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You Can't "Nudge" Nuggets: An Investigation of Late Night Dining With Behavioral Economics Interventions

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The American College Health Association reports that 33% of college students are overweight or obese (American College Health Association National College Health Assessment, 2017), and American undergraduates often gain weight while at college (Pope, Hansen, & Harvey, 2016). People who become obese or develop poor eating habits during childhood and young adulthood are more likely to struggle with these problems in adulthood (Nelson, Story, Larson, Neumark-Sztainer, & Lytle, 2008; Serdula et al., 1993). This can lead to a variety of illnesses including diabetes, cardiovascular disease, and cancer (World Health Organization, 2003).

Consumption of “junk food” and evening snacks may be large contributing factors in college weight gain (Levitsky, Halbmaier, & Mrdjenovic, 2004). Evidence indicates between 32.5%-72.8% of college students report that they often/always have evening snacks (DeBate, Topping, & Sargent, 2001; Driskell, Kim, & Goebel, 2005). Some research suggests calories consumed late at night contribute to greater weight gain than if the calories were consumed during the day, due to the body’s fluctuating metabolism (Garulet & Gómez-Abellán, 2014). This means unhealthy late-night meals may be especially detrimental for diet-related health. A study of Korean college students found that living in dormitories was associated with significantly increased calorie intake at night compared to living at home, especially from fried chicken and flour-based foods (Jun, Choi, & Bae, 2015). However, little research has analyzed late-night eating at American colleges.

Students living in dormitories on American college campuses often consume meals in college dining halls as part of a pre-paid meal plan. These plans often are structured around “all you care to eat” dining experiences where a student can take and eat as much or as little food as they would like each time they enter the dining hall. Dining hall intervention studies have demonstrated the potential for cafeterias to encourage healthy eating choices. These interventions are informed by behavioral economics, which examines the reasons why consumers make seemingly non-rational decisions (Thaler & Sunstein, 2008). The positioning of food within both the serving line and cafeteria has been shown to influence the amount and types of food people will take (Hanks, Just, Smith, & Wansink, 2012; Rozin et al., 2011; Thorndike, Sonnenberg, Riis, Barraclough, & Levy, 2012; Wansink & Hanks, 2013). These interventions have been called “Nudging Interventions,” because they subtly push consumers towards healthier choices without removing unhealthy options (Thaler & Sunstein, 2008). While many studies have looked at applying behavioral economics to dining halls, to our knowledge no studies have looked at using these interventions during late-night college dining. To address this research gap, the objectives of this study were to examine college students’ perceptions of health and late night dining, while also implementing two nudging interventions in a late-night college dining environment to determine their impact on food choices.

Methods

Research was conducted at the University of Vermont (UVM), which, enrolled 9,786 undergraduate students in the 2016-2017 school year. “Late-Night Dining” was

held Monday-Wednesday from 10:00pm-12:30am at an all-you-care-to-eat cafeteria on campus. Minimal food service staffing during these hours restricted the types of food that could be easily served. Options were usually limited to fried processed foods and dishes that could be premade and quickly reheated, such as chicken nuggets, corn dogs, and pulled pork.

After receiving IRB approval from the UVM Committee on Human Research in the Behavioral and Social Sciences, a survey about Late-Night Dining was administered through Campus Labs. The survey was developed collaboratively to collect information of interest to both campus administrators, Dining Services, and researchers. Participants were recruited through an email to all 4,994 students living in on-campus housing. Survey completion was voluntary, and incentivized by the chance to win \$25 towards on-campus dining. Students were asked about their frequency and reasons for attending the university’s Late-Night dining option. Students used a 7-point Likert scale to rate the importance of health on their late-night food choices (“Health score”), ranging from “Not at all” to “Very important”. Students were also asked about other foods they would like to see offered (if any). Responses were double-coded by researchers into three categories: 1) those wanting healthy options, 2) those wanting less healthy options, or 3) those seeking “more” options (Corbin & Strauss, 1990). Requests for fruits, vegetables, lean protein, and whole grains were classified as healthy options whereas options high in fat, sugar, or calories were classified as less healthy. Students who requested both healthy and less healthy options were classified as wanting “more” options. Table 1 displays survey questions and variables created for analysis.

