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Food Choices of Minority and Low-Income Employees:

A Cafeteria Intervention

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Abstract

Background—Effective strategies are needed to address obesity, particularly among minority and low-income individuals.

Purpose—To test whether a two-phase point-of-purchase intervention improved food choices across racial, socioeconomic (job type) groups.

Design—A 9-month longitudinal study from 2009 to 2010 assessing person-level changes in purchases of healthy and unhealthy foods following sequentially introduced interventions. Data were analyzed in 2011.

Setting/participants—Participants were 4642 employees of a large hospital in Boston MA who were regular cafeteria patrons.

Interventions—The first intervention was a traffic light–style color-coded labeling system encouraging patrons to purchase healthy items (labeled green) and avoid unhealthy items (labeled red). The second intervention manipulated “choice architecture” by physically rearranging certain cafeteria items, making green-labeled items more accessible, red-labeled items less accessible.

Main outcome measures—Proportion of green- (or red-) labeled items purchased by an employee. Subanalyses tracked beverage purchases, including calories and price per beverage.

Results—Employees self-identified as white (73%), black (10%), Latino (7%), and Asian (10%). Compared to white employees, Latino and black employees purchased a higher proportion of red items at baseline (18%, 28%, and 33%, respectively, $p < 0.001$) and a lower proportion of green (48%, 38%, and 33%, $p < 0.001$). Labeling decreased all employees’ red item purchases (–11.2% [95% CI= –13.6%, –8.9%]) and increased green purchases (6.6% [95% CI=5.2%, 7.9%]). Red beverage purchases decreased most (–23.8% [95% CI= –28.1%, –19.6%]). The choice architecture intervention further decreased red purchases after the labeling. Intervention effects were similar across all race/ethnicity and job types ($p > 0.05$ for interaction between race or job

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type and intervention). Mean calories per beverage decreased similarly over the study period for all racial groups and job types, with no increase in per-beverage spending.

Conclusions—Despite baseline differences in healthy food purchases, a simple color-coded labeling and choice architecture intervention improved food and beverage choices among employees from all racial and socioeconomic backgrounds.

INTRODUCTION

The overall prevalence of obesity is rising, and obesity is more common among minority and low-income populations than other populations.^{1–2} Differences in diet and caloric intake are important contributors to these disparities.^{3–7} Consumption of sugar-sweetened beverages is strongly linked to weight gain, cardiovascular disease, and type 2 diabetes^{8–9} and is highest among non-Hispanic blacks and low-income individuals.^{4,10} Diets with greater nutrient density are more expensive than less-healthy calorically dense diets and contribute to socioeconomic disparities in health and the paradox of food insecurity and obesity.^{11–13}

Point-of-purchase calorie labeling is a new public health policy to reduce obesity.¹⁴ However, evidence for the effectiveness of calorie labeling has been mixed, with some studies finding reductions in calories per purchase when calorie labels are present,^{15–20} and others finding no effect.^{16, 20–27} Low literacy and low numeracy contribute to difficulty reading and understanding nutrition labels, even among individuals with relatively high educational status. In a study of primary care patients, black race and low income were associated with low literacy, low numeracy and low performance on reading nutrition labels.²⁸ Other studies examining the effect of calorie labeling in low-income, high-minority communities have found little evidence that calorie labeling changed eating behavior.^{21,22, 24, 29}

Labeling strategies that minimize cognitive demands at the point of purchase^{30,31} may improve nutritional choices among diverse populations. Simplified labeling techniques, such as traffic-light labels, convey complex information quickly. Other strategies can lower barriers to better nutrition by making healthy food and beverages convenient for consumers to purchase by changing the “choice architecture.”³² These strategies are relatively unobtrusive and low-cost.

No study has examined the effectiveness of a food labeling intervention across people of different racial and economic backgrounds. Prior work demonstrated that a two-phase green, yellow, and red labeling intervention followed by a choice architecture intervention improved healthy purchases in a large hospital cafeteria.³² In the current study, cafeteria purchases of 4642 employees were analyzed to determine if the effectiveness of the intervention differed by race and job type.

METHODS

The Partners HealthCare IRB deemed the study exempt from review on September 28, 2009.

