York City’s failed push to ban supersized sugar-sweetened beverages, a form of choice elimination.

Although no single intervention can reverse the obesity burden, a report from the McKinsey Global Institute suggests that the highest impact intervention area may be portion control (26). According to the report, portion size reduction in packaged foods, restaurants and cafeterias could save more than two million disability-adjusted life years in the whole population of the UK or 4% of the total disease burden attributable to overweight and obesity. A recent review has further demonstrated the impact portion guidance and control could have in weight loss (27). Successful interventions cited in the review used different strategies, such as segmentation cues in food packaging (insertion of visual markers in a snack food package, such as a red potato chip every 10 regular ones), forming implementation intentions (specific action plans, such as ‘the next time I want chocolate I will eat an apple instead’) and the use of other self-regulatory, portion control strategies (efforts to control and maintain adequate selection and intake of the amount of food) (28–31). In part, the success of these interventions appears to be a reliance on subconscious mechanisms that transform the default behaviour to a healthier and easy-to-adopt option. Some portion size interventions use choice architecture to subliminally influence behaviour change affecting consumer perception, judgement and decision, ultimately changing the social norm (32). The most recent Dietary Guidelines for Americans 2015–2020 published by the US Department of Health and Human Services and the US Department of Agriculture also recommend reducing portion size of a wide variety of foods (33).

The paradigm shift around non-communicable disease causation – from individual choice to complex interplay of factors in the obesogenic environment – requires innovative public health approaches (34). The National Academy of Medicine has specifically called for ‘leaders across all levels of society’ to engage and implement a



**Figure 1** A ladder of interventions (Adapted from Ref. 24)

comprehensive approach to tackle obesity (35). Indeed, in order to solve a problem as complex as obesity, a multi-sectoral and multi-setting approach is needed, and portion size interventions, although not the sole response to the problem, can play an important role in this fight. Cross-sectoral collaborations are needed to maximize the effect of portion size interventions (36). Currently, there is need for a national movement to manage portion size, which would require multiple sectors coming together to address both the supply of and demand for food. There is an opportunity for stakeholders from different sectors (i.e. public agencies, private companies, non-profits and academia) to engage in coordinated and sustained efforts to strategically intervene in different settings (34,37,38).

Within this framework of a coordinated multi-sectoral dialogue, this study aims to inform the roadmap for a national movement for portion size management, which aims at helping people consume more appropriately sized portions of food. The Center for Systems and Community Design at the City University of New York Graduate School of Public Health and Health Policy is working in collaboration with Georgetown University's Global Social Enterprise Initiative (GSEI) to help shape this roadmap. This paper describes a Delphi survey study regarding key levers and strategies that could form the basis of this roadmap, based on opinions of select experts from public health, government, non-profits and industry. Following the Delphi method, the investigators asked a series of broad questions regarding population nutrition before

narrowing the survey to portion size interventions. Moreover, in order to give maximum freedom of reflection to all respondents, portion size interventions were often presented as one possible option to improve nutrition, rather than the only possibility, to eliminate any bias and allow respondents to respond freely.

## Methods

### Study population and recruitment

The researchers reached out to a multidisciplinary group of key informants that represent different interest groups in the fields of obesity, public health, food production, access and distribution and the broader nutrition field who were experts in their areas of work. Informant expertise was established by leadership positions, contributions to the field, research and invitation to the roundtable for key stakeholders on the topic of obesity and portions. Using the Delphi method, non-probability sampling techniques were used, and participants were purposively selected. A pool of heterogeneous respondents was identified during the Roundtable on Obesity and Portions hosted by GSEI on 22 January 2018. Contact information for participants was obtained through GSEI and an initial invitation to participate in the study was sent out.

