

# Reducing Consumer Food Waste in Restaurants

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## Abstract:

Food waste is an economic and environmental problem of increasing concern. The food production chain, from agricultural processes to distribution, is costly, and anything that is wasted throughout the process comes with an additional monetary cost. Further, food waste accounts for a significant portion of anthropogenic greenhouse gas emissions. The foodservice industry in particular, which includes restaurants and canteens, accounts for a significant portion of waste—much of which can be attributed to plate waste from customers who do not eat everything they are served. Our proposed behavioral intervention aims to reduce food waste by increasing the number of restaurant customers that bring home their leftovers. We propose a 2x4 field experiment that leverages norms-based messages to test default to-go container availability against tabletop messages. We anticipate that by increasing the visibility of to-go containers and the saliency of taking food home, we will be able to successfully nudge customers to make less wasteful decisions in these food service environments. The following proposal frames the problem within the appropriate context, provides an explanation of the intervention's design, and indicates directions for future research.

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## Introduction

According to the Intergovernmental Panel on Climate Change's *Special Report on Climate Change and Land*, about one-third of anthropogenic greenhouse gas (GHG) emissions in the last decade can be attributed to land use for food production, agriculture, and forestry (Shukla et al., 2019). Animal food production, for example, is more resource intensive than other human activities related to land use (Gerber et al., 2013), and as a result, many behavioral interventions have been introduced to reduce consumption (Gravert & Kurz, 2019; Kurz, 2018; Sparkman, 2020; Vandenbroele et al., 2019; Vandenbroele et al., 2020). Alas, this is only one method for chipping away at our exorbitant GHG emissions, but the prevailing focus on such food purchase behavior overshadows a widespread issue that is an equally important component of environmental progress: food waste.

According to the Food and Agriculture Organization of the United States, one-third of all food produced every year is either wasted or lost throughout the entire food supply chain, from production to transportation to consumption (FAO, 2011). It is estimated that this waste accounts for about 8% of global anthropogenic GHG emissions (Wieben, 2017). In the United States, 54 million of the 229 million tons (24%) of food available went to waste in 2019 alone, and roughly 23 million of those 54 million tons (43%) of food waste occurred in customer-facing businesses such as grocery stores, restaurants, and other foodservice organizations (ReFED, n.d.a). Not only is food waste an environmental problem, but it is also an economic one. The total value of US food waste in 2019 added up to \$285 billion, \$152 billion (53%) of which was attributed to restaurants and canteens. Reducing these numbers would not only save money and reduce some of the associated climate impacts of our food system, but it would also help our world meet food security demands. Approximately 800 million people are undernourished (Food, 2015), and it is estimated that about two billion people suffer from micronutrient deficiencies (Tulchinsky, 2010). Given that the world population is expected to rise to roughly 10 billion by 2050 (Springmann et al., 2018), wasting food is no longer an acceptable option.

Much food waste at the industrial and retail levels comes as a result of structural problems: bad weather, processing issues, unstable markets, non-standardized labels, and more. Yet, food waste at the foodservice level is mostly a collective behavioral problem, not just the result of business policy. Roughly 70% of restaurant waste is due to plate waste from customers who do not eat all that they are served or all that they take from a buffet (ReFED, n.d.). Of the many solutions to combat this type of food waste, reshaping contextually-dependent consumer environments has been identified as the solution area with the most potential in terms of net financial benefit, climate impact, water savings, and meal creation (ReFED, n.d.), making this issue well-suited for a behavioral intervention. Given that food waste behavior is considerably context-dependent, it is only natural that this area of research is furthered through the use of field experiments. In addition to providing plausible settings to measure actual behavior rather than self-reported behavior, field experiments will enhance the relevance and external validity of research in this key action area.

With the problem and context in focus, we turn our attention to behavioral interventions, where there is growing empirical evidence that promises highly-beneficial environmental effects (Sunstein & Thaler, 2003) that are both effective and cost-efficient (Benartzi et al., 2017). Additionally, behavioral interventions have gained considerable traction as a method to change food consumption and food waste behavior in recent years (Reisch et al., 2020). Of 56 behavioral studies identified by Reisch et al. (2020) investigating food consumption and food waste, priming, disclosure, social norms, and defaults were the most common interventions. Of 20 studies that examined the effects of behavioral interventions on food waste specifically, social norms and defaults were the most common.

