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Waste on Impulse? Food ordering, calorie intake and waste in out-of-home consumption

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ABSTRACT

The fast-growing out-of-home consumption sector is responsible for monumental food waste. At the same time, this sector is transforming and increasingly introduces pre-ordering via smartphones and mobile devices to cater to consumers' busy lifestyles. Drawing on construal level theory, we show in two behavioral studies that acquiring food for a distant consumption moment leads to more impulsive food acquisitions and higher calorie intake. Emphasizing the (un)healthiness of food by using traffic light labels does not dampen impulsive acquisitions at the point of sale, but does help consumers to consume fewer calories at the expense of wasting more food. Our findings introduce a dilemma for managers in the out-of-home consumption section. While making it easy for consumers to change or add to their order placed in advance boosts sales, this practice leads to more calories consumed and more waste.

1. Introduction

One of the major shifts in lifestyles over recent decades is the increasing out-of-home consumption of food and drink—in for instance restaurants, café's, canteens, schools, hospitals and care centers. In the US, more than half of the total food and beverage spending occurs out of home (U.S. Department of Agriculture 2022). In Europe, one in five meals is consumed outside the home (Iri 2018). This shift in lifestyle relates to two grand challenges of our times—food waste on the one hand and public health challenges as a result of overconsumption on the other hand.

The out-of-home sector is responsible for monumental food waste at the consumer level (Bräutigam, Jörissen, and Priefer 2014; Monier et al. 2010). In the UK, 0.92 million tons of food are wasted annually in food service outlets, of which 75% is avoidable (Parry, Bleazard, and Okawa 2015). In Italy, the restaurant sector is responsible for 21% of the total amount of consumer food waste (Pellegrini et al. 2019). At the same time, higher out of home consumption rates have been related to poorer diet quality, characterized by for instance higher calorie and lower fiber intake (Gesteiro et al. 2022). The current shift to out of-home consumption is therefore highly problematic with obesity rates having tripled since 1975 (World Health Organization 2020; Werkman, van Doorn, and van Ittersum 2022).

Given that consumers are the biggest producers of food waste in industrialized countries (Parfitt, Barthel, and Macnaughton 2010; Bräutigam et al. 2014), UN's Sustainable Development Goal #12 demands that food waste at the retail and consumer levels is halved by 2030 (UN 2016). Interestingly, despite the fact that consumers should be economically motivated to minimize food waste, reducing consumer food waste proves to be a difficult endeavor (Lim 2022). Urgent calls from the marketing and consumer behavior literature as well as from public policy bodies have therefore highlighted the need for further insights into what causes food waste and how it can be mitigated (Block et al. 2016; NASEM 2020). Previous literature shows that consumers are less likely to purchase food with suboptimal aesthetics or with waste reduction benefits highlighted (Grewal et al. 2019; De Hooge et al. 2017; Loebnitz, Schuitema, and Grunert 2015; Symmank, Zahn, and Rohm 2018; De Visser-Amundson, Peloza, and Kleijnen 2021). Moreover, partitioning a package into small units makes consumers anticipate to waste less (Petit, Lunardo and Rickard 2020). Yet another approach may be for retailers to stimulate the sales of suboptimal food via discounts, thereby preventing these products to go to waste (Närvänen et al. 2022; Mullick et al. 2021).

However, insights in how consumer food waste occurs in the out-of-home sector are scarce. Such insights are important because this sector is not only growing, but also transforming. One important transformation

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is the increased introduction of pre-ordering via smartphones and mobile devices to cater to consumers' busy lifestyles (Wong 2014; Business Insider 2016), also fueled by the COVID-19 pandemic to enable social distancing. At Starbucks, mobile pre-ordering represented 22% of total transactions in the second quarter of 2020 (Maze 2020). About 25% of McDonald's US sales occur digital through the app or delivery orders, leading McDonald's to roll out a new restaurant design for mobile and delivery orders (Meisenzahl 2022). The company Allset offers not only table reservations at a restaurant but also the option to order the meal in advance via an app (Gould 2017). Disney World offers pre-ordering of meals so customers can spend more time in rides and attractions (Kelleher 2019). Other examples where the food consumed out-of-home has been planned and purchased at an earlier point in time include choosing what and how much to take from home, or at the convenience store in the morning, for lunch at work. Mobile ordering from the table once inside the restaurant is usually done on the spot though and is therefore beyond the scope of this paper.

Given evidence that pre-ordering leads to healthier choices (Stites et al. 2015; VanEpps, Downs, and Loewenstein 2016a), the rising trend to let consumers decide beforehand on what to eat when consuming food out of their homes should be good news from a consumer health perspective. However, the large amount of food wasted during out-of-home consumption raises the question of whether pre-ordering food can curb food waste or instead aggravates the problem. Drawing on construal level theory (Liberman and Trope 2000; Trope and Liberman 2003), our first contribution is to show how this transition affects food consumption and waste in out-of-home consumption. We propose that the temporal distance between the planned and actual moment of consumption, introduced by advance ordering, leads to a discrepancy between planned and actual food consumption that affects the calories consumed and wasted. We explicitly assert that (over)consumption and waste should be studied simultaneously, especially as previous research has predominantly studied them in isolation (for exceptions, see Freedman and Brochado 2010; Vermote et al. 2018).

Second, we extend previous literature by showing that the choice environment critically influences the gap between planned and actual consumption. When impulsive choices are not possible, pre-ordering food is a win–win situation for consumer health and the environment because fewer calories are consumed and less food is wasted. However, when offered delicious cookies or brownies at the cashier while picking up the pre-ordered food (Hennessy 2016; The Columbian 2015), it may be difficult for consumers to resist temptations at the consumption moment. In particular consumers who have acquired food for a distant consumption moment are likely to give in to such temptations and acquire extra calories, resulting in more calories consumed.

Third, we show that traffic light labels that make the healthiness of the available food options more salient do not dampen impulsive choices for consumers acquiring food for distant consumption, but do help them to consume less of the food they ordered—at the cost of generating more waste.

Our findings obtained in two behavioral experiments involving actual food choice, consumption, and waste introduce a dilemma for managers in the out-of-home consumption section. While making it easy for consumers to change or add to their order placed in advance boosts sales, this practice leads to more calories consumed and more waste. Public policy makers should strive to limit the opportunities in consumers' daily lives for impulsively acquiring additional food, and be cognizant of food waste as a potential dark side of introducing nutritional labels.

