



Healthier vending machines in a university setting: Effective and financially sustainable

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1. Introduction

Vending machines are a pervasive part of the American food environment and have often been overlooked in efforts to improve diet quality and weight status. Each year, vending machines in the United States sell approximately \$10 billion in snacks and candies and \$24 billion in cold drinks. (Census of the Industry, 2014, 2014) The snacks and beverages sold in vending machines tend to be low in nutritional value and high in calories, fat, salt, and sugar (Browne, Friedman, & Wootan, 2014; Byrd-Bredbenner et al., 2012), and therefore foods and beverages sold in vending machines are increasingly being scrutinized and addressed by federal policies. (“Public Law 108–265 - Child Nutrition and WIC Reauthorization Act of 2004,” n.d., “Nutrition Standards for Foods in Schools,” n.d., “A Guide to Smart Snacks in School,” 2016; Food and Drug Administration, HHS, 2014) Private institutions and local

governments have also recently begun to implement voluntary policies and programs to encourage healthier purchasing from vending machines. Strategies have generally included increasing the number of healthy items available, changing prices, and promoting healthy choices through posters, machine branding, and stickers that identify healthier items (Grech & Allman-Farinelli, 2015; Hua & Ickovics, 2016; Matthews & Horacek, 2015). Healthy vending programs have been implemented in a variety of settings including hospitals (Gorton, Carter, Cvjetan, & Ni Mhurchu, 2010), city parks (Mason, 2014), public buildings, (Centers for Disease Control and Prevention, n.d.) worksites (French et al., 2001; Wilbur, Zifferblatt, Pinsky, & Zifferblatt, 1981) and college campuses (Dingman, Schulz, Wyrick, Bibeau, & Gupta, 2015; French, Jeffery, Story, Hannan, & Snyder, 1997; Hua et al., 2017; Stöckli, Stämpfli, Messner, & Brunner, 2016). However, institutional concerns about losing revenue are commonly reported as a significant barrier in voluntarily implementing a healthier vending program (Terry-McElrath, Hood, Colabianchi, O'Malley, & Johnston, 2014), and the reliance on vending machine revenue is an important consideration for a sustainable healthy vending program (Grech & Allman-Farinelli, 2015; Hua & Ickovics, 2016).

College is an important transitional period for many adolescents, with newfound independence in food and lifestyle choices. Unfortunately, the average college food environment generally does not promote healthful eating, which has been associated with excessive weight gain in college students, particularly during their first year (Smith-Jackson & Reel, 2012; Vella-Zarb & Elgar, 2010, 2009). However, college can also be seen as an opportunity to support adolescents in establishing positive eating habits that promote their long-term health. Providing and encouraging healthier vending options is one way to foster a health-promoting food environment for students, faculty and staff.

There have been relatively few evaluations of healthier vending initiatives on college campuses, and the results of these studies are mixed. Reducing the price of healthier items significantly increased the number of healthier items sold for French and colleagues

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(French et al., 1997), but not for Hua and colleagues (Hua et al., 2017), however for both studies price reductions resulted in revenue loss. Promotion strategies have also had mixed effects in the university setting. Brown and colleagues (Brown, Flint, & Fuqua, 2014) found that classifying all vending items with a red-yellow-green sticker system resulted in increased purchasing of healthier (green) items, and Stöckli and colleagues (Stöckli et al., 2016) found that even non-food-related imagery could prime vending machine customers to purchase healthier products. However, providing nutritional information on a poster was not effective in changing consumer behavior in other university based studies (Dingman et al., 2015; Hoerr & Loudon, 1993). Hua and colleagues found that promotional signs alone had a small but positive impact on sales volume, but that these effects were significantly higher when paired with either machines fully-stocked with healthier items or machines which have reduced the price of healthier items (Hua et al., 2017).