One such study leveraged injunctive social norms and defaults as part of an experiential learning project in a buffet-style university dining hall. The intervention led to a 17% reduction in total food waste, with a large portion of that reduction attributed to post-consumer plate waste (Ahmed et al., 2018). In another study, researchers used two nonintrusive nudges—reducing plate size (defaults) and providing social cues (social norms)—and found a 20% reduction in the amount of food waste in hotel restaurants (Kallbekken & Sælen, 2013). Additional studies were conducted with restaurant guests in three different

European settings: Italy, Switzerland and Greece. All three studies employed the same intervention: leveraging defaults and social norms to make it easier for customers to bring home their leftovers. Ultimately, these interventions led to an increase in the number of doggy bags provided to customers by 32-44% (Cesareo et al., 2019). To our knowledge, there has been limited research examining this behavior within the specific context of a United States restaurant, thus providing ample opportunity for further study.

Across the existing body of food waste research, it remains the case that individuals' waste behavior is highly reflective of, and dependent upon, the given food context. Elements to consider when examining a behavior contextually include the relevant schemas and scripts. Scripts can be understood as "prescriptive sequences of actions of varying levels of specificity that people automatically engage in (and are expected to engage in) while in particular situations" (Bicchieri, 2016, p.132). Scripts for taking home leftovers in restaurants differ considerably depending not only on the broader cultural norms surrounding waste and dining experiences but also on the type of restaurant in which people order and eat their food. Fast-casual dining, a relatively new market segment, represents the middle of the formality, cost, and convenience spectrums of restaurant dining, ranging from fast-food to fine-dining experiences. In 2013, there were 19,231 fast-casual restaurant locations in America and by 2018, there were 25,118 (Klein, 2019). The fast-casual restaurant segment is quickly growing, and given the potential value of improving standard practices within this context, there are substantial implications of even a small reduction in food waste per location. This segment shows promise as a largely-untapped but suitable domain for behaviorally-informed interventions for food waste reduction.

Fast-casual restaurants generally do not provide full table service; however, many provide non-disposable servingware and cutlery. Although there is no singular unifying set of management principles, the general script for dining at a fast-casual restaurant is that customers approach a counter, order food from the provided menu by speaking with food service personnel or by using a digital kiosk, seat themselves in the dining area, and a short time later, are either brought their food or are requested to approach a service window/counter to retrieve their order. If leftovers are desired—a decision usually

made towards the end of a meal following the visual cue of uneaten food on a plate and the internal cues of satiation—an additional script is activated. In a fast-casual context where servingware is non-disposable, taking home leftovers generally requires customers to approach the counter to make a direct request for containers, as standard table service is generally not provided. Scripts about leftovers are less readily accessed by restaurant patrons, and the current “containers-by-request” default requires additional effort and interpersonal interaction. This leads us to question if the existing scripts for taking home leftovers represent barriers to reducing plate waste at restaurants.

Also important to consider are the interrelated personal and environmental schemata relevant to the concepts of food waste and leftovers in the broader sense. To date, no comprehensive study has been conducted to directly examine the schemata of leftovers specifically; however, leftovers can be considered a physical attribute applicable to a variety of foods across both at-home and eating-out food contexts (Blake et al., 2007). According to the International Food Information Council Foundation, taking home leftovers is the most common response American consumers gave when asked to identify ways to reduce waste while eating out (IFIC, 2019). Thus, there is evidence to support the idea that taking home leftovers is schematically linked to dining out experiences, particularly through the context of food waste reduction.

Given this intersection of research, we propose a field experiment designed to address the collective behavioral problem of food waste. To implement this research, we have decided to partner with a medium-sized, American fast-casual restaurant chain that serves food at scale and, thus, stands to gain considerably even if the resulting reduction in food waste is a small one. Among these potential partner organizations, we honed in on Panera Bread, an organization that fits the optimal context criteria with an ethos compatible with the project’s intentions (Panera Bread, n.d.).

Panera Bread is an American chain of fast-casual restaurants with over 2,000 locations. Panera provides a diverse range of food, including pizza, sandwiches, baked goods, and salads. As many of these particular food items are easy to carry out in a container, we anticipate that customers’ preference for such items will increase the likelihood that they will take leftovers home (Lorenz et al., 2016). Additionally,

the purpose of this research matches well with Panera's values: Panera has a history of supporting local communities, promoting sustainable services, and, as the first national restaurant company to post calorie information on restaurant boards, being first movers (Panera Bread, n.d.). Given that Panera has also already invested in the reduction of its carbon footprint, we are confident that Panera would be amenable to partnering with us and supporting this foundational and worthwhile research.