2. Theoretical framework

Our research is situated in the out-of-home consumption sector that is responsible for more than half of the food and beverage spending in the US (U.S. Department of Agriculture 2022). We define food waste as a discrepancy between planned and actual food consumption. In our conceptual framework (Fig. 1), we distinguish between choices that were planned, such as when deciding beforehand what to have for lunch, and impulsive choices of add-on food at the actual moment of, and during, consumption. These two taken together make up the overall food available to the consumer. This food can be consumed entirely or partly consumed and partly wasted. We propose that two factors in the choice environment critically shape the amount of food selected, consumed, and wasted. The first factor is whether the choice environment offers the option to impulsively acquire extra food. The second factor is the presence of nutritional labeling that makes the healthfulness of food more salient.

2.1. Construal level theory and impulsive choices

We draw on construal level theory (Liberman and Trope 2000; Trope and Liberman 2003) that explains why and how choices can become inconsistent over time, which is likely the issue in the occurrence of food waste. In line with previous literature, we expect that consumers opt for healthier choices, i.e., select fewer calories, for a distant versus immediate consumption moment (Milkman et al. 2010; Read et al. 1999; VanEpps et al. 2016a/b). However, the dark side to this may be that consumers have a hard time satisfying their desire to indulge with the choices made for distant consumption (Hoch and Loewenstein 1991). Hence, if they have the opportunity to do so, they may impulsively acquire additional food, for instance when tempted by a delicious cookie located at the cashier (Hennessy 2016; The Columbian 2015) when picking up the order. Research has shown that despite having chosen a healthy snack (e.g., an apple) in advance, consumers opt for higher calorie food (i.e., a chocolate bar) when given the opportunity to reconsider choices at the moment of consumption (Read and van Leeuwen 1998; Weijzen, de Graaf, and Dijksterhuis 2009).

The choices consumers have made for immediate consumption according to construal level theory are already relatively unhealthy, decreasing the impulse to acquire more food at the moment of consumption (Read and van Leeuwen 1998; Dholakia, Gopinath, and Bagozzi 2005). We therefore expect that when an opportunity arises to impulsively choose additional food at the moment of consumption, consumers who chose for a distant (vs. immediate) consumption moment will be more likely to complement their initially planned

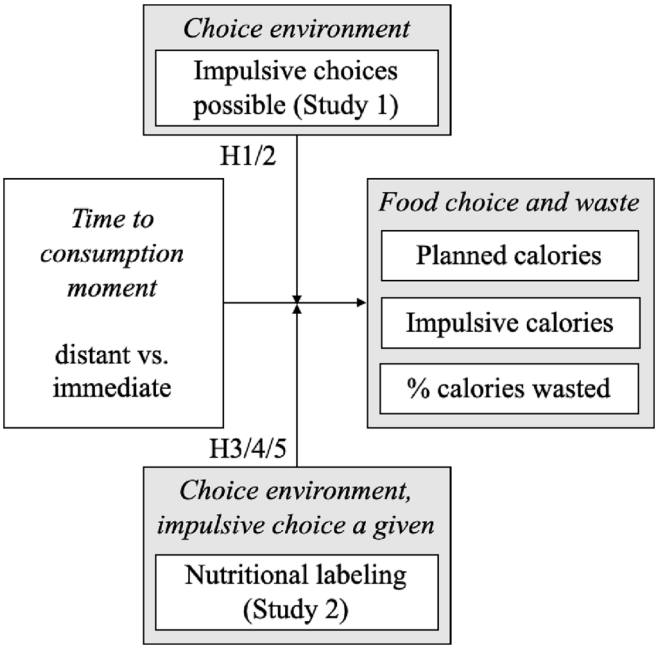

Fig. 1. Conceptual framework.

choices with additional impulsive choices (Hoch and Loewenstein 1991). Accordingly, we hypothesize:

H_1: When impulsive choices at the moment of consumption are possible, consumers who initially chose food for a distant consumption moment will impulsively choose more calories than consumers who initially chose for immediate consumption.

2.2. Consumption and waste

As pointed out above, the lower-calorie food selected for a distant consumption moment is likely not what consumers desire at the moment of consumption. Consumers may therefore reconsider consuming, and rather waste, this food, in particular if other options are available (Read and van Leeuwen 1998; Weijzen, de Graaf, and Dijksterhuis 2009). This possibility is supported by findings in literature that food is often wasted because other food is purchased and consumed in its place (Conrad et al. 2018). Moreover, lower-calorie food options are less likely satisfy consumers' desire to indulge and therefore rarely get overconsumed (Kivetz and Simonson 2002; Laran 2009). We therefore expect that, when extra impulsive choices can be made, consumers who chose food for distant consumption will waste more food than consumers who chose for immediate consumption. When impulsive choices are not possible, we expect consumers to eat according to their plan, irrespective of when the choices were made.

H_2: When impulsive choices at the moment of consumption are possible, consumers who initially chose food for a distant consumption moment will waste more calories than consumers who initially chose for immediate consumption.

2.3. Nutritional Labeling, Consumption, and waste

In the US, restaurants and retail food establishments with>20 locations are required to provide customers with calorie and other nutritional information (FDA 2018; Miller et al. 2016). From a theoretical perspective, nutritional labeling should make the healthiness of the available options more salient and entice consumers to make healthy choices when consuming food away from home. However, evidence regarding the effectiveness of such labeling is mixed (VanEpps et al. 2016c; Berry et al. 2019). To the best of our knowledge, the effect of nutritional labeling on food waste for out-of-home consumption has not yet been researched. In our research, we use traffic light labels because they have the advantage that consumers also take nutrients into account that may promote favorable health outcomes (Andrews et al. 2021) and in a previous study have shown to reduce total calories ordered via an online pre-order menu by about 10% (VanEpps et al. 2016b). We expect traffic lights to affect the choices made in the different stages detailed in our conceptual model, that is, the planned and impulsive calories selected, as well as the propensity to consume versus waste the calories available at the moment of consumption.

Given that consumers are already focusing more on their long-term health goals and likely make healthier choices for distant consumption, we expect nutritional labeling to be of less added value (Milkman et al. 2010; Read et al. 1999; VanEpps et al. 2016a). When food is selected for an immediate consumption moment, nutritional labels can help consumers opt for fewer calories (VanEpps et al. 2016b). We therefore expect nutritional labeling to have more impact when food is chosen for immediate than for distant consumption.