These results suggest there is still significant work to be done in bringing healthy vending to college campuses, however the mixed results of these studies may not be surprising in the broader context of the literature. Many of these studies are small in scale, intervening on fewer than ten machines and generally analyzing two weeks to a month's worth of sales data, which are common challenges and short-comings in healthy vending research (Hua & Ickovics, 2016; Matthews & Horacek, 2015). Several studies do not consider proportion of healthier items and revenue simultaneously, which complicates comparisons across studies (Matthews & Horacek, 2015). It is also unclear what proportion of university vending machine customers would be amenable to the influence of choice-architecture in vending machines, or if healthier vending machines simply attract a new customer base (Grech & Allman-Farinelli, 2015). Lastly, several studies make note that interventions could be implemented with higher fidelity and healthier vending policies could be more sustainable with more engagement with the university's vending operators.

1.1. Purpose

The goal of this intervention was to test the feasibility of increasing the proportion of healthier products purchased at vending machines on a large university campus, without losing revenue. We also aimed to better understand our university's vending machine customer base, in particular whether they approach the machine with a specific intention of what to buy. We hypothesized that through choice-architecture strategies we could increase the proportion of healthier products purchased without significant changes in revenue, and customers who approach a vending machine without the intention to purchase a specific product – referred to in this paper as “undecided customers” – would be more amenable to a choice-architecture intervention and have a greater likelihood of purchasing a healthier product. The intervention was part of a larger interdisciplinary effort by the university, called the Healthy Campus Initiative, to promote healthy choices among students, faculty and staff, and was designed in collaboration with leadership from the campus Housing and Hospitality, which operates all vending machines on campus.

2. Material and methods

2.1. Intervention

Healthier vending machine products were identified through a three-step process. First, we reviewed criteria for healthier vending machine products published by various government agencies and vending industry organizations. We adopted the Los Angeles

County Department of Public Health's criteria of a healthier item which includes: not containing more than 250 Calories, 35% calories from fat, 10% calories from saturated fat, 35% sugar by weight and 360 mg of sodium for the contents of the entire package. (“Policy # 3.155. County of Los Angeles Vending Machine Nutrition Policy,” n.d.) Second, we developed a database of all relevant nutritional information for all products sold in university vending machines, and used the criteria to identify which products classified as healthier. Third, university nutritionists reviewed all products and their initial classification. At their recommendation, products that met initial nutrition criteria were reclassified if they contained corn syrup or other added sugar as one of the first three ingredients, any trans fats, or were fried. In addition, unsalted nut and seed products that did not meet the initial nutritional criteria because of their high caloric and fat content were reclassified as healthier products. This classification is consistent with a recent opinion that criteria for healthfulness should be based in well-established nutritional guidelines, but also individualized (Matthews & Horacek, 2015). A list of products as healthier choices and their nutrition information are available from the authors on request.

Intervention machines were purposefully sampled to ensure a sufficient number of high-usage machines across campus, as has been done in other university-based vending studies (Brown et al., 2014; French et al., 1997; Hoerr & Loudon, 1993). Intervention machines were branded with a large Healthy Campus Initiative sticker, which included a web address for more information regarding the intervention and nutritional criteria for healthier products. Healthier products were each identified with “Eat Well” stickers. Basic choice architecture principles (Johnson et al., 2012; Thorndike, Sonnenberg, Riis, Barraclough, & Levy, 2012) were used to reorganize items in the machines. Healthier products were placed in cohesive groups for visual impact. Large healthier product were arranged in dedicated rows placed at eye level and accounted for 25%–45% of all large snack products. Small healthier products accounted for at least a third of all small snack products. In contrast, comparison machines maintained their original inventory of healthier and other products.

For all vending machines, the price of popular candy bars was raised from \$1.00 to \$1.25, regardless of experimental condition. All intervention machines were converted over a two-day period just prior to the start of the fall academic quarter in September 2013.

2.2. Vending machine measures

Data were collected during the months of October and November 2013. Monthly machine-level sales reports were generated to measure revenue, profit, number of total products sold, and number of healthier products sold. To evaluate potential impact on financial performance, sales reports were generated for these same intervention and comparison machines during the same period in 2012.

2.3. Customer measures

A point-of-purchase survey of 100 vending machine customers was conducted immediately after the purchaser made their purchase to better understand individual-level purchasing behavior. In addition to questions regarding demographics, university affiliation, and typical frequency of vending machine purchasing, customers were asked: “Did you come to the vending machine just now to specifically purchase [item purchased]?”. Customers who replied “no” were considered to be “undecided customers”.

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