Table 1
Survey Questions and Variables

Survey Question	Scale/Options	Variable(s)
How many nights/week do you eat between 10PM and midnight when you are not at UVM?	0-7 nights/week	Home_Habits
How often do you go to late-night dining at Harris-Millis?	Never-3 times/week	Attendance
What time do you plan on going to bed tonight?		Bedtime
Are you satisfied with the options at late-night?	Yes/No	Satisfaction
Are there any particular foods you’d like to see offered at late-night?		Desire_Healthy Desire_Unhealthy Desire_Vegetarian
What is your primary reason for going to late-night at Harris-Millis?	Snack/Meal/Socializing/Bored/Other	Reason_Snack Reason_Meal Reason_Socialize Reason_Bored
How big of a factor is health in your late-night dining choices?	1-7 Likert Scale: 1=Not at all, 7=Very Important	Health Score

Following the online survey, a second survey was administered in-person in the cafeteria during Late-Night Dining. This survey contained a subset of the questions from the emailed survey. Additionally, students reported the food they had selected to eat that night. These reported food choices were double-coded by researchers as healthy, less healthy, both, or unknown using the same criteria as the Pre-Survey. Due to the anonymous nature of both surveys, it is unknown how many students completed both the Pre-Survey and the At-Late-Night survey.

Researchers and dining staff worked together to implement two behavioral economics-based interventions at Late-Night Dining during the spring semester of 2017. In the first intervention, vegetable-heavy entrées were added at the beginning of the self-serve line. These entrées were vegetable lasagna (Mondays), broccoli mac-and-cheese (Tuesdays), veggie-egg scramble and a root-vegetable hash (Wednesdays); they were added to the usual options of chicken nuggets (Mondays), pulled pork sandwiches (Tuesdays), and pancakes and sausage (Wednesdays). The intervention was carried out for three weeks, for a total of nine days (late night dining only occurs on three days out of the week). During this time, researchers stood near the serving line to record the food choices and gender of everyone taking food. Additionally, the number of people coming into the dining hall each night was recorded electronically through the cash register.

In the second intervention, a healthy snack-food convenience line called the “Crunchy Munchy Bar” was added. It was placed beside the salad bar, which Dining Services reported had minimal foot traffic prior to the intervention. Snack foods included chips and salsa, hummus, popcorn, trail mix, yogurt, and pre-cut fruit. Researchers tallied how many students took something from the snack food line, broken down by gender. This intervention was also carried out for three weeks, for a total of nine days. During this time, the veggie-heavy entrée intervention was discontinued so that each intervention could be looked at in isolation. Initially, we hoped to assess the effectiveness of both interventions using Dining Services production reports. Unfortunately, these reports were less accurate than we anticipated. Therefore, we did not get the depth of quantitative food production data that would have allowed us to compare our observational data with all food served every night.

Survey responses were analyzed using STATA 15 (StataCorp, 2017). Since the majority of the variables were either binary or ordinal, Kendall’s tau correlations were used to determine relationships between variables on the Pre-Survey and At-Late-Night Survey. An analysis of variance with Scheffe’s multiple comparison tests (Jaccard, Becker, & Wood, 1984) was utilized to explore varying outcomes based on different groups and pairwise comparisons. Finally, to assess the multiple potential variables related to a student’s perceived health score, ordered logistic regressions were used on both the Pre-Survey and the At-Late-Night Survey. Results for the model are reported in odds ratios.

Results

Surveys

Descriptive statistics for both surveys are reported in Table 2.

Table 2
Descriptive Statistics

Variable	<u>Pre-Survey</u>			<u>At-Late-Night</u>		
	N	Mean ^a	S.D.	N	Mean ^a	S.D.
Class Year	647					
First-Year		53.0%				
Sophomore		41.1%				
Junior		3.5%				

Senior		1.2%				
Other		1.1%				
Gender (female=1)	674	67.4%				
Home_Habits	626	2.76	2.03	128	3.40	2.01
Attendance	627					
Never		26.5%				
<1 time/week		42.0%				
1 time/week		12.8%				
2 times/week		11.3%				
3 times/week		5.6%				
Other		2.0%				
Satisfaction (yes=1)	627	41.6%		128	72.7%	
Desires	409					
Desire_Healthy		39.6%				
Desire_Unhealthy		30.1%				
Desire_More		29.8%				
Desire_Vegetarian (yes=1)	409	10.8%				
Reasons	482			141		
Reason_Snack		35.9%			21.3%	
Reason_Meal		33.5%			44.7%	
Reason_Socialize		24.3%			24.8%	
Reason_Bored		2.3%			5.0%	
Reason_Other		4.1%			4.3%	
Health (1-7 scale)	627	3.94	1.92	127	3.48	1.94

Note. ^a Categorical variables reported as percentages.