H_3: Nutritional labeling has a stronger impact on planned calories when the consumption moment is immediate (vs. distant).

Reflecting the food-rich environment consumers must navigate on a daily basis, in our theorizing we assume that consumers have the option to make impulsive choices at the consumption moment. Given that previous literature has shown that nutritional labels make health goals more salient and can therefore lead consumers to opt for fewer calories (Ellison, Lusk, and Davis 2013; Lowe, de Souza-Monteiro, and Fraser 2013; Thorndike et al. 2014), we expect traffic lights to decrease the number of calories impulsively added. This effect should particularly arise for consumers who ordered for a distant consumption moment and are more prone to give in to impulsive behavior.

H_4: When provided with nutritional labeling, consumers who initially chose food for a distant consumption moment will choose fewer impulsive calories than when nutritional labeling is absent.

However, the effect of nutritional labeling on food waste is less clear. On the one hand, when nutritional labeling leads consumers to be less inclined to give in to their desire to indulge (VanEpps et al. 2016b), a surplus of food becomes less likely, particularly for consumers who choose food for a distant consumption moment. That response should increase the probability that the food chosen is actually consumed, resulting in less waste.

On the other hand, nutritional labeling can have a dark side: stimulation of more waste. First, nutritional labeling can make the calories food contains very salient, leading consumers to eat only part of the food they selected, perhaps even generate an excuse to waste. This response may be particularly the case for consumers with more salient health goals (Bublitz, Peracchio, and Block 2010; Moorman and Matulich 1993). Second, a larger part of the order may be wasted because in particular consumers who order in advance find the lower-calorie food they selected less tasty and enjoy its consumption less (Kivetz and Simonson 2002). We therefore expect consumers who decide on their food for a distant consumption moment to waste more food when nutritional labeling is shown.

H_5: When provided with nutritional labeling, consumers who initially chose food for a distant consumption moment and had the option to order impulsively will waste more calories than when nutritional labeling is absent.

3. Behavioral studies on food Choice, Consumption, and waste

We test our hypotheses in two experimental behavioral studies conducted in an out-of-home lunch setting, where participants chose lunch for either distant (i.e., in a few hours' time) or immediate consumption and actually consume the lunch. Our setting therefore not only has ecological value and relevance but also allows us to measure actual consumption and food waste.

3.1. Study 1: Time to consumption Moment, impulsive Choices, and food waste

Study 1 (conducted before the COVID 19 pandemic and approved by the university's IRB) tested how time to consumption moment and the possibility for impulsive add-on choices affect how much food is selected, consumed, and wasted.

3.1.1. Design, Procedure, and stimuli

Two hundred students at a large European university in a 2 (time to consumption moment: distant vs. immediate) × 2 (impulsive ordering possible vs. not) between-subjects design were recruited in the hallways of the university buildings to voluntary sign up for a free lunch. As a cover story, participants were told that the assortment of food currently offered by the university canteen was under review, and that we were

interested in students' preferences. Participants ordered lunch either in advance (between 9:30 a.m. and 10:45 a.m.) or for immediate consumption (around 11:45 a.m. for lunch at noon and 12:45 p.m. for lunch at 1 p.m.). Participants could choose from a randomized order menu that included pictures and descriptions of six foods that represent typical local lunch options that differed in terms of healthiness and calories[1]—a multigrain roll with ham (133 kcal), a muesli roll with cheese (235 kcal), a vegetarian wrap (168 kcal), a sausage roll (325 kcal), a cheese roll (407 kcal), and a croquette in a bun (336 kcal), and were asked to indicate the quantities they would want to order for lunch.

In line with our cover story that students were supposed to test the assortment of food currently offered, we did not let participants pay for the food. We acknowledge that this condition may have led participants to order more food than they usually would, potentially resulting in more waste. However, this approach was necessary to keep participants in a relatively closed system in which choices could be observed and manipulations controlled. Furthermore, offering food for free likely increases the amount of food chosen and wasted across all conditions and should only marginally affect the difference between the experimental conditions that we are interested in.

Lunches were held in a customized lunchroom in the university building in two shifts, starting at noon and 1:00 p.m., in two groups of approximately 30 participants per lunch. Participants indicated their hunger level when ordering the food ("How full does your stomach feel right now?"; 1 = "not at all full," 7 = "very full"). In the lunchroom, all participants received a bottle of water and collected their lunch order. Three research assistants served the food from behind a counter on which all six food items were displayed. Participants were told that they were not allowed to take any food from the lunchroom after they had finished eating and were asked to put all remaining food back in the lunch bag and leave it on the table.

While collecting their ordered lunch, participants who were randomly placed in the impulsive consumption groups were given the opportunity to order additional food (the same items from the menu) if desired. Participants were not told in advance that they would have this opportunity to order additional food. The process was fully scripted:

> Hi, I am here to fill up your lunch bag with the items you have ordered from the order menu. Please let me check what you have ordered. [*Server looks at the filled-in order menu on the participant's lunch bag. Server fills up the lunch bag with the ordered items.*] We also have extra food available. [*Server shows food items on the shelf.*] Would you like to have anything in addition? [*Server puts additional food item in bag.*] Great, here you go. Let me note that on your order sheet.

Participants in the impulsive consumption groups were further informed and reminded that they could order additional food as long as they were in the room. After lunch, an exit survey collected participants' socio-demographics. After all participants had left the room, research assistants took the food leftovers out of the lunch bags and manually weighed the leftovers of each individual food item.

Measures. We computed the number of planned and impulsive calories by multiplying the items ordered by the calories they contain on average. We computed the calories wasted based on the weight of the leftovers of each item and obtained the percentage of calories wasted by dividing the calories wasted by the total calories ordered.

3.1.2. Summary statistics

Six participants were removed because the calorie content of their orders exceeded three standard deviations from the sample mean. Thus, the final sample consisted of 194 participants (57% male; $M_{age} = 21.64$). Of all calories ordered, 3.5% were wasted—an average of 28.30 calories (SD = 69.42) per participant. Satisfaction with the lunch did not differ between the experimental conditions (all $ps > 0.452$). Hunger levels did not differ between respondents ordering for distant versus immediate consumption ($p = .237$).