There are no specific guidelines suggesting the numbers to be included in the panel of experts for Delphi surveys; however, different researchers agree that the sample size should not be smaller than seven or larger

than 50 participants (39–41). Most studies that use the Delphi technique recruit panels of between 15 to 35 people (42). Because multi-step repeated surveys may have attrition issues, especially after the first cycle, the researchers decided to send out the study invitation to 105 people initially and included all those who agreed to participate, encompassing representatives from public health, government, civil society and the food industry (43).

This research was deemed exempt from review by the City University of New York Human Research Protection Program.

### Data collection – Delphi survey

Data were collected using the eDelphi technique, which follows the Delphi protocol method through a web-based survey tool (SurveyMonkey). At the beginning of January 2018, approximately 3 weeks before the survey was first administered, potential participants were informed of the study objectives, provided information about the Delphi process and invited to participate. Participants were also assured that responses were confidential and known only to the survey moderator (lead author). The study followed the protocol used in the majority of Delphi studies applied to health research, in which the first round consists of

many open-ended questions or a modified approach to develop initial statements and subsequent rounds using percentage of agreement and measures of central tendency (mostly median) to aggregate data and transform questions into Likert scales, preferably without a midpoint (44–46).

This study consisted of three successive rounds of surveys to a panel of respondents comprised of experts in diverse fields over a period of 3 months (January–March 2018). Each survey round was conducted over 4 to 5 weeks: 1 week for pilot testing (for the first round only), 2 weeks for response acquisition (including e-mail reminders prior to the closing date) and 2 weeks for data analysis and preparation of the subsequent round. Personalized e-mail messages were sent to respondents with a URL link to the survey. The list of respondents from each round was then copied into new recipient lists for subsequent rounds. Between the first and second rounds, 44% ( $n = 14$ ) of participants were part of the GSEI roundtable on portion size, and more information on the topic was gathered in person through observation of and notes from the meeting (see Figure 2 for an overview of the process). This was seen as an advantage in an effort to achieve consensus, as the roundtable provided participants with more information about the importance of portion size.