Pre-Survey. Our Pre-Survey received 681 responses for a response rate of 13.6%. The mean Health Score for respondents was 3.94, with 14% of respondents reporting a Health Score of 1 meaning that health was not at all a factor in their Late-Night food choices. Students provided open-ended answers to the question “Are there any particular foods you would like to see offered at Late-Night?” Of these responses (N=409), 39.6% of students requested healthier options, 30.1% of students requested less healthy options, and 29.8% requested a combination of both. Additionally, 10.8% of all these responses made explicit requests for more vegetarian/vegan options. Table 4 includes examples of student feedback.

ANOVA results examined whether gender was correlated with different reasons for attending late night. Overall, 49% of males compared to 25% of females reported attending Late-Night for a meal, a statistically significant difference ($F=28.24, p<0.001$). Conversely, fifteen percent of males compared to 33% of females reported attending Late-Night for socializing ($F=17.55, p<0.001$). There was no significant difference in

gender for those attending Late-Night for a snack or because they were bored. ANOVA results also examined the relationship between (Desires), (Satisfaction), and (Health Score). Students that exclusively wanted less healthy options (Desire_Unhealthy) were significantly more likely to have a lower Health Score ($M=2.66$, $SD=1.57$) than other students ($M=4.72$, $SD=1.77$, $F=124.28$, $p<0.001$). Fifty-seven percent of students who wanted less healthy options (Desire_Unhealthy) were satisfied with the food offered at Late-Night, compared to 21% for other students, which was statistically significant ($F=59.44$, $p<0.001$). Conversely, students who requested healthier options (Desire_Healthy) had significantly higher Health Scores ($M=5.35$, $SD=1.60$) than students who requested other types of food ($M=3.28$, $SD=1.73$, $F=147.67$, $p<0.001$). Only 19.7% of students who requested healthy options (Desire_Healthy) were satisfied with the food at Late-Night, compared to 40.5% of other students, which was significantly different ($F=20.09$, $p<0.001$).

Pre-Survey model. A logistic regression model was run to look at factors influencing a student's Health Score (Table 3). We find that students who more frequently ate late-night meals when home from college (Home_Habits), students who were more satisfied with the current Late-Night offerings (Satisfaction), and students who attended Late-Night primarily for snacking or socializing (Reason_Snack; Reason_Socialize), all had significantly greater odds of having a lower Health Score ($p<0.05$). Students who desired healthy options (Desire_Healthy) and students who desired vegetarian options (Desire_Vegetarian) both had increased odds of having a higher Health Score, but only Desire_Healthy was statistically significant ($p<0.01$).

Table 3
Ordered Logistic Regressions for Student Health Scores

Variable	Pre-Survey ^a			At-Late-Night Survey ^b		
	Odds Ratio	Std. Err.	P> z	Odds Ratio	Std. Err.	P> z
Home_Habits	0.8693626	0.0415414	0.003	0.9921917	0.0916186	.932
Attendance	0.8790754	0.0641382	0.077			
Satisfaction	0.5502334	0.1135728	0.004	0.1987938	0.0858332	0.000
Bedtime				0.9635462	0.1653251	0.829
Desire_Healthy	4.402831	1.048484	0.000			
Desire_Unhealthy	0.3459277	0.0870566	0.000			
Desire_Vegetarian	1.305367	0.4030509	0.388			
Reason_Snack	0.5849335	0.1547966	0.043	2.249482	1.319639	0.167
Reason_Meal	0.6100174	0.1769659	0.088	2.979909	1.709523	0.057
Reason_Socialize	0.4325845	0.1234397	0.003	1.868892	0.9909147	0.238
Reason_Bored	0.5260575	0.3570424	0.344	4.374742	3.668882	0.078

Notes. ^aN=409, Pseudo R²=0.1217. ^bN=118, Pseudo R²=0.0554.