3.1.3. Planned and impulsive calories

An ANCOVA of consumption moment (distant vs. immediate) on the planned calories controlling for gender and hunger reveals that, in line with previous literature, fewer calories are ordered for distant than for immediate consumption ($M_{distant} = 596.00$ kcal vs. $M_{immediate} = 669.87$ kcal; $F(3,190) = 6.54$; $p = .011$; $\eta^2 = 0.033$). An ANCOVA of consumption moment (distant vs. immediate), impulsive ordering possible (vs. not), and their interaction on the calories ordered impulsively with gender and hunger as covariates reveals significant main effects of consumption moment ($F(5,188) = 5.912$; $p = .016$; $\eta^2 = 0.030$) and the possibility to order impulsively ($F(5,188) = 56.184$; $p < .001$; $\eta^2 = 0.230$), together with a significant interaction effect ($F(5,188) = 4.664$; $p = .032$; $\eta^2 = 0.024$). Gender ($F(5,188) = 3.571$; $p = .060$; $\eta^2 = 0.019$) and hunger ($F(5,188) = 2.772$; $p = .098$; $\eta^2 = 0.015$) marginally affect the results, with male participants ordering more than female participants. Contrasts reveal that participants who ordered their food for distant consumption took more calories impulsively compared with those ordering for immediate consumption ($M_{distant} = 197.91$ kcal vs. $M_{immediate} = 114.32$ kcal; $F(1,188) = 10.887$; $p = .001$; $\eta^2 = 0.055$), supporting H_1. Total calories ordered do not significantly differ between these two groups of participants though ($p = .227$).

3.1.4. Calories wasted

An ANCOVA of consumption moment (distant vs. immediate), impulsive ordering possible (vs. not), and their interaction on the percentage of calories wasted with gender and hunger as covariates reveals a significant main effect of the possibility to order impulsively ($F(5,188) = 13.024$; $p < .001$; $\eta^2 = 0.065$) and a marginally significant interaction effect ($F(5,188) = 2.795$; $p = .096$; $\eta^2 = 0.015$), while the main effect of consumption moment is insignificant ($F(5,188) = 1.570$; $p = .212$; $\eta^2 = 0.008$).

Contrasts reveal that when impulsive ordering is possible, participants who order for distant consumption waste less than those ordering for immediate consumption ($M_{distant} = 4.01\%$ vs. $M_{immediate} = 7.47\%$; $F(1,188) = 4.425$; $p = .037$; $\eta^2 = 0.023$). This outcome is opposite from what we expected in H_2. There are no differences when impulsive ordering is not possible ($M_{distant} = 1.04\%$ vs. $M_{immediate} = 0.76\%$; $F(1,188) = 1.853$; $p = .175$; $\eta^2 = 0.010$). Furthermore, the possibility to order impulsively increases the percentage of calories wasted by participants who ordered for immediate consumption ($M_{impulse} = 7.47\%$ vs. $M_{noimpulse} = 0.76\%$; $F(1,188) = 15.774$; $p < .001$; $\eta^2 = 0.077$), but not significantly for those ordering for distant consumption ($M_{impulse} = 4.01\%$ vs. $M_{noimpulse} = 1.04\%$; $F(1,188) = 1.853$; $p = .175$; $\eta^2 = 0.010$; see Fig. 2). Gender also affects how much participants waste ($F(5,188) = 5.083$; $p = .025$; $\eta^2 = 0.026$), with males wasting less than females.

3.1.5. Discussion

Study 1 makes an important extension to previous literature by showing the effect of time to consumption moment on food consumption and waste in out-of-home consumption. While choosing food for a distant consumption moment increases the healthiness of food choices as consumers select fewer calories (Milkman et al. 2010; VanEpps et al. 2016a), it comes with the downside that at the consumption moment, consumers are more likely to acquire additional calories, nullifying the advantages of advance ordering. Moreover, those who ordered for distant consumption ended up eating more, and wasting less of it, than those ordering for immediate consumption - an outcome desirable from a food waste perspective, but not from a health perspective.

We can only speculate why food ordered in advance is more likely to

[1] The caloric value of each food item is derived from the calculation tool provided by The Netherlands Nutrition Centre (2017) and https://www.voedingswaardetabel.nl. By offering all food items pre-prepared and hence ready to eat at the time of consumption, we control for the fact that some food items are more effortful to prepare than others.

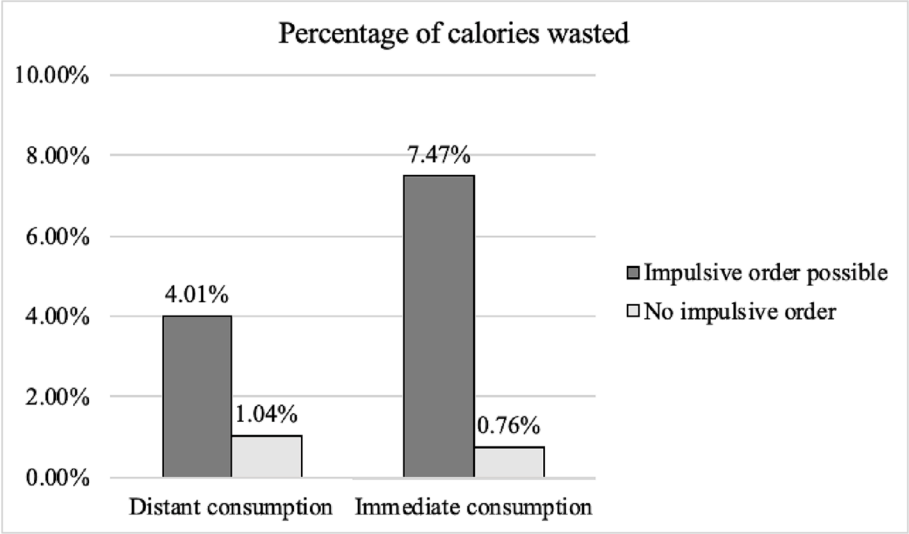

Fig. 2. Calories wasted in Study 1.

be consumed, and less likely to be wasted than food ordered instantaneously, countering H_2. Possibly consumers feel ownership of food the moment they order it. Then, the increased consumption can be explained by the endowment effect entailing that consumers value objects more when they have owned them for a longer time (e.g., an hour vs. instantly; Strahilevitz and Loewenstein 1998).