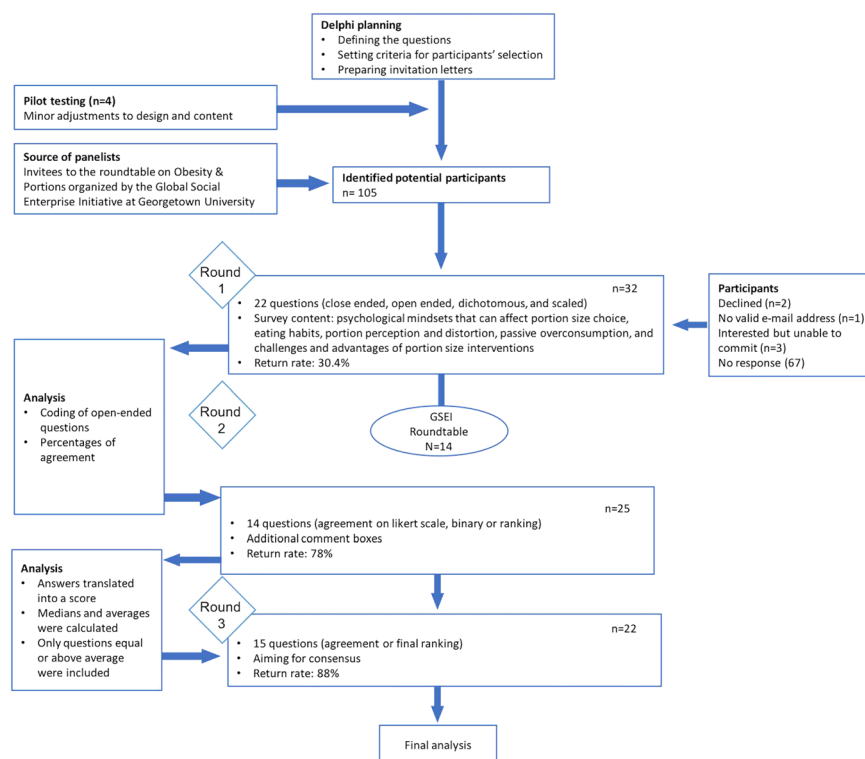


Figure 2 Delphi process

## First round

The first questionnaire asked 22 questions (see <http://www.cunycscd.org/questionnaire>) that were developed by the investigators including demographic information. This initial input provided focus for the subsequent round. The questions aimed at gathering opinions on the following issues surrounding portion guidance and effect on population nutrition: psychological mindsets affecting portion size choice, eating habits, portion perception and distortion, passive overconsumption and challenges and advantages of the tool to improve population nutrition. The questionnaire included a mix of question types – close-ended, open-ended, dichotomous and scaled.

## Second round

In the questionnaire, the majority of questions were transformed into statements using a Likert-type scale of agreement without a midpoint (strongly disagree, disagree, agree or strongly agree) to eliminate the possibility of a non-answer. Questions that already provided an average as an answer in the first round (e.g. 'On a scale of 1 to 10 what is the extent to which the private sector can shape population nutrition?') were transformed into binary questions (agree or disagree). Questions that were open-ended in the first round were transformed into categorized and coded statements. Any category that was voiced by at least two respondents in round 1 was included in questions for round 2 where respondents were asked to agree with them or not. Any language that was used by participants in open-ended questions was kept as close to the original as possible to avoid introducing bias. Additional comment boxes were added to all questions that were open-ended in the first round to ensure that analysis was comprehensive. Questions in the first round that asked for a ranking of items were translated into a selection of the three most important items. This round also had a new question that was added to clarify confusing statements from the first round.

## Third round

The third and final round aimed at narrowing issues even further to reach consensus. Mean and median scores were calculated for every answer of the second round. The final questions included only items that received a score equal or higher to the mean (chosen over median as it was the most conservative number and allowed for more answers to be included).

## Results

### Delphi participants

Invitations to participate in the Delphi survey were sent by e-mail to the 105 experts who were invited to the GSEI Roundtable on Obesity and Portions. Thirty-seven (35%) experts responded to the invitation, of which 2 (2%) explicitly declined to participate in the study, 3 (3%) expressed interest but were unable to commit time and 32 (30%) agreed to be part of the study; 67 (64%) did not respond. Of the 32 panellists that participated in round 1, seven (22%) did not respond to the subsequent round; and among round 2 respondents ( $n = 25$ ), three (12%) did not respond to round 3.

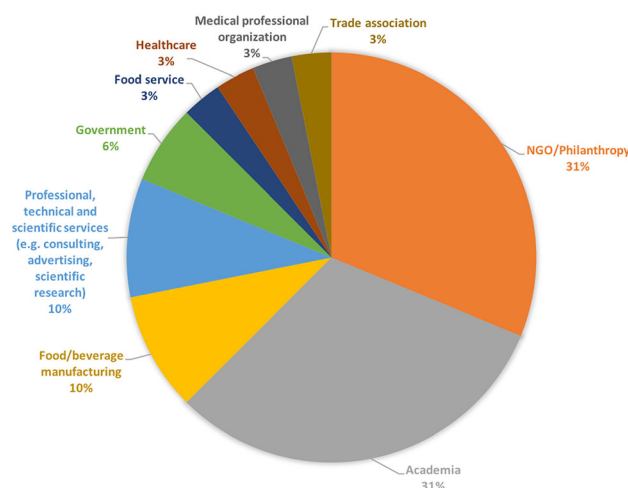
The majority of participants worked in either NGO/philanthropy (31%) or in academia (31%). Nine per cent of the experts worked in food/beverage manufacturing, 9% worked in professional, technical and scientific service and 6% worked in government. The remaining 12% of experts worked in food service, healthcare, medical professional organizations and trade associations (Figure 3). Of the respondents, most held the title of either Director or Managing Director (25%); 16% held the title of Vice President; 12% were Professors; 6% were Senior Policy Advisors; and 6% were Presidents of the organization they worked for. The majority of respondents were female (81%) and White/Caucasian (84%). Thirty-seven per cent of participants were between 45 and 54 years of age (Table 1).