At-Late-Night Survey. One hundred and twenty eight students agreed to take the in-person survey conducted during Late-Night. Descriptive statistics are reported in Table 2. The mean Health Score of students surveyed at Late-Night was 3.48. Notably, 24% of respondents at Late-Night chose a Health Score of 1, indicating health was “not at all” a factor in their Late-Night Dining choices (as compared to 14% in the Pre-Survey).

ANOVA tests were used to compare each student’s Health Score to their actual reported food choices. There was no statistically significant difference between a student’s Health score and the foods they actually took at Late-Night, ($F=0.39$, $p=0.883$), indicating that how important health was for their late-night dining options did not correlate into actual food choices.

A logistic regression model was run to look at factors influencing a student’s Health Score at Late-Night (Table 3). Students who reported being unsatisfied with the offerings at Late-Night (Satisfaction) were significantly increased odds of having a higher Health Score ($p<0.001$). No other factors from the At-Late-Night Survey had any significant influence on a student’s Health Score.

Nudging Interventions

Vegetable-heavy entrées were added to the main entrée line for three weeks, from March 27-April 12. During this time, researchers observed 2,397 trips through the entrée line, 28% by females and 72% by males. Student food choices during the vegetable-heavy entrée intervention period are shown in Figure 1. March 27, April 3, and April 10 are all Mondays when chicken nuggets were served alongside vegetable lasagna. A sharp contrast between those three Mondays and the other six dates can be seen. On Tuesdays and Wednesdays, between 54%-79% of students incorporated a vegetable-heavy entrée into their Late-Night selection (Veggie-Heavy + Both). On chicken nugget Mondays, only between 9%-14% of students took a serving of the vegetable lasagna.

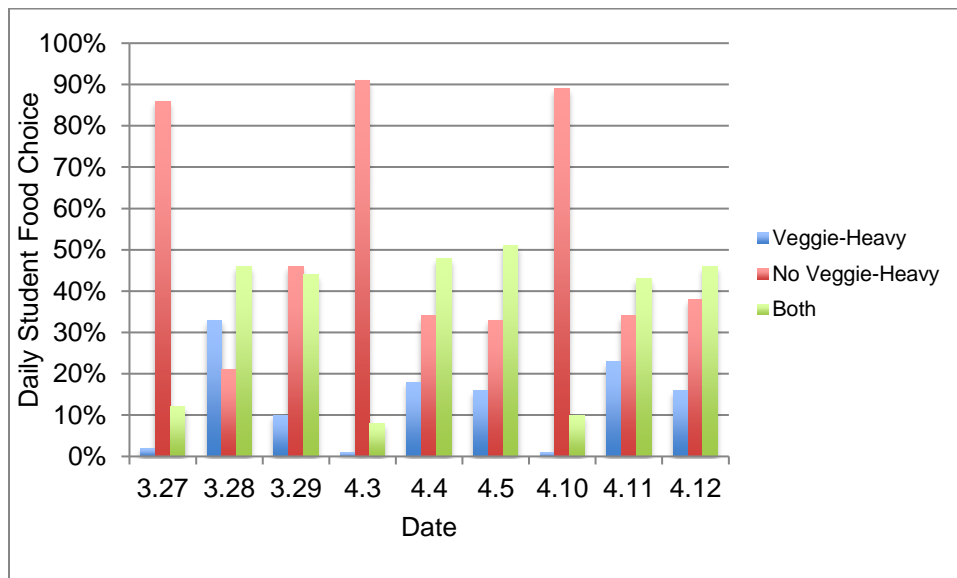


Figure 1. Vegetable-heavy intervention observations. Percentage breakdowns of daily student food choice during our first intervention period.

After the vegetable-heavy entrée intervention concluded, the Crunchy Munchy healthy snack food bar was implemented. Over the course of three weeks, students made 1,975 trips to the snack bar. Gender breakdown for usage was 51% female, 49% male. Qualitative assessment of student feedback (shown through quotes in Table 4), suggest that the Crunchy Munchy Bar led to increased selection of (and excitement about) healthy foods.