There is substantial evidence to support our exploration of this topic, but it is important to note that our study fills an important gap in the literature by exploring the effects of defaults and social norms in the context of a large-scale American fast-casual restaurant chain. This study will be one of the first studies to explore the effects of defaults and social norms in the context of a large-scale American fast-casual restaurant chain. Due to limited prior research on this topic, we will first conduct an exploratory study to diagnose people's motivations and beliefs surrounding restaurant leftovers. Then, a field experiment will be used to measure people's actual behaviors and empirically examine the effectiveness of defaults and social norms. Overall, we expect that the use of defaults and social norms will significantly increase the likelihood that restaurant patrons' take their leftovers home.

## **Study 1: Diagnosing Behavior**

As Bicchieri et al. (2014) indicate, a collective practice is not necessarily a social norm. Thus, the purpose of Study 1 is to properly diagnose people's motivations to save or waste food. Using the measurement tools of interviews and surveys, this study will investigate whether the behavior of bringing leftovers home is a rational response, a custom, a moral preference, a convention, or a social norm. Following Bicchieri's approach (2016), to distinguish between collective practices, we will first examine if the practice of taking food home from a restaurant has conditional or unconditional preferences. If the behavior is not conditional on social expectations, it can be identified as a rational response, a custom, or a moral rule. Secondly, we will investigate if people's behavior is influenced by empirical expectations only or by both empirical and normative expectations. The prior condition would indicate that the

collective practice is a convention, and the latter condition would indicate that it is a social norm. This theoretical approach is adopted for both Study 1a and Study 1b.

## **Study 1a**

The goal of the initial exploratory study is to identify common explanations for what motivates people to take or not take leftovers home. We will conduct qualitative interviews with restaurant patrons at Panera to collect a sample of thorough responses about their beliefs and motivations to bring leftovers home. We anticipate that findings from this study may also be of use to the partnering restaurant through the additional insights we will gain about their customers' habits and preferences.

### **Method**

#### ***Participants***

In line with the design of Study 2 (below), we will recruit participants for Study 1a from the eight selected locations of our restaurant partner. From each location, we will interview ten dine-in restaurant patrons, bringing the total number of participants for this study to 80 (10 patrons x 8 locations). This helps ensure that our sample is diverse and representative of the restaurant's customer base. Interviews will be conducted by two research assistants over the course of a 4-day period (Monday-Thursday). Each research assistant will conduct interviews at one location each day of the study period from 11:00 A.M. to 2:00 P.M. local time during the standard lunch service window. Patrons must be at least 18 years old to participate.

#### ***Measure***

Patrons will be asked questions following Bicchieri's diagnostic steps (2016). The questions will be asked in the following order:

1. Why did you (not) take leftovers with you just now?
2. Do you always (not) take leftovers? Why or why not?
3. Do you think you should take leftover food home?



4. Do you believe other diners take home leftover food?
5. Do you believe people in the restaurant think you should take home leftover food?
6. How strongly do you think other's behavior influences you?

### ***Procedure***

As patrons exit the restaurant after their meal, a research assistant will approach and ask if they would be interested in participating in a 5-7 minute verbal survey in return for a \$5 coupon off their next visit to the restaurant. If they express interest, they will be presented with a statement of consent and asked to verbally confirm that they consent to participate. The research assistant will then begin recording audio and ask the questions listed above. After patrons answer the questions, demographic information including age, gender, and the size of the group they ate with will be recorded. The restaurant coupon will be given following the conclusion of the interview.

### **Expected Results**

The audio of the patrons' responses will be transcribed and then analyzed using *in vivo* (verbatim) coding methods to study the actual words and phrases spoken by the participants while preserving the meanings expressed (Manning, 2017). We expect to use this analysis to identify (1) if there are common answers to the questions, (2) patrons' sentiments toward different forms of social expectations, and (3) patrons' attitudes toward wasting food and the behavior of taking leftover food home. The results will be used to inform the norms-based messages introduced in Study 2.

### **Study 1b**

In addition to an exploratory field survey, we will also run an online experiment to collect data from a larger sample size. The goal of this experiment is to investigate how strongly different social and personal expectations (normative expectations, empirical expectations, and personal normative beliefs) motivate people to take leftover food home. We hypothesize that normative expectation is the strongest

predictor of whether people intend to take leftover food home, followed by empirical expectation and personal normative belief.