### Delphi results

The three rounds of questions can be broadly categorized as (i) thoughts on public interaction with the private sector for social action, (ii) opinions on factors that impact population nutrition, (iii) specific challenges and advantages of portion size interventions, (iv) ideas on the practical implementation of such interventions and (v) envisioning supermarkets and restaurants of the future. The final questions about a future vision of supermarkets and restaurants were purposely vague to investigate if respondents saw portion size changes implemented in the future even when not prompted to think about these specific interventions. Language used in this paper's results section came directly from responses given by participants, and words were not altered to avoid introducing bias.

### Public-private partnership for social action

In the first round, participants were asked to rank on a scale of 1 to 10 (10 being the most) the extent to which



**Figure 3** Delphi survey panellists' industry areas of work

**Table 1** Demographic information of Delphi survey panellists

	N (%)
Gender	
Female	26 (81)
Male	6 (19)
Age	
25 to 34	5 (16)
35 to 44	6 (19)
45 to 54	12 (37)
55 to 64	7 (22)
65 to 74	2 (6)
Race/ethnicity	
White/Caucasian	27 (84)
Asian/Pacific Islander	2 (6)
Middle Eastern/Arab	2 (6)
Hispanic	1 (3)

the private sector could shape population nutrition. The average answer was 7 with a range of scores from 3 (3%) to 10 (22%). This score was confirmed in both round 2 (72% agreement) and round 3 (77% agreement).

Participants were asked to list the greatest challenges for the private sector in taking social action to improve population nutrition. The responses were coded into different categories. Responses with a percentage of agreement equal to or higher than the average on round 2 were asked again in the final round. The contradiction between the aim of private profit versus public responsibility emerged as the greatest challenge for social action by the private sector (64% strongly agreed), followed by consumer preference (32%) and social norm (32%) (Table 2).

### Tools to impact population nutrition

After participants were asked to list in order of importance different tools for improving population nutrition, in round 2, participants were asked to pick three tools that they believed were most impactful. The tools that were chosen were patient/consumer diet education and counselling (64%), marketing for healthy food (40%), limiting portion size (33%) and limiting junk food marketing (27%). In the final round, when asked to rank tools by potential impact, 36% of participants agreed that limiting junk food advertisement was the first most impactful tool to improve nutrition at the population level, 45% agreed that marketing for healthy food was the second most impactful tool and 43% chose limiting portion size as the third most impactful tool.

### Advantages and challenges of portion size interventions

After being prompted to list the benefits of portion size interventions, participants most often strongly agreed with the following cited advantages: decrease caloric intake (36%), enable automatic behaviour change (36%), educate consumers on appropriate portion sizes (23%) and allow small treats (18%).

As for the disadvantages of portion size interventions, participants most often agreed that portion size interventions do not take into account the context of a total diet (36%); portion size interventions are hard to implement without a great deal of resources and support from industry (27%); price/value might be a problem for communities with low socioeconomic status (27%); it is very hard