3.2. Study 2: Traffic lights and food waste

Study 1 clearly shows that impulsive additions are the key culprits when it comes to wasting food. However, restricting opportunities in daily life for impulsively acquiring additional food may be complex. In Study 2 we therefore investigate whether impulsive orders can be suppressed by highlighting the caloric content of the food through traffic light labeling which in the US is mandatory for many restaurants and retail food establishments (Miller et al. 2016). As previous research has indicated that consumers' health orientation affects the response to nutritional claims, we include dietary restraint as a potential moderator (Berry et al. 2019; Kral et al., 2002; Bublitz, Peracchio, and Block 2010).

3.2.1. Design, Procedure, and stimuli

Study 2 (conducted before the COVID 19 pandemic and approved by the university's IRB) employed a 2 (consumption moment: distant vs. immediate) × 2 (traffic light labels present vs. not) between-subjects design in which 287 students participated. The study design and measures were similar to those of Study 1, with half of the participants ordering for distant consumption and the other half for immediate consumption. However, in contrast to Study 1, in Study 2 all participants had the opportunity to order additional food at the moment of consumption.

Traffic light labels with information concerning sugar, fat, saturated fat, and salt, and calories were added to the order menu and to the displays in the lunchroom for half of the sample. The resulting labels were presented numerically (values per serving size), and the displayed colors were based on the guidance values from the Food Standards Agency (FSA) (2016) (Fig. 3).[2] We measured dietary restraint according to Polivy, Herman and Warsh (1978) and averaged the items (Cronbach's alpha = 0.71).

[2] Calories were not color-coded, as the FSA offers no guidance.

3.2.2. Summary statistics

Four incomplete cases were removed, as well as six participants whose calorie content of the orders exceeded three standard deviations from the sample mean. Thus, the final sample consisted of 277 students (58.6% male; M_{age} = 22.08). Of participants in the traffic light conditions, 80% indicated in the exit survey that they had noticed the labels, suggesting a successful manipulation. Of all calories ordered, 5.32% were wasted, an average of 48.43 (SD = 113.29) calories per participant.

3.2.3. Method

We used ANCOVA to test our hypotheses and include time to consumption moment (distant vs. immediate) and traffic light labels (present vs. absent) as binary independent variables and dietary restraint as a continuous independent variable, as well as the interactions between temporal distance and traffic light labels and dietary restraint and traffic light labels. We also controlled for gender and hunger, which did not significantly differ between ordering for distant versus immediate consumption (p =.180). Planned calories, impulsive calories and the percentage of calories wasted are our focal dependent variables.

3.2.4. Planned and impulsive calories

Planned calories are affected by time to consumption moment ($F(5,269) = 10.413$; p =.001; $\eta^2 = 0.037$) and its interaction with traffic lights ($F(5,269) = 6.146$; p =.014; $\eta^2 = 0.022$), while the main effect of traffic light labels is insignificant ($F(5,269) = 0.003$; p =.930; $\eta^2 = 0.000$). Neither dietary restraint ($F(5,269) = 0.804$; p =.371; $\eta^2 = 0.003$) nor its interaction with traffic light labels ($F(5,269) = 0.022$; p =.883; $\eta^2 = 0.000$) affects planned calories. Gender ($F(5,269) = 40.945$; p <.001; $\eta^2 = 0.132$; males ordering more) and hunger affect how much participants order ($F(5,269) = 2.929$; p =.088; $\eta^2 = 0.011$).

Contrasts reveal that fewer calories are ordered for distant compared with for immediate consumption only when no traffic lights are included on the order menu ($M_{distant}$ = 587.53 kcal vs. $M_{immediate}$ = 802.90 kcal; $F(1,269) = 17.682$; p <.001; $\eta^2 = 0.062$). When traffic lights are shown, participants choose about the same number of calories for distant versus immediate consumption ($M_{distant}$ = 672.92 kcal vs. $M_{immediate}$ = 686.67 kcal; $F(1,269) = 0.249$; p =.618; $\eta^2 = 0.001$), indicating that traffic light labels dampen the effect of advance ordering on planned choices. These results are in line with H_3. Participants order fewer calories for immediate consumption when traffic lights are shown (vs. not) ($F(1,269) = 3.672$; p =.056; $\eta^2 = 0.013$). Traffic lights do not affect planned calories though (p =.223).