Table 4

Examples of Student Feedback

<u>A Selection of Student Food Requests From the Pre-Survey</u>	<u>Student Quotes at Crunchy Munchy</u>
<ul style="list-style-type: none"> • TASTY GLUTEN FREE DRUNK FOOD gluten free mac and cheese, gluten free pizza, etc. 	<ul style="list-style-type: none"> • I just ate mushrooms at Late Night night, it was an incredible experience.
<ul style="list-style-type: none"> • Healthy ones, normal people food like not corn dogs and fries ew 	<ul style="list-style-type: none"> • There's raspberries!
<ul style="list-style-type: none"> • Have the corn dogs more often 	<ul style="list-style-type: none"> • This is awesome!
<ul style="list-style-type: none"> • At night I am looking for snacks. The late-night dining choices ... almost encourage eating an entire full meal, and that's often what happens as a result even though it is unnecessary. 	<ul style="list-style-type: none"> • Actually, like, decent food
<ul style="list-style-type: none"> • I like the options, love the chicken nuggets 	<ul style="list-style-type: none"> • They have crunchy munchies!
<ul style="list-style-type: none"> • Something warm. To help sleep. like soup. 	

Discussion

From our two surveys, we gain some important insight into the way college students think about late-night food and health. We find key differences between the responses of students completing the Pre-Survey away from Late-Night Dining compared with students taking the At-Late-Night survey while in the Late-Night environment. We also see a disconnect between students' health goals and their behaviors during Late-Night.

The mean student Health Score on the Pre-Survey was 3.94, while the mean Health Score of students at Late-Night was 3.48, almost a half point lower. While we cannot compare these statistically since the samples are not the same, this suggests that in the moment while at Late-Night, students place a lower emphasis on healthy eating than they do at other times. This could be due to projection bias, which is when a person incorrectly estimates how they will react in a future situation (Loewenstein, O'Donoghue, & Rabin, 2003). Students taking the Pre-Survey in a "cold" logical state imagine that health will be a very important factor in their future food choices; this ends up not being true when they arrive at Late-Night in a "hot" visceral state (Liu, Wisdom, Roberto, Liu, & Ubel, 2014). In their dorms during the day, students overestimate the importance of health on their decision-making. After a long day of classes and homework, students

place less emphasis on health and are more interested in fulfilling their immediate cravings for comfort food.

Student food choices during Late-Night were not significantly impacted by student Health Scores. Students were just as likely to choose less healthy options if they said health was “very important” or “not at all important” to their food choices at Late-Night Dining. This suggests that even students who strongly desire to make healthy choices are not making them “in the moment.” This could be due to what O’ Donoghue & Rabin (1999) refer to as *present-biased preferences*: students put more weight on their immediate preferences (eating chicken nuggets) than their long-term goals (making healthy food choices). This can present a challenge for dining services trying to satisfy student desires. In “cold” states, students request that healthier options be offered; however, when they are in “hot” states they walk right past the healthy options and head for the junk food. This disconnect between students’ stated desires and actions can be frustrating for dining service administrators, and may encourage the dining service to simply continue catering to students’ “hot” states.

Students’ present-biased preferences could potentially be exacerbated by intoxicants such as alcohol or marijuana. As Ajzen (1991) notes, “performance of a behavior is a joint function of intentions and perceived behavioral control” (Ajzen 1991, p. 185). While students may have the intention of eating healthfully, intoxicants may reduce their ability to regulate their own behaviors. We did not collect data on rates of student intoxication, but multiple students were overheard saying they were currently under the influence of marijuana, and another study identified alcohol as an influencing factor in students’ late-night food consumption (Nelson, Kocos, Lytle, & Perry, 2009). Future research on the role intoxicants play in student food choice is needed.

We observed an interesting gender divide between the entrée station and the Crunchy Munchy bar. Only 28% of students using the entrée line were female, while 51% of Crunchy Munchy bar trips were made by females. This is consistent with our survey responses, where women reported being much more likely to attend Late-Night for a snack or to socialize, while men were much more likely to go for a meal. Counihan (1992) attributes gendered eating differences in America to cultural food norms, where men are socially encouraged to consume large amounts of hearty food while women are encouraged to more sparingly eat healthy items. However, Wichianson, Bughi, Unger, Spruijt-Metz, & Nguyen-Rodriquez (2009) identified stress as a common reason for college students’ nighttime food consumption, and found that among their sample, men were more likely than women to use maladaptive eating practices to try to manage stress. Understanding the gender division in late-night dining would be beneficial both for student health and college dining services.