**Table 2** Greatest challenges for the private sector in taking social action

Question*	Percentage of agreement	Quotation	Round 1 (n = 32)				Round 2 (n = 25)				Round 3 (n = 22)			
			Strongly disagree	Disagree	Agree	Strongly agree	Strongly disagree	Disagree	Agree	Strongly agree	Strongly disagree	Disagree	Agree	Strongly agree
What are the greatest challenges for the private sector in taking social action in population nutrition?	50	'Competition for market share is greatest challenge - fundamentally the private sector is designed to make a profit and fight things that get in the way of that. Thus, limitations that position companies negatively or that single them out, such as mandatory policies that do not create a level playing field for them, are solutions they will fight. Alternatively, multi-sector in centive-based solutions are embraced by companies, particularly when they acknowledge the operational and financial challenges that companies must overcome to successfully implement health-promoting changes'	16%	16%	32%	36%	16%	8%	68%	16%	0%	27%	55%	18%
Consumer misinformation	16	'Population misinformation on what is good nutrition and therefore driving what they think they should be buying and eating and ultimately profit for the right healthy foods'	8%	8%	68%	16%	8%	20%	68%	8%	0%	18%	50%	32%
Consumer preference	16	'The greatest challenges include how to best market healthy, reasonably sized portions of foods to consumers, particularly in an	4%	4%	68%	8%	4%	20%	68%	8%	0%	18%	50%	32%

Continues

Table 2. Continued

Question*	Round 1 (n = 32)		Round 2 (n = 25)				Round 3 (n = 22)			
	Percentage of agreement	Quotation	Strongly disagree	Disagree	Agree	Strongly agree	Strongly disagree	Disagree	Agree	Strongly agree
Public sector hostility	16	environment that values "bigger is better." Also, providing consumers with nutritious food that is also delicious and satisfying' 'Being supported for incremental progress rather than demonized for not doing enough'	12%	56%	16%	16%				
No information on what works	13	'the private sector is often risk-averse and may want to be sure action will be positively rewarded (financially, PR-wise, etc.) before taking action'	12%	32%	56%	0%				
No interest in social action	9	'do not think it is their responsibility'	24%	56%	16%	4%				
No consensus among stakeholders	9	'Lack of consensus by key stakeholders on effective solutions inhibits action'	12%	28%	48%	12%	4%	50%	32%	14%
Social norm	9	'The greatest challenge is likely a cultural shift'	0%	28%	52%	20%	0%	14%	54%	32%
Issue complexity	6	'The complexity of the multifactorial issue. We live in a world of both under and over nutrition plus the complexity of cultural/ socio-economic and others issues with nutrition. Adding is the confusion of what good nutrition is and what good nutrition delivers (improved health vs weight loss)'	12%	40%	32%	16%				

\*This is the question asked in round 1. In round 2, participants were given a summary of the answers given by at least two respondents and were asked to choose their level of agreement. In round 3, they were presented with the five answers that were selected by the majority on the previous round and asked to choose their level of agreement.



to convince food companies as big portions bring big profits (18%); and consumers might get angry with perceived loss of value of bigger portions (14%).

### Practical implementation strategies of portion size interventions

Participants answered specific questions about implementing portion size interventions (Table 3). Participants agreed that the most effective strategy to enhance the psychological value of smaller food and beverage portions was to display options at more valued places of the store (59%). They also believed that the most effective strategy to reduce food consumption was to create an artificial stopping point, such as separating a large package into several smaller sub-packages or using internal sleeves (59%). In addition, participants believed that the portion size intervention with the highest impact potential was product reformulation, as a way to reduce the energy density of the food while keeping the same size (73%). Sixty-four per cent (64%) of participants believed that restaurant settings with portion size interventions could have the most impact in improving population nutrition. Finally, almost all participants (91%) agreed that portion innovations should be stealth and unnoticed by consumers (Table 4).

### The future of supermarkets and restaurants

At the end of the first questionnaire, participants were asked to describe what supermarkets and restaurants would look like in 2030. The answers were further refined in subsequent rounds. By the final survey, a clear image emerged. Participants envisioned the restaurant/cafeteria of the future as a place where, first and foremost, more options of healthy food would be offered (100%). They also envisioned a place where healthy food would be beautiful and appealing (95%) and at a reasonable price (95%). According to participants, the restaurant/cafeteria of the future would also offer detailed nutrition information for all meals (91%) and that information would be personalized, most likely through smartphones (82%).