Setting and Study Population

The study took place in the main cafeteria of Massachusetts General Hospital (MGH) from December 2009 through August 2010. MGH is a teaching hospital in Boston, Massachusetts with >23,000 employees. The cafeteria, owned and operated by the hospital, is open daily 6:30am–8:00pm. On average weekdays, there are 6534 transactions totaling \$31,404. Over the 2 years preceding the study, cafeteria sales did not vary by season. Hospital employees

can pay for cafeteria purchases by direct payroll deduction using a “platinum” card. During the study period, 5865 employees utilized the platinum card.

Interventions

After collection of baseline cafeteria sales data over 3 months, a two-phase intervention was conducted over 6 months. Details of the interventions are described elsewhere.³² Briefly, Phase 1 was based on the 2005 USDA My Pyramid recommendations³³ and used color-coded labeling to inform patrons about the relative healthiness of cafeteria items. Every item was labeled green, yellow, or red, and was rated on three positive (fruit/vegetable, whole grain, or lean protein/low fat dairy as the main ingredient) and two negative criteria (saturated fat content and caloric content). Items with more positive than negative criteria were green (“consume often”). Items with equal numbers of positive and negative criteria or only one negative were yellow (“consume less often”). Items with two negative and no positive criteria were red (“there is a better choice in green or yellow”). Water and diet beverages with 0 kcal were green, despite having no positive criteria.

At the introduction, permanent signage was placed throughout the cafeteria and a temporary crew of dietitians was available to explain the labeling. Food choices were relatively stable during the study period, so minimal label maintenance and updates were required. Phase 2, a choice architecture intervention,^{34,35} was added after the labeling scheme had been in place for 3 months. It was designed to increase the visibility and accessibility of select green-labeled foods and beverages while decreasing the same for certain red-labeled items.

Data Collection and Measures

For platinum card users, cash register data were linked to employee identifiers and sociodemographic data from human resources files. Available employee characteristics were age, gender, self-reported race/ethnicity (white, black, Asian, or Latino), full-time/part-time status, and job type (a measure of SES). Human resources data did not provide information on race and ethnicity separately, so employees coded white or black were non-Latino, and race could not be distinguished among Latinos. Employees with missing race data were excluded ($n=99$). Characteristics of employees in the study were similar to those in the hospital as a whole.

Specific job codes were aggregated to five larger categories of roughly increasing educational attainment: service workers (manual and/or unskilled laborers), administrative/support staff, technicians (e.g., radiology technicians, respiratory therapists); professionals (e.g., occupational therapists, pharmacists); and management/clinicians (including hospital managers, physicians, and nurses). Education was unreported by many employees, so education was omitted from the analyses. However, among employees reporting education, 90% of service employees had high school or less, while 83% of professionals and management/clinicians had bachelor’s degrees or higher. Salary data were excluded because salaries at teaching hospitals are not always based on educational level, which is correlated with literacy and numeracy.

Cash register data were used to track all purchases made in the cafeteria. The primary goal of the study was to measure changes in green, yellow, and red purchases by employees from different racial/ethnic and job categories from baseline to Phase 1 (labeling) and from Phase 1 to Phase 2 (choice architecture). For each 3-month phase, the proportion of items purchased by an individual that were coded green, yellow, or red was calculated. Separate analyses examined cold beverage purchases, which made up approximately 20% of sales.³² Additional outcomes included changes in kcal per beverage and price per beverage during the intervention. Although prices were unchanged during the study period, it was important

to ascertain whether changes in the types of beverages purchased affected employee spending on beverages.

Statistical Analysis

Employees were included only for phases in which they made three or more purchases using the platinum card. All weekend and holiday transactions, including December 24, 2009 to January 3, 2010, were excluded.

Analysis of proportions, calories, and beverage prices used linear regression models. In this study, the limitations of applying these models to bounded data (e.g., proportions) are small and outweighed by the advantage they offer in interpretability;³⁶ alternatives such as logistic models yield nearly identical findings. Regression-adjusted (standardized) mean baseline purchases were estimated using linear regression with robust SEs.^{37,38} Linear regression models with employee random intercepts were used to estimate within-person changes in purchasing following the interventions, thus accounting for within-person correlations over the study period. The coefficients on the products of indicator variables for the interventions and either race/ethnicity or job type were assessed using Wald tests to determine whether there were interactions indicating the intervention effects differed across subgroups. All models controlled for the full set of sociodemographic characteristics described above. All analyses were conducted in 2011 using Stata 10.1.