Our nudging interventions appear to have been partially successful in increasing healthy food choices. Based on our observational data, we know that students were incorporating more vegetables into their diet than they otherwise would have, since prior to the intervention no vegetables were served in the Late-Night entrées. However, one unintended consequence of these interventions may have been that the additions of new vegetable options just led to more food selection, rather than a reduction in less healthy selections. Increased consumption of vegetables and fruits is often suggested as a way to promote healthy weight due to their low energy-density and high fiber content (Rolls, Ello-Martin, & Tohill, 2004). However, Djuric et al. (2002) observed a six-pound weight

gain among women who only focused on increasing vegetable and fruit consumption without also focusing on reducing fat intake. Another study found that some vegetables were associated with weight loss, while others were associated with weight gain (Bertoia et al., 2015). Solely emphasizing vegetable and fruit consumption may not be enough to positively influence college student health in dining halls. We would need more concrete data on how much food was served to draw conclusions about the interventions' effectiveness at improving student health.

Chicken nugget Mondays appear to have been mostly impervious to nudging interventions. Although we did see a drop in nugget servings per student, around 90% of students on Mondays ignored the vegetable lasagna in favor of the chicken nuggets and french-fries. Two factors might be in play here. The first is that self-serving the lasagna from the tray took a bit more effort than scooping up nuggets. The lasagna was pre-cut, but students had to use a spatula to separate and serve pieces. This could slow down their progression, while dozens of other hungry college students waited behind them. Research has shown that even mild increases in the effort needed to access food can reduce selection (Brunner, 2013). The second factor is that students may just have a strong preference for chicken nuggets, or a strong preference against vegetable lasagna, that cannot be overridden by nudging interventions. One study targeting elementary students tried to increase fruit consumption over french-fry consumption by making apple slices the default item served, but given the option 96% of students switched their apple slices for fries (Just & Wansink, 2009). As long as french-fries were available, students took them. Similarly, when chicken nuggets were offered, students were able to ignore the nudging intervention, skipping right over the vegetable lasagna and loading up their plates with piles of nuggets. These results demonstrate some potential limitations for nudging interventions to positively influence consumer health.

Our interventions concluded at the end of the spring semester. The following fall semester, dining services continued to offer both vegetable-heavy entrées and the Crunchy Munchy bar. Instead of using the nudging intervention, vegetable-heavy entrées are the only option served on some nights. The campus head chef reported that this may potentially reduce food costs, because students were previously over-serving themselves the less healthy options. He also noted that the Crunchy Munchy bar has continued to be popular with students. Dining services also decided to only serve chicken nuggets occasionally, rather than every Monday, to make nugget night less of a habitual weekly event.

This research had several limiting factors. Our Pre-Survey and At-Late-Night Survey had population overlap; therefore while we were able to note differences between the two groups, we were unable to compare them statistically. Students were asked about the role health plays in their decision-making, but "health" was self-defined by each student. We focus on physical health here, but students may have considered mental health in their answers. To gain a greater understanding of how student preferences change between "hot" and "cold" states, future research should include more nuanced definitions of health, and either track the same student responses over time or ensure statistically independent samples. Our conclusions were also limited by problems with the Dining Services production report data, which made it difficult to assess our interventions' effects on less healthy food selection. More robust tracking of the food served and wasted by students would be beneficial for evaluating cafeteria nudges.

Finally, our study was limited to repeated menu offerings of the same foods on the same days each week. Randomized control trials evaluating different food pairings on different days of the week could help control for additional factors influencing student food choice. The biggest strength of our research was taking a mixed-methods approach to investigate a relatively unstudied area of student dining. Through a mixture of quantitative, qualitative, and observational data, we were able to create a baseline understanding of students' late-night dining behavior that can inform future research.

Conclusion

From our survey data, we concluded that the stated importance of health on food selection did not have a relationship to actual student food choice: even students who said health was very important chose less healthy foods. We also found that, on average, students in their dorms placed a higher value on health than students attending Late-Night Dining. We found a significant difference in the reasons males and females attended Late-Night Dining, with males more likely to go for a meal and females more likely to go to socialize. Although we don't know whether our nudging interventions decreased less healthy food selection, they were effective at increasing vegetable selection in at least some contexts. The exception to this was during chicken nugget nights, where students demonstrated their overwhelming preference for nuggets. For colleges and dining services looking to positively impact student health, it is important to assess the strengths, but also the limitations, of nudging interventions within the dining hall.

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