Participants described the restaurant of the future as a place where shopping would be a personalized experience (95%), and there would be detailed nutrition information on everything (86%). Finally, participants envisioned cafeterias as a place that would offer more package size options (86%) and specific incentives to eat healthy, such as a points card (82%).

As for the supermarket of the future, all participants agreed that it would offer healthy pre-packaged options (100%). The vast majority also agreed that food would

be aesthetically beautiful (91%) and that healthy food would be very visible and easily accessible (91%).

## Discussion

This study is one of the first to gauge the perception of diverse stakeholders regarding priorities for a national strategy around portion size management and control. The results of this study can inform the agenda of a multi-sectoral collaboration to manage portion sizes in the USA, from both supply and demand perspectives. The science on increasing portion size in the American diet and how it contributes to overconsumption is clear. However, little coordinated public health effort has been directed towards addressing this problem. Portion size interventions can be highly cost-effective in changing norms, can be applied to a vast population at the same time and tend to be long-lasting (26). A national movement could facilitate cross-sectoral partnerships that would be difficult to achieve through strategies targeting single products (e.g. sugar-sweetened beverages) or single ingredients (e.g. fat or sugar).

Experts who participated in the Delphi process agreed on the power the private sector has in shaping population nutrition. Most participants also believed that marketing, which is one of the most used tools by private companies, could be among the most impactful tools to improve nutrition (59%). A large percentage of participants also highlighted that one of the greatest obstacles that portion size interventions might encounter is difficulty of implementation without private sector support and resources. However, despite acknowledgement of the role that industry can play in this area, participants expressed scepticism that such collaboration is feasible. Most participants highlighted the underlying tension that industry has between maximizing profits and improving population health. This suggests that for a national movement to come together, building trust and a transparent and accountable governance mechanism will be critical (38,47).

This study highlights the importance of addressing not just the supply of food but also its demand. Respondents agreed that established social norms might hinder action by the private sector and specifically mentioned consumer preference and consumer misinformation as obstacles to change. Any coordinated movement will likely require mutually reinforcing strategies to tackle both the supply and demand to ensure one optimally impacts the other, in a truly systems-oriented fashion. Industry marketing expertise as well as grass-roots mobilization practices could be used to shift public demand. Research is needed to identify specific communication frames that would be most useful in different consumer segments.

**Table 3** Consensus building on practical implementation of portion size interventions

Questions*	Round 1 (n = 32)					Round 2 (n = 25)			Round 3 (n = 22)	
	Percentage of agreement	Not effective	Moderately effective	Effective	Very effective	Least effective	Effective	Most effective	Most effective	Most effective
New research shows that a 'low status mindset' (i.e. feeling that one is low in power within a social group) can lead consumers to strive for status through consumption of larger portions of food. Rate from 1 to 10 how effective the following strategies to enhance the psychological value of smaller food and beverage portions are:		3%	25%	63%	9%	32%	28%	40%	41%	59%
Media advertisement Point of sale display (offering smaller foods in more valued places of the store) Enhance the packaging of smaller food options		0%	31%	57%	12%	24%	40%	36%		
On a scale of 1 to 10, how effective do you believe the following strategies to reduce food consumption can be:		9%	37%	51%	3%	12%	32%	56%	59%	
Create an artificial stopping point (e.g. separating a large package into several smaller sub-packages and using internal sleeves) Offer reduced-sized packages – along with the normal-sized packages – and charge a premium (per unit) price for the smaller products Offer a 'vice-virtue bundle' (e.g. apples and brownie for the same portion size)		32%	44%	21%	3%	68%	28%	4%		
In order of importance, choose the top 3 settings in which		9%	50%	28%	13%	20%	40%	40%	41%	
School	50					68%	28%	4%		
Work site	22					20%	60%	20%		
Grocery store	50									