Results

There were 4,642 employees meeting the study's inclusion criteria. The mean age was 41 years, and 71% were female. Employees self-identified race as white (73%), black (10%), Latino (7%), and Asian (10%). Employees held the following job types: 7% service workers, 12% administrative/support, 9% technicians, 20% professionals, and 53% management/clinicians. The majority (75%) were full-time employees. Service workers disproportionately self-identified as black (37%) or Latino (27%), and management/clinicians were disproportionately white (83%). Employees in our sample completed 53,371 transactions during the 3-month baseline period, purchasing 131,417 items.

Figure 1 shows unadjusted differences in overall cafeteria purchases across racial/ethnic categories. Compared to white employees at baseline, Latino and black employees purchased more red items (18%, 28%, and 33%, respectively, $p<0.001$) and fewer green items (48%, 38%, and 33%, $p<0.001$). Beverage purchases were similar, with black and Latino employees purchasing more red beverages and fewer green beverages compared to white employees ($p<0.001$ for all comparisons). For both overall purchases and beverage purchases, each racial group purchased a smaller proportion of red items during each of the intervention phases compared to baseline.

Table 1 shows relative changes in all red and green cafeteria purchases by race/ethnicity and job type controlling for age, gender, and full-/part-time status, as well as race/ethnicity or job type, as applicable, in multivariate analyses. Overall, employees decreased red item purchases 11.2% during the Phase-1 labeling intervention and further decreased red purchases 4.1% during the Phase-2 choice architecture intervention. Green purchases increased 6.6% during Phase 1, then decreased 1.9% during Phase 2 relative to Phase 1. Although the point estimates for red and green purchases differed by race/ethnicity and job type at baseline, the relative changes in purchases during Phase 1 and Phase 2 were similar across all categories, and tests of the interaction terms between the intervention effects and race/ethnicity or job type yielded no statistical evidence that intervention effects varied by subpopulation.

Relative changes in purchases of red and green cold beverages are shown in Table 2. Overall, employees' red beverage purchases decreased 23.8% during the Phase-1 labeling intervention, and further decreased 14.2% during the Phase-2 choice architecture intervention. Green beverage purchases increased 5.6% during Phase 1 and increased another 2.3% during Phase 2. Despite differences in baseline point estimates across race/ethnicity, intervention effects were similar across all racial/ethnic groups ($p>0.05$ for all interaction tests). However, during both the Phase-1 and Phase-2 interventions, decreases in red beverage purchases were different across job types. Professionals had the largest decrease in red purchases during Phase 1 (−29.1%), and Management/Clinicians had the largest decrease during Phase 2 (−21.1%). There were no consistent trends according to the SES of the job types.

Table 3 demonstrates the change in mean kcal and price per beverage from baseline to Phase 2 of the intervention. At baseline, the average kcal per beverage purchased varied widely by race/ethnicity and job type. Nevertheless, there were significant reductions in mean kcal per beverage observed over the study period for all groups, with the magnitude of the reduction ranging from 12 kcal per beverage (95% CI= −21 to −3) for Latino employees to 17 kcal per beverage (95% CI= −25 to −9) for black employees. At baseline, black employees and service workers paid the highest amount per beverage, and white employees and management/clinicians paid the least. Overall, the shift towards lower-calorie beverages during the intervention did not lead to an increase in per-beverage spending, and for black employees and service workers, there was a significant decrease in cost per beverage during the study period.

Discussion

The current study demonstrates that black and Latino employees and employees in job types requiring lower average education were more likely to purchase unhealthy foods and to pay more per beverage than employees who were white or with job types requiring higher levels of education. Despite these baseline differences, employees from all racial/ethnic and job-type groups had similar improvements in purchasing after color-coded labeling followed by a choice architecture intervention were implemented, indicating that these interventions work equally well in populations at particular risk. To our knowledge, this is the first study to examine the effectiveness of a food labeling intervention across different racial/ethnic and socioeconomic backgrounds.