## **Method**

### ***Participants***

In total, 350 participants will be recruited on Amazon's Mechanical Turk (MTurk). Participants will be limited to people in the United States to ensure all participants have the same cultural context of the scenarios presented. Participants must be at least 18 years old.

### ***Procedure***

Participants will complete an online Qualtrics survey on MTurk. The survey will be completed in private and all responses will be anonymous. Participants will be compensated according to the budget allocated by the restaurant partner, not to exceed \$1.00 per participant. We anticipate the study will take no more than five minutes to complete.

The procedure of this study is adopted from Barth, Jugert, & Fritsche (2016). Participants will read a scenario and rate their levels of agreement with the statements given. Yet unlike Barth et al. (2016), this study will use vignettes as our major measurement tool. Instead of using "you" (i.e., the participants themselves as the character in the scenario), the study will use an imaginary character, which can help eliminate participants' potential social desirability bias to "look good" (Bicchieri et al., 2014).

Participants will read a short story of Joe, who is a person suggestively similar to the participant, eating at a fast-casual restaurant. Participants will first be introduced to the context of the restaurant. The price and the content of the food that Joe ordered are then introduced. The story ends with Joe starting to feel full although half of the food is still uneaten on the plate. The full story is presented in Appendix I.

After reading the vignette, participants will be given a set of statements on which they will rate the extent of their agreement. The statements will include items that address participants' general acceptance of the behavior (e.g. "Joe will take leftover food home."), personal normative belief (e.g. "Joe should take the leftovers."), empirical expectation (e.g. "Joe thinks other people in the restaurant take

home leftover food.”), and normative expectation (e.g. “Joe believes other people in the restaurant think that Joe should take home leftover food.”).

Then, participants will complete the Environment Attitudes Scale. This scale assesses participants' attitudes toward protecting the environment (Heyl et al., 2013). On a 7-point Likert scale ranging from “Strongly Disagree” to “Strongly Agree,” participants will self-report their levels of agreement on 19 items categorized into six major ways for individuals to help protect the environment, including recycling, energy consumption, water consumption, transportation, responsible consumption of products, and participation. After reverse scoring appropriate items, final scores will be calculated by averaging the scores of all items in each category, or in all categories. A higher final score in each category, or in total, indicates a more positive attitude towards protecting the environment.

Lastly, participants will report their demographic information including age, gender, income, and education. This information may be used by the restaurant partner to better understand their customers. After participants respond to all questions, they will be thanked and debriefed.

## **Expected Results**

We will first investigate the correlation between participants' level of general acceptance of the behavior with their level of agreement on the personal normative belief, empirical expectation, and normative expectation using Pearson Correlation. A high positive correlation between two variables indicates that the corresponding belief or expectation is more likely to be rated high when participants think Joe will take leftover food home. Following our hypothesis, we predict that participants' general acceptance of taking leftover food home will be most correlated with people's normative expectation.

We will then run a hierarchical regression to test the predictability of different beliefs and expectations on participants' general acceptance of the behavior. Having the demographic variables and the participants attitudes toward protecting the environment controlled, we predict that normative expectation is the strongest predictor of whether people intend to take leftover food home.

## **Study 2: Field Experiment**

The second part of our proposed study is a field experiment designed to explore and test the effectiveness of norm messages on reducing food waste by implementing tabletop messages alongside new defaults for takeout container access across multiple locations of a fast-casual restaurant chain. The use of normative messages and default options have both been successful mechanisms for behavior change in previous research (Reisch et al., 2020). Normative messages, generally used to signal to participants what behavior is appropriate or approved of in a given situation, and defaults can both be used to shift behavior by lowering the cognitive costs to decision making. We have opted to test both of these techniques because they have been shown to be effective as well as cost-sensitive in the context of food waste (Reisch et al., 2020). Additionally, there is evidence supporting nudge techniques as being minimally disruptive to participants (Allcott, 2011; Angner, 2015), rendering them worthy of additional testing in this context.

### **Method**

#### ***Participants***

We anticipate that field study participants will be relatively representative of the restaurant franchise's customer base in the local area.