Time to consumption moment ($F(5,269) = 24.090$; p <.001; η^2 =

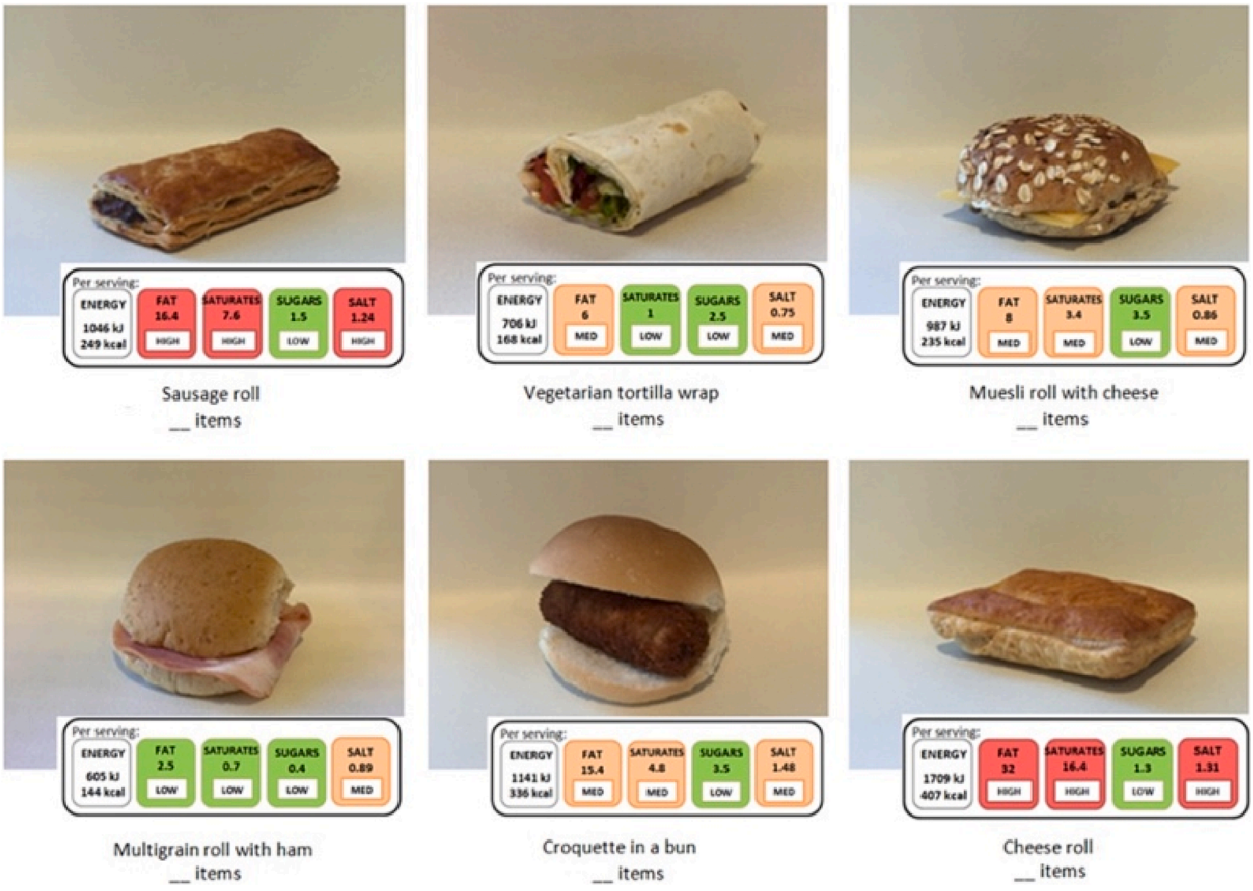

Fig. 3. Order menu of Study 2 with traffic lights.

0.082) affects the impulsive calories participants order, and as in Study 1, males order more ($F(5,269) = 4.371$; $p = .038$; $\eta^2 = 0.016$). All other effects are not significant ($ps > 0.119$). Contrasts reveal that participants who ordered their food in advance ordered more calories impulsively, both when traffic lights are shown ($M_{distant} = 178.89$ kcal vs. $M_{immediate} = 71.79$ kcal; $F(1,269) = 10.795$; $p = .001$; $\eta^2 = 0.039$) and not shown ($M_{distant} = 182.12$ kcal vs. $M_{immediate} = 76.37$ kcal; $F(1,269) = 13.386$; $p < .001$; $\eta^2 = 0.047$; see Fig. 4). Hence, we cannot support H_4.

3.2.5. Calories wasted

The percentage of calories wasted is marginally affected by the interactions between traffic light labels and time to consumption ($F(5,269) = 2.845$; $p = .093$; $\eta^2 = 0.010$) and between traffic light labels and dietary restraint ($F(5,269) = 2.890$; $p = .090$; $\eta^2 = 0.011$), as well as hunger ($F(5,269) = 6.505$; $p = .011$; $\eta^2 = 0.024$; all other $ps > 0.227$).

Contrasts show that participants ordering for distant consumption waste a larger part of their order when traffic lights are shown ($M_{trafficlights} = 6.89\%$ vs. $M_{notrafficlights} = 3.16\%$; $F(1,269) = 4.171$; $p = .042$; $\eta^2 = 0.015$), while traffic lights do not affect the amount wasted by participants acquiring food for immediate consumption ($M_{trafficlights} = 5.64\%$ vs. $M_{notrafficlights} = 5.89\%$; $F(1,269) = 0.030$; $p = .863$; $\eta^2 = 0.000$). This finding confirms H_5.

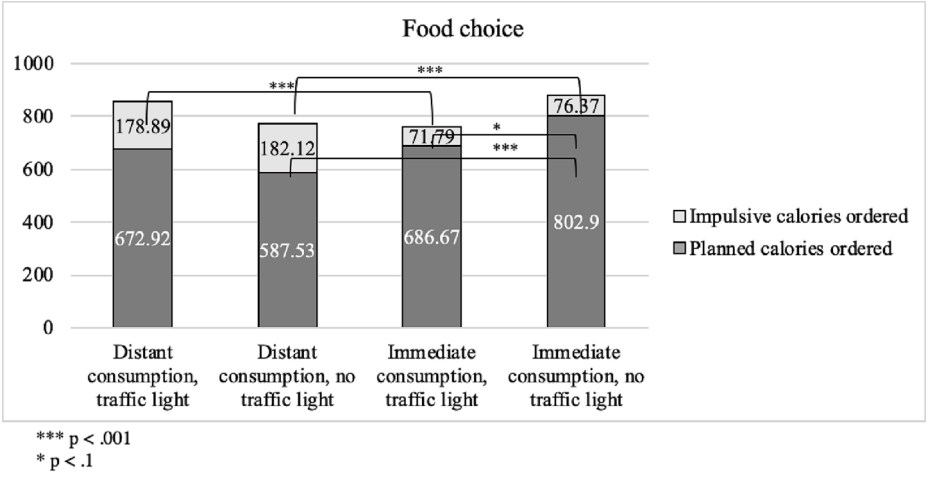

Fig. 4. Planned and impulsive calories ordered in Study 2.

While directionally participants who order for distant consumption waste less than those ordering for immediate consumption without traffic light labels, in line with Study 1′s results, this difference is not significant ($M_{distant} = 3.16\%$ vs. $M_{immediate} = 5.89\%$; $F(1,269) = 2.270$; $p = .133$; $\eta^2 = 0.008$; see Fig. 5). Hence, we again find no support for H_3. An additional analysis shows that participants high in dietary restraint (+1 SD above the mean) marginally waste a larger percentage of their order when traffic lights are shown (vs. not shown) (effect = 0.058; t = 1.857; $p = .064$).[3]

3.2.6. Discussion

Study 2 shows that traffic light labels do not only mitigate positive health effect of advance ordering, but surprisingly entirely eliminate its benefits—benefits that in both studies clearly emerge in the absence of traffic light labels. Possibly traffic lights trigger the "healthy is less filling" paradox: consumers may order larger amounts of food when it is portrayed as healthier (Berry et al. 2019; Suher, Raghunathan, and Hoyer 2016). Also, the second potential advantage of traffic light labels - preventing participants who chose for distant consumption from impulsively adding extra items on the spot – could not be established. However, traffic light labels seem to make it easier for participants who ordered for a distant consumption moment and ended up with a surplus of food to waste part of their order instead of consuming it. This result may have occurred because traffic light labels made the caloric content of the food more salient, especially for consumers high in dietary restraint.