The labeling scheme in this study was consistently effective for reducing purchases of red-labeled items across all subgroups. In previous studies of calorie labeling interventions, only modest attention has been paid to the role of socioeconomic or racial/ethnic differences.^{28,39} One study of New York City's policy requiring chain restaurants to post calorie information found that low-income and minority consumers improved their calorie-count estimates at the point of purchase, but the overall level of accuracy remained low.⁴⁰ Other studies of high-minority, low-income populations have found that calorie labeling has little to no effect on purchases.^{21,22,24} However, these studies did not include higher-income, non-minority populations for comparison, and therefore could not determine whether the lack of effectiveness was unique to low-income, minority consumers. Another study in New York City found that changes in the calorie content of purchases varied little according to neighborhood poverty levels, but the authors did not test the significance of their findings.²⁷

While it was not possible to determine the exact mechanism of the labeling scheme's effectiveness, two key features of the labels may have contributed. First, a traffic-light system is simple and does not have the numeracy demands of calorie counts. Second, it gives consumers information about what not to eat. Self-control is an inhibitory process, and

may best be triggered by specific information on what actions to avoid.^{41–43} The traffic-light approach has been regarded as informative and simple to understand by consumers in the United Kingdom.^{44,45} A German study testing the effectiveness of several food labeling strategies concluded that the multiple traffic-light label was more effective than a simple “healthy choice” label or a Guideline Daily Amount label.⁴⁶

The second, “choice architecture” phase of the current intervention resulted in decreases in overall red purchases and red beverage purchases, as well as an increase in green beverage purchases. This intervention was more subtle than the labeling and placed no cognitive demand on consumers. The direction of effect was the same for most subgroups, although fewer than half were significant, possibly because the intervention applied to only a small subset of cafeteria items. Because the labeling intervention was designed as a permanent change to the cafeteria, it was possible to test only the incremental effect of the choice architecture intervention while the labeling was in place.

Consumption of sugar-sweetened beverages is associated with multiple negative health outcomes, including diabetes and cardiovascular disease.^{8,9} The shift in beverage purchases observed in this study led to reductions in the number of calories per purchase while at the same time, the average price per beverage was mostly flat or declining. Although the high cost of nutritious foods may contribute to socioeconomic disparities in obesity and health,¹¹ cost does not appear to be a barrier to switching to lower-calorie beverages.

Labeling criteria can be debated, but this research provides evidence that these simple interventions can positively affect food choices. In particular, this study showed improvement among groups that are at increased risk of obesity and obesity-related diseases. A strength of this intervention is that it was not tailored to any one group of consumers and therefore was effective for everyone. However, a limitation is that the intervention could not ameliorate the wide disparity in healthy food choices that were observed during the baseline period. Although all groups improved healthy choices during the intervention, minority and less well educated employees never achieved the same levels of healthy purchasing as white and more highly educated employees. Future research in worksite, cafeteria, and retail settings that serve minority and/or low-income consumers could potentially address these disparities by culturally tailoring interventions.

This study is subject to certain other limitations. First, there was no control group. However, all analyses were based on within-person changes in purchasing and were not vulnerable to the biases associated with changing study populations or imperfectly matched control groups. Second, it was not possible to match purchases made without the platinum card to specific employees. Third, the study includes employees from only one urban hospital. Although this may limit the generalizability of conclusions, employees in this sample do span a broad range of demographic and socioeconomic groups, and between-group differences in purchasing of healthy and unhealthy foods and beverages mirror those observed in national studies.

Conclusion

In a large employee population, this study found that a simple point-of-purchase color-coded food labeling and choice architecture intervention improved healthy choices equally among employees from all racial/ethnic and socioeconomic backgrounds. Importantly, switching to lower-calorie beverages did not change the average amount of money that employees spent on beverages. These straightforward interventions should be considered in point-of-purchase efforts to improve food choices and improve dietary health among diverse populations alongside interventions designed to improve food choices in specific vulnerable populations.

The promise of labeling and choice architecture interventions is their simplicity, and potential for wide, inexpensive dissemination.

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Figure 1.