#### ***Procedure***

Eight intervention conditions will be tested in eight Panera Bread locations within a large American city over a period of eight weeks. Following a two-month baseline data collection period, we will implement one condition in each of the locations for the entire duration of our study. Data will be collected at the end of each day of the week for eight weeks. Similarly to previous studies, we will measure the number of takeout containers taken by customers as a proxy for reduction in food waste and as our outcome variable of interest (Cesareo et al., 2019).

Following the success of existing research, our field study will employ a two-by-four between-subjects design testing a new default for easy-access takeout containers alongside four different

tabletop messages: two norms-based messages (one descriptive, one injunctive), a no-message condition, and a generic information-only message. (See *Figure 1*)

		To-Go Container Access Method	
		Standard (Containers by request-only)	Direct Access (Containers available at self-service station)
Message Type	No message	<i>Control</i>	<i>Direct Access Only</i>
	Information-only message	<i>Info Provisioning</i>	<i>Info + Direct Access</i>
	Descriptive norm message	<i>Desc. Norms Only</i>	<i>Desc. Norms + Direct Access</i>
	Injunctive norm message	<i>Inj. Norms Only</i>	<i>Inj. Norms + Direct Access</i>

**Figure 1 – 2 x 4 Field Study Design**

### **Tabletop Messages**

Of primary interest are the potential effects of norms-based messaging on increasing to-go container uptake. In the descriptive norm message conditions, the message will read “*Many of our customers bring their leftovers home to reduce food waste. [Ask for/Grab] a to-go box!*” which signals the commonness of the desired behavior to dine-in restaurant patrons. In the injunctive norm message conditions, the message will read “*Many of our customers agree that bringing their leftovers home reduces food waste and helps our environment. [Ask for/Grab] a to-go box!*” which signals the desirability of reducing food waste as expressed by fellow restaurant patrons, a relevant reference group. Both of these norms-based messages will feature accurate reference group information acquired in Study 1 to preserve authenticity and maintain the ethical integrity of our study. If Study 1 by chance yields null results, we will simply replace the *Many of our customers* context with *Many people*. To assess the impacts of increased salience of taking food to-go without norms-based messaging, we will also add generic information-only message conditions reading “*Leftovers? [Ask for/Grab] a to-go box!*” This will allow us to distinguish whether the norms component of our messages has any effect beyond the

increased salience of providing information about takeout containers. Finally, we will also include a control condition with no tabletop message provided. Note that the language across each message differs slightly to reflect the accessibility condition. (See *Accessibility of Takeout Containers* below.)

All messages will be printed in English on high-quality cardstock and inserted into easily-sanitizable acrylic displayettes which stand upright atop flat surfaces. The displayettes will be placed in the center or at the end of all dining tables in the restaurant, each with the same message displaying on both sides to maximize visual observation of the messages. Using brand-compatible design elements, the messages will be accompanied by the Panera brand logo at the top of the display card and photos of the takeout containers below the message (see Appendix II for the design mockups of the message display cards). In the no-message (control) condition, a message displayette will not be placed on the table. We anticipate that visibly displaying these messages on all tables will act as a sufficient nudge for customers to acquire a to-go container should they desire it.

### ***Accessibility of Takeout Containers***

Secondarily, to assess the impact of reduced interpersonal barriers to accessing takeaway containers and the interaction effects these defaults may have across message conditions, we will test the effects of introducing a new default for how customers acquire such containers. In *Direct Access* conditions we will change the existing containers-by-request-only default by augmenting pre-existing self-service stations to stock to-go containers, thereby making them more readily available to customers. We anticipate that by placing to-go boxes with other items at the self-service station customers will 1) be more likely to notice the containers (increased salience) and 2) be more inclined to consider using takeaway containers should they have need of them by the end of their meal. Note that this intervention does not restrict customers' ability to request takeout containers from food service personnel. Therefore, as an additional measure, we will collect daily data on the number of times a takeout container is requested in customer-accessible default conditions which we can compare with the baseline by-request-only conditions to see if the new default condition effectively reduces customers' reliance on pre-existing scripts for obtaining takeaway containers. To accurately reflect these access conditions across

message conditions, we will adjust the action elements of messages to accurately inform dine-in patrons of the method of container access: *Ask for* language will be used in the standard access method conditions, and *Grab* language will be used in the new direct container access conditions (i.e., *Leftovers? Ask for a to-go box!* vs. *Leftovers? Grab a to-go box!* across information-only message conditions).

