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## Promoting healthy choices from vending machines: Effectiveness and consumer evaluations of four types of interventions

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## ABSTRACT

Vending machines often provide relatively energy-dense snack foods and beverages at a wide variety of points-of-purchase. Vending-machine interventions that stimulate low-calorie choices can therefore play a role in improving the healthfulness of the food environment landscape. The aim of this study is to examine the effects of four vending-machine interventions, varying in level of intrusiveness, on consumers' choices, consumers' acceptance of such interventions, and consumers' evaluations of the choice they made.

In a between-subjects design experiment (N = 206), respondents were asked to purchase a snack and a beverage from a vending machine. In addition to a no-intervention condition, four types of incrementally intrusive interventions were implemented: calorie labelling, increasing accessibility of low-calorie choices, increasing prices of high-calorie choices, and restricting availability of high-calorie choices. A post-choice questionnaire included items concerning intervention acceptance, and assortment and choice evaluations.

Compared to the no-intervention condition