Unadjusted differences in baseline purchasing by race/ethnicity

Note: In the labeling phase (“L”), foods were labeled green (“consume often”), yellow (“consume less often”), or red (“there is a better choice in green or yellow”). In the choice architecture phase (“C”), select items’ visibility and accessibility were increased if they were labeled green and decreased if they were labeled red.

Table 1

Intervention effects by race/ethnicity and job category, for overall purchases

	Baseline	Phase 1: Labeling		Phase 2: Choice Architecture	
		Relative percentage change from baseline (95% CI)	<i>p</i> -value for difference across groups	Relative percentage change from Phase 1 (95% CI)	<i>p</i> -value for difference across groups
Red Purchases					
Overall	20.9	-11.2 (-13.6, -8.9)		-4.1 (-6.8, -1.4)	
Model comparing across races/ethnicities			0.51		0.32
White	19.3	-12.1 (-15.1, -9.1)		-5.0 (-8.5, -1.6)	
Asian	21.3	-6.1 (-14.1, 2.0)		-7.1 (-15.8, 1.5)	
Latino	24.7	-11.4 (-18.8, -4.0)		3.7 (-4.6, 12.1)	
Black	29.0	-10.1 (-15.5, -4.8)		-3.0 (-8.9, 3.0)	
Model comparing across job categories			0.50		0.30
Mgmt/Clinician	18.9	-11.7 (-15.3, -8.2)		-7.3 (-11.4, -3.2)	
Professionals	18.5	-9.9 (-16.3, -3.4)		-4.1 (-11.3, 3.2)	
Technicians	24.6	-14.5 (-21.2, -7.8) *		0.4 (-7.4, 8.2) *	
Admin/support staff	26.6	-10.6 (-16.0, -5.1) *		1.3 (-4.8, 7.4) *	
Service workers	28.4	-8.3 (-14.8, -1.7)		-1.9 (-9.1, 5.3)	
Green Purchases					
Overall	45.4	6.6 (5.2, 7.9)		-1.9 (-3.2, -0.6)	
Model comparing across races/ethnicities			0.53		0.57
White	46.5	6.6 (5.0, 8.1)		-1.5 (-2.9, 0.0)	
Asian	46.9	3.9 (-0.6, 8.5)		-1.9 (-6.3, 2.5)	
Latino	43.1	9.4 (4.2, 14.7)		-5.2 (-10.1, -0.4)	
Black	37.6	6.7 (1.6, 11.8)		-2.4 (-7.3, 2.5)	
Model comparing across job categories			0.68		0.32
Management/Clinician	42.7	7.5 (5.5, 9.5)		-2.3 (-4.2, -0.5)	
Professionals	48.6	4.6 (1.5, 7.7)		1.0 (-2.0, 4.0)	
Technicians	39.3	9.9 (4.7, 15.2)		-4.5 (-9.2, 0.3)	
Admin/support staff	39.0	6.6 (2.0, 11.2)		-2.6 (-7.0, 1.7)	

	Baseline	Phase 1: Labeling		Phase 2: Choice Architecture	
		Relative percentage change from baseline (95% CI)	p-value for difference across groups	Relative percentage change from Phase 1 (95% CI)	p-value for difference across groups
Red Purchases					
Service workers	Absolute % of all purchases, adjusted M 37.9	6.9 (0.8, 13.0)		-3.5 (-9.3, 2.2)	

All values adjusted for age, gender, full-/part-time status, as well as race or job category, as applicable. Bolded text indicates a significant effect of the intervention ($p<0.05$)

* significant difference in intervention effect compared to Management/Clinician ($p<0.05$)