## Expected Results

Our hypotheses are as follows:

**H1:** *The introduction of descriptive and injunctive norms-based messaging will increase takeout as measured by the total number of containers used when compared to no-message and information-only message conditions.*

**H2:** *The introduction of direct-access takeout container stations will increase takeout container use as measured by the total number of containers used when compared to the by-request-only default conditions.*

**H3:** *The introduction of norms-based messaging and direct-access takeout container stations will increase takeout container use the most across all conditions.*

To test these hypotheses, we will conduct a Mann-Whitney U test (non-parametric test) to compare the means between our treatment conditions to the control condition, as well as between the treatment conditions. We will measure the number of to-go containers taken from each location per treatment, and our dependent variable will be the average number of to-go containers taken across all locations for each treatment.

We predict that in conditions where direct access to containers is made available with descriptive norm messaging and injunctive norm messaging (*Desc. Norms Only*, *Desc. Norms + Direct Access*, *Inj. Norms Only*, and *Inj. Norms + Direct Access* conditions) we will see the most significant increases in to-go container use. Additionally, we expect to see small positive effects for both no-message and generic-message conditions with defaults for request-free takeout containers. Similarly we expect small effects in conditions with descriptive norm messaging or injunctive norm messaging without the customer-accessible container default. We expect that both aspects of our field study intervention will help reduce food waste by making it easier for customers to opt in to the desired behavior, taking their

leftovers with them; thus, we expect an increase in this desired behavior will lead to significant reductions in the amount of food wasted by restaurant patrons.

## **Discussion and Limitations**

Our research aims to investigate how we can incorporate norm-based messages to increase the uptake of customers taking home their leftovers in a fast-casual restaurant. We anticipate that both descriptive and injunctive norm messages will increase the number of restaurant patrons bringing their leftovers home, and the results will be greater in the condition where to-go containers are accessible directly (available at self-service stations). Several studies (Ahmed et al., 2018; Kallbekken & Sælen, 2013) have investigated how norm-based messaging can reduce food waste in different dining settings. The findings of this research showed positive results that social norm messages can be an effective tool to decrease food waste, especially when implemented in conjunction with default mechanisms. To date, we are not aware of any studies that have been conducted to understand the (post-purchased) food waste issue in a fast-casual restaurant. Nonetheless, we are confident our interventions will show promising results that align with previous similar studies.

Our proposed intervention has several advantages. First, the introduction of *direct access* to-go boxes is designed to simplify the process of getting one and is not mutually exclusive with the standard default (asking or requesting from service staff). Restaurant patrons retain the freedom of choice to ask for a to-go box if they wish or can decide to grab one from the self-service station without interacting with restaurant employees or having to wait for one. Second, making a task simple to perform can encourage individuals to take action. Our descriptive and injunctive norm messages are precisely designed to achieve this. By indicating that asking for, or grabbing, a to-go box is easy and requires little to no considerable amount of effort, restaurant patrons are more likely to take their leftovers home, as the cost of the action is low. Lastly, using Bichierri's norm diagnostic framework (2016), Study 1 has laid the simple groundwork for us to delve into understanding restaurant patrons' normative, empirical, and personal beliefs and motivations pertaining to their leftovers. This provides a valuable foundation for future research, as well



as for restaurant businesses. Though scripts and schemas vary between different types of restaurants, future studies can continue to accommodate different types of restaurant settings to understand customers' beliefs or motivations regarding their leftovers.

We have also identified some of the limitations of our studies. First, due to the narrow scope of psychological mechanisms assessed by the diagnostics and field experiment, the present research is unable to comprehensively assess all known relevant factors that might impact restaurant patrons' leftovers decisions. In addition to the personal and normative beliefs addressed by our research, a study conducted by Lorenz et al. (2017) identifies palatability, portion size, time pressure, food choice, and the presence of others as environmental factors that may affect individuals intentions to avoid wasting food and the quantity of leftovers people end up taking with them. Since these factors will not be directly assessed, we cannot control for or speak to the potential interactions with these other known influences on food waste behavior.

Another limitation of this study is the limited generalizability of our findings due to the contextual specificity and dependency of our behavioral approach. Our research is restricted to one type of fast-casual restaurants in the United States, and therefore, due to the wide variation of scripts, schemas, patrons, and in-restaurant behaviors that exist in the broader food service context, our findings will not be as readily applicable to dissimilar restaurant market segments (i.e. fast food contexts, fine dining contexts, etc.). Additionally, we are only able to study the behavior of dine-in customers, which may result in biased insights if this population or sample differ considerably from Panera Bread customers who 1) request their food be delivered, 2) order food through select locations' drive-through windows, or 3) ask for their food "to-go" at the counter upon ordering.