For participants choosing for immediate consumption, traffic light labels do what they are supposed to do: participants ordered fewer calories. This finding corresponds with earlier results that providing labels on an online lunch ordering menu reduces the calories chosen by 10% (VanEpps et al. 2016b). Going beyond previous literature, the results of our study suggest that providing traffic light labels to steer consumers toward making healthier choices may not be recommended when consumers are making choices for a temporally distant consumption moment.

4. Discussion

The out-of-home consumption sector is not only growing, but also transforming and increasingly supporting the pre-ordering of food via mobile devices. The reduced friction and convenience of mobile pre-ordering are key to this development that has been sped up by the COVID-19 pandemic that demanded social distancing. From a company perspective, mobile pre-ordering promises higher margins. Therefore, companies such as Starbucks and McDonalds are not only investing in digital interfaces, but also in new pick-up formats (Maze 2020; Meisenzahl 2022). At the same time, a large proportion of food in this sector gets wasted (Monier et al 2010) and there is a social imperative to steer customers toward more healthy choices, for instance by providing nutritional labeling (Stites et al. 2015; VanEpps et al. 2016c). Our investigation breaks new ground by examining how these measures affect not only what consumers choose but also what they waste. Table 1 provides an overview of our hypotheses and offers the results from our studies. We propose that food waste arises from a discrepancy between planned and actual food consumption and suggest that the ubiquitous availability of additional, tempting food contributes to this mismatch.

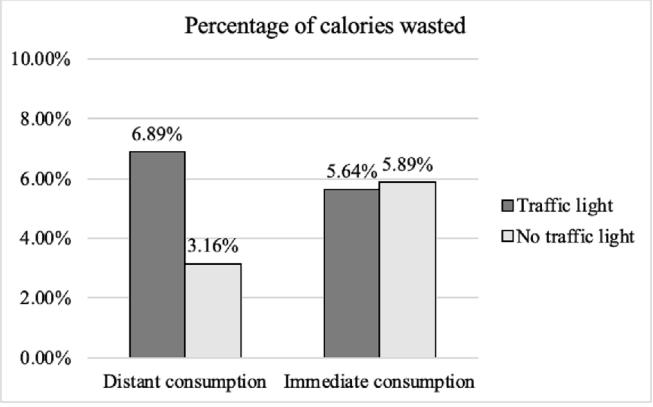

Fig. 5. Food waste in Study 2.

4.1. Consumers stick to healthy choices only if no opportunity exists to change them

Both studies corroborate the findings of past work that consumers make healthier choices—in the context of our studies, opt for fewer calories—if they acquire food for a distant consumption moment rather than for immediate consumption (Milkman et al. 2010; Read et al. 1999; VanEpps et al. 2016a). Therefore, the current trend to mobile pre-ordering is a promising one from a health perspective.

However, our studies also demonstrate that a dark side may exist, in that the desire to consume more calories at the moment of consumption thwarts the healthy consumption plans. This finding implies that consumers who ordered food in advance may be particularly susceptible to the temptation to add on purchases. While actively targeting these consumers to boost sales by providing temptations at the pick-up point may be an attractive opportunity for the out-of-home consumption sector (Hennessy 2016; The Columbian 2015), the likely surplus of food that translates into consuming more calories than needed or into waste is less desirable. This trade-off is important to consider for companies such

Table 1
Overview of Our Results.

	Study 1	Study 2
H_1: When impulsive choices at the moment of consumption are possible, consumers who initially chose food for a distant consumption moment will impulsively choose more calories than consumers who initially chose for immediate consumption.	Confirmed	Confirmed
H_2: When impulsive choices at the moment of consumption are possible, consumers who initially chose food for a distant consumption moment will waste more calories than consumers who initially chose for immediate consumption.	Not confirmed (more consumption though)	Not confirmed
H_3: Nutritional labeling has a stronger impact on planned calories when the consumption moment is immediate (vs. distant).		Confirmed
H_4: When provided with nutritional labeling, consumers who initially chose food for a distant consumption moment will choose fewer impulsive calories than when nutritional labeling is absent.		Not confirmed
H_5: When provided with nutritional labeling, consumers who initially chose food for a distant consumption moment will waste more calories than when nutritional labeling is absent.		Confirmed

[3] The analysis was carried out with the PROCESS macro for SPSS. As a robustness check, we repeated the analyses without dietary restraint. The results remained stable, with the following exceptions: Planned calories are marginally higher for distant consumption when traffic lights are shown ($p = .087$). Significance of the interaction between time to consumption and traffic light labels on food waste is $p = .106$.

as Chipotle, McDonald's, Taco Bell, and Chick-fil-A that are currently investing in pick-up formats specifically for mobile orders (Meisenzahl 2022).

4.2. Impulsive behavior leads to more waste

Study 1 shows that the opportunity to impulsively acquire additional food is the main culprit of generating food waste. We expected consumers who order for distant consumption to be particularly prone to wasting because the food they ordered in advance may not satisfy their desires at the consumption moment. Surprisingly, we found in Study 1 that these consumers actually waste *less* than consumers who acquire food for immediate consumption. We speculate that this result may be due to the endowment effect: the food acquired in advance may be valued more highly, making consumers reluctant to waste it (Strahilevitz and Loewenstein 1998). However, Study 2 only directionally shows this effect and we cannot draw very strong conclusions.

We note that the amount of waste we document in this study is with around 5% lower than what is often reported in the out-of-home sector. This is probably due to the low-income student population of our study in general wasting less than other groups with higher budgets. Another reason why respondents in our study do not waste that much is that we, for practicality reasons, only offered sandwiches for lunch without side dishes such as vegetables, fries, or crisps that may be more prone to getting wasted. Therefore, results may be different when consumers are offered more choices than what we could offer within the limits of our experiment.

All in all, our results reinforce that curbing food waste is a complex task because it involves a trade-off between the surplus food getting consumed— with negative downstream effects regarding consumers' caloric intake—and food getting wasted. Stimulating advance ordering while limiting the possibility for impulsive behavior at the point of sale seems the best strategy for curbing both food waste and overconsumption, but it may be difficult to realize with tempting food available everywhere and at any time. However, letting consumers pay for their food while pre-ordering or let consumers pick up their order at a separate desk, without any temptations, may discourage impulsive behavior and be a step in the right direction.