Table 2

Intervention effects by race/ethnicity and job category, for beverage purchases

	Baseline	Phase 1: Labeling		Phase 2: Choice Architecture	
	Absolute % of all purchases, adjusted M	Relative percentage change from baseline (95% CI)	p-value for difference across groups	Relative percentage change from Phase 1 (95% CI)	p-value for difference across groups
Red Purchases					
Overall	24.0	-23.8 (-28.1, -19.6)		-14.2 (-19.8, -8.5)	
Model comparing across races/ethnicities			0.79		0.53
White	21.8	-25.6 (-31.0, -20.1)		-17.1 (-24.5, -9.7)	
Asian	28.2	-17.1 (-30.2, -4.0)		-18.1 (-34.2, -2.0)	
Latino	29.1	-23.3 (-35.8, -10.8)		-3.3 (-19.7, 13.1)	
Black	33.0	-20.6 (-30.3, -10.9)		-5.9 (-18.3, 6.6)	
Model comparing across job categories			0.03		0.04
Mgmt/Clinician	22.9	-18.6 (-24.7, -12.5)		-21.1 (-28.7, -13.4)	
Professionals	24.5	-29.1 (-39.0, -19.2)*		-13.1 (-27.1, 1.0)	
Technicians	27.5	-26.2 (-38.4, -14.0)		-7.9 (-24.5, 8.6)	
Admin/support staff	30.4	-21.2 (-30.9, -11.4)		3.0 (-9.4, 15.5)*	
Service workers	38.7	-25.4 (-35.1, -15.8)*		-1.6 (-14.6, 11.4)	
Green Purchases					
Overall	59.3	5.6 (3.5, 7.6)		2.3 (0.3, 4.3)	
Model comparing across races/ethnicities			0.81		0.68
White	62.8	5.8 (3.5, 8.1)		2.4 (0.2, 4.6)	
Asian	51.4	5.4 (-3.3, 14.0)		0.5 (-7.9, 8.9)	
Latino	51.4	5.2 (-3.2, 13.7)		-0.9 (-9.0, 7.2)	
Black	47.2	3.8 (-4.4, 11.9)		5.8 (-2.2, 13.8)	
Model comparing across job categories			0.77		0.72
Mgmt/Clinician	54.4	5.1 (2.0, 8.2)		3.6 (0.6, 6.6)	
Professionals	53.1	7.3 (1.9, 12.8)		2.6 (-2.6, 7.7)	
Technicians	46.3	12.1 (3.4, 20.8)		0.8 (-6.9, 8.6)	
Admin/support staff	44.7	6.5 (-1.5, 14.5)		-1.4 (-8.9, 6.2)	

	Baseline	Phase 1: Labeling		Phase 2: Choice Architecture		
		Absolute % of all purchases, adjusted M	Relative percentage change from baseline (95% CI)	p-value for difference across groups	Relative percentage change from Phase 1 (95% CI)	p-value for difference across groups
Red Purchases						
Service workers	38.6		8.5 (−3.1, 20.1)		4.4 (−6.3, 15.2)	

All values adjusted for age, gender, and full-/part-time status, as well as race or job category, as applicable.

Bolded text indicates a significant effect of the intervention ($p < 0.05$)

* significant difference in intervention effect compared to Mgmt/Clinician ($p < 0.05$)

Table 3

Intervention effects on calories and price per beverage by race/ethnicity and job category

	Average calories (kcal) per beverage at baseline, adjusted M	Change in calories (kcal) per beverage from baseline to Phase 2 (95% CI)	p-value for difference across groups	Average price per beverage at baseline, adjusted M (\$)	Change in price per beverage from baseline to Phase 2, \$ (95% CI)	p-value for difference across groups
Overall	95	-15 (-18, -13)		1.34	0.00 (-0.01, 0.01)	
Model comparing intervention effects across races/ethnicities						
White	87	-15 (-18, -12)	0.84	1.30	0.02 (0.00, 0.03)	0.005
Asian	112	-14 (-23, -5)		1.35	-0.02 (-0.07, 0.02)	
Latino	113	-12 (-21, -3)		1.42	-0.04 (-0.08, 0.01)	
Black	126	-17 (-25, -9)		1.42	-0.04 (-0.08, 0.00)	
Model comparing intervention effects across job categories						
Mgmt/Clinician	97	-15 (-18, -11)	0.59	1.31	0.03 (0.01, 0.05)	<0.001
Professionals	93	-16 (-22, -10)		1.32	-0.02 (-0.05, 0.01)	
Technicians	107	-20 (-28, -12)		1.35	-0.05 (-0.09, -0.01)	
Admin/support staff	111	-11 (-18, -4)		1.33	0.00 (-0.03, 0.04)	
Service workers	127	-17 (-26, -8)		1.41	-0.06 (-0.10, -0.01)	

All values adjusted for age, gender, and full-/part-time status, as well as race or job category, as applicable.

Bolded text indicates a significant effect of the intervention ($p < 0.05$)