Perhaps most importantly, we acknowledge the inherent limitation of food waste containers used/taken by customers as a proxy measurement for reduced food waste. Research has shown that two of the most common sources of food waste in homes are leftovers: leftovers from restaurants represent the third most-wasted category of food in homes with leftovers from home-cooked meals as the most wasted category of in-home food overall (IFIC Foundation, 2019). Clearly, taking home leftovers does not

automatically equate to food eaten, and because our study is limited to in-restaurant observations and interventions, we will not be able to measure or thereby determine definitively whether a reduction in food waste has occurred as a result of our intervention. We do feel that the number of takeout containers used/taken serves as an adequate proxy because it can be, at a minimum, considered a signal of an individual's intention to reduce food waste by consuming some or all of the remaining food at home. However, with the understanding that people's intentions are not necessarily equatable to actual behavior due to the intention gap between thoughts and actions, we thus acknowledge the limitations inherent in approximating restaurant patrons' intentions for reducing plate waste rather than the ultimate actions of post-restaurant consumption that reduce food waste (Frederiks et al., 2015). Additional research would be required to explore what behavioral design elements in home contexts could help reduce consumers' propensity to waste restaurant leftovers beyond the restaurant environment.

## **Conclusion**

Climate change poses a serious threat to not only the current generations but also to future generations of life on Earth. Despite the efforts of many countries and businesses who have pledged to reduce their carbon footprints, the multifaceted nature of climate change makes it a wicked problem to solve. In the past decade, a growing amount of research has turned to norm interventions (i.e. norm-based messaging) to look at how we can harness the power of social norms to foster behavior change in solving the climate crisis. Reducing food waste is only one small piece of the puzzle for mitigating and potentially resolving our climate crisis, but we should not underestimate the relevance and the scope of the problem that this research addresses. We believe that we can leverage behavioral interventions to reduce food waste by diagnosing and projecting to restaurant patrons the relevant anti-food-waste norms of taking home leftovers from fast-casual restaurants after meals. We hope that by introducing norms-based messaging and providing direct customer access to to-go boxes, we can better understand what effectively motivates this desired and critical behavior change. Through evidence-based interventions, it is our aim to

encourage restaurant patrons to bring their leftovers home and thereby help individuals and industry leaders shift the script on food waste for the betterment of our one planet.

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## **Appendix I**

Below is the full vignette presented to participants in Study 1b.

A person like you, Joe, is having a meal at a chain restaurant. The restaurant is fast and casual. After customers order food and pay at the counter, they are free to find their own tables and grab their own drinks in the middle of the restaurant. It is a weekend night, so all tables are full.

Joe spent \$16 on a combo meal that included a drink, a sandwich, a salad, and chips. This is one of Joe's favorite restaurants, and Joe is really enjoying the food. However, Joe is starting to get full pretty quickly. He has finished the whole salad and half of the sandwich. Because this is a pretty large meal, Joe is sure that the rest of the food is enough to be his lunch tomorrow.

## Appendix II

Treatment: Information Provisioning



Treatment: Information Provisioning + Direct Access





Treatment: Descriptive Norm



**MANY OF OUR CUSTOMERS BRING THEIR LEFTOVERS HOME TO REDUCE FOOD WASTE.**

**ASK FOR A TO-GO BOX!**



Treatment: Descriptive Norm + Direct Access



**MANY OF OUR CUSTOMERS BRING THEIR LEFTOVERS HOME TO REDUCE FOOD WASTE.**

**GRAB A TO-GO BOX!**



Treatment: Injunctive Norm



**MANY OF OUR CUSTOMERS AGREE THAT  
BRINGING THEIR LEFTOVERS HOME REDUCES  
FOOD WASTE AND HELPS OUR ENVIRONMENT.**

**ASK FOR A TO-GO BOX!**



Treatment: Injunctive Norm + Direct Access



**MANY OF OUR CUSTOMERS AGREE THAT  
BRINGING THEIR LEFTOVERS HOME REDUCES  
FOOD WASTE AND HELPS OUR ENVIRONMENT.**

**GRAB A TO-GO BOX!**