More broadly, to curb food waste and obesity, temperance in consumption practices, in particular not acquiring more food than needed, seems advisable. Such mindful consumption has in literature been discussed as one road towards more sustainable consumption practices (Lim 2017).

4.3. Traffic light labels are less effective when consumers choose for distant consumption

While we expected traffic light labels to be less effective in steering consumers acquiring food for distant consumption towards selecting fewer calories, our finding that traffic light labels eliminate the benefits of advance ordering and also fail to dampen impulsive choices is rather unexpected. A reason may be that traffic lights may trigger the "healthy is less filling" paradox and steer consumers towards ordering larger amounts (Berry et al. 2019; Suher, Raghunathan, and Hoyer 2016). In line with previous literature (e.g., VanEpps et al. 2016b) and as intended, traffic light labels steer consumers ordering for immediate consumption to select less food. Summing up, traffic light labels should be applied with care in advance-ordering situations.

4.4. Traffic light labels do not curb food waste

Consumers acquiring food for distant consumption waste more when they see traffic light labels. Traffic light labels seem to give consumers a license to waste their surplus food instead of overconsuming, with benefits for their own waist. This result may occur because traffic light labels heighten the salience of the caloric content of the food, making consumers reluctant to consume more food than needed. We also find that consumers high in dietary restraint react even more strongly to traffic light labels than consumers low in dietary restraint (Bublitz, Peracchio, and Block 2010; Moorman and Matulich 1993) and waste more food. This finding corroborates our reasoning that traffic light labels may make the (un)healthiness of food more salient, leading consumers to prioritize their own waist over avoiding waste of food. Unfortunately, however, traffic light labels do not lead consumers with strong health goals to adapt the size of their order beforehand. Therefore, potential positive health effects of traffic light labels may come at the cost of increased food waste, particularly if food is acquired in advance.

Yet, our study did not allow for more fine-grained order variations such as differently sized food items. Pre-ordering and traffic lights may have different effects on calorie intake and waste if consumers also have to select the size of their portion, in particular because portion size may be difficult to gauge on a mobile device. Given the importance of portion and serving sizes for calorie intake and waste (Werkman, van Doorn, and van Ittersum 2022), this is an important avenue for future research.

5. Managerial and public policy implications

This research generates valuable insights for managers and public policy makers in the growing out-of-home consumption sector, yet under the condition that the pattern of results can be replicated in other settings given the numerous limitations of our study addressed in the limitations section. For managers, our finding that impulsive choices appear to be a major driver of food waste introduces a dilemma. While making it easy for consumers to change or add to their order placed in advance may boost sales (Hennessy 2016; The Columbian 2015), this practice leads to more waste. Restaurants and other food establishments should therefore design their sales strategy according to the goal they prioritize. Companies such as Chipotle, McDonald's Taco Bell, and Chick-fil-A should be cognizant of this dilemma when designing formats for mobile orders (Meisenzahl 2022). In Study 1, we find that the participants are equally satisfied with the meal regardless of whether they had the opportunity to impulsively add extra items, which is an encouraging result for parties who wish to discourage impulsive changes to an order to prevent not only extra calorie consumption but also waste.

For public policy makers, restricting opportunities for impulsive choices may be complex. However, a smaller step that can be taken is to require public organizations to refrain from offering additions to pre-ordered food. As already having paid for the acquired food may discourage impulsive behavior, making pre-payment while pre-ordering the default could also be a route to limit impulsive behavior.

Our finding that nutritional labeling is not a suitable way to suppress impulsive acquisitions at the point of sale when food is acquired in advance implies that managers of, for example, health care institutions who encourage their clients make healthier choices should either adopt pre-ordering or place nutritional labels on their menus, but not implement both at the same time. Public policies aimed at widely introducing nutritional labels for meals consumed out of home need to be cognizant that generating waste is a potential negative side effect, particularly if food is ordered in advance and if the target population has very salient health goals.

6. Future research and limitations

Our work suggests several interesting avenues for future research. First and foremost, our theoretical framework, which we test for out-of-home consumption, is more widely applicable and can be extended to the context of meal planning and grocery shopping. Second, we did not account for suggestive selling attempts at the moment of ordering. Future research could examine whether consumers' response to these attempts differs depending on time to consumption moment, and how suggestive selling at different moments affects waste.

Third, our studies show that participants who ordered food for distant consumption ate more of the food they acquired, which we speculated can be due to the endowment effect. Future research could investigate this possibility in more detail. Fourth, future studies could further research how consumers respond to traffic light labeling on an order menu with for instance eye-tracking devices (Lim 2018). Fifth, research should further investigate the trade-off between (over)consumption and waste. Given that curbing obesity and food waste are two important goals in many societies, strategies need to be developed for reaching the two goals concurrently (Werkman, van Doorn, and van Ittersum 2022).

Some limitations are worth noting. First, in our experiments the food was offered for free, which might have encouraged over-ordering, overconsumption, or food waste. Future studies could manipulate costs or conduct a similar experiment in which participants pay for their lunch. Second, the experiments were conducted among students of a European university who for instance may differ from society at large regarding hunger and impulse control. Therefore, the findings may not be generalizable to other demographic groups and other settings.

Third, cultural differences with regard to food consumption and disposal may apply (Parfitt et al. 2010). While we selected lunch options that are typical for the country our study was conducted in, we realize that this differs from a typical meal for lunch served in other countries. Relatedly, the menu options in real eating establishments are likely less limited.

Fourth, the presence and behavior of others at the consumption moment may have affected individuals' choices (De Castro and Brewer 1992; Herman, Roth, and Polivy 2003; Parker et al. 2019). Nevertheless, as food consumption often takes place in a social setting, both at home and at work, the set-up of the current research can be considered a relevant setting. Fifth, we did not offer to wrap up any leftovers for possible later consumption. However, previous research indicates that leftovers often remain uneaten (Farr-Wharton, Foth, and Choi 2014). In all, given the detrimental societal and environmental effects of wasting food, more research is needed.

Authors' note:

This manuscript is based on the second author's dissertation. We have no conflicts of interest to declare.

CRediT authorship contribution statement

Jenny van Doorn: Writing – review & editing, Supervision, Methodology, Formal analysis, Data curation, Conceptualization. **Marit Luiting-Drijfhout:** Writing – original draft, Methodology, Investigation, Formal analysis, Data curation. **Koert van Ittersum:** Writing – review & editing, Supervision, Conceptualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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