Table 3. Continued

Questions*	Percentage of agreement	Round 1 (n = 32)					Round 2 (n = 25)			Round 3 (n = 22)			
		Not effective	Moderately effective	Effective	Very effective	Least effective	Effective	Most effective	Most effective				
portion size interventions could have the most impact in improving population nutrition	88 22 31 31 19												
Restaurant													
Other retailers (e.g. drug stores)													
Home Cafeteria													
Vending machine													
On a scale from 1 to 10, rank the following portion size interventions in terms of impact:													
Reduce the size of the single serving of a large package on its nutrition label		44%	41%	15%	0%								
Produce smaller packages		3%	32%	49%	16%	40%	32%	28%					
Tax particularly big packages of energy-dense food/beverages		15%	25%	41%	19%	48%	32%	20%					
Product reformulation (reduce energy density of the food while keeping the same size)		3%	25%	47%	25%	12%	36%	52%					
Offer a larger variety of portion sizes		3%	50%	34%	13%								

\*These are the questions asked in round 1. In round 2, respondents were asked their opinion on the effectiveness of the answers that scored higher or equal to average on the precedent round. In round 3, respondents were asked to pick the most effective strategy/tool/setting.

**Table 4** Portion innovations – stealth versus announced

Should portion innovations be stealth and unnoticed by the consumer or explicitly announced?		Round 1 (n = 32)		Round 2 (n = 25)		Round 3 (n = 22)	
Quiet and unnoticed	Explicitly advertised	72%	28%	Disagree, portion innovations should be explicitly advertised	Agree, portion innovations should be quiet and unnoticed	9%	91%
				Disagree, portion innovations should be explicitly advertised	Agree, portion innovations should be quiet and unnoticed	28%	72%

There is a high level of agreement among participants in regard to supply-side strategies for portion size management and control. Key recommendations include displaying smaller packages in highly valued places of a supermarket/food markets and creating sub-units of portions within large units. As mentioned earlier, restaurants were thought to be the most important intervention setting. Nearly half of food budgets in American households are directed to foods away from home, suggesting that restaurants and other providers of prepared foods represent an important sector to effect a national movement on portion size management (48).

Our panel of experts overwhelmingly suggested that changes in portions should be stealth and not explicitly advertised. There may be some merit in this as marketing research shows that stealth approaches to product reformulation are better received by consumers (49). However, further investigation is needed to understand the implication of this approach, especially because most respondents thought that portion size interventions could be overly paternalistic, which stands in contradiction to a stealth intervention approach. Moreover, although limiting portion size was considered an effective tool to improve nutrition, marketing healthy food and limiting marketing for junk food were considered even more impactful measures. This suggests that to increase public health buy-in, a national movement on portion size needs to be coordinated with other environmental and policy strategies to address obesity and chronic disease. Portion size interventions may be an important strategy to leverage, but it should not be seen as the panacea to the obesity epidemic.

In Delphi studies, threats to validity might arise from pressures for convergence and agreement, which could undermine the purpose of the method to be able to forecast and gather consensus. To respond to this concern, the researchers thoroughly explained the research process to participants and highlighted the importance of expressing individual opinions at each round. This study also had attrition; 10 participants were lost out of the original 32 between the first and final round. However, the final number of respondents (n = 22) was well within the range recommended in the literature (42). The panel of experts was not as diverse as it could be (predominantly female and White/Caucasian) but was more or less representative of typical stakeholders in nutrition-related roles. Finally, stakeholders from different sectors were not equally represented in the panel of respondents. Although an equal number of representatives from different areas was invited, the majority who responded worked in either academia or civil society. In particular, the restaurant industry was not represented.

## Conclusion

This study is a first step towards building a national strategy to manage portion size in the American food supply and diet. Results help inform the initial agenda with specific priority targets and action steps, including the importance of investing in trust building across sectors. This Delphi study represents the first step towards a scientific approach to cross-sectoral collaboration and sets the stage for defining a framework for focusing on portion control and management as a key strategy in chronic disease prevention going forward.

## Conflict of Interest Statement

All authors declare no conflict of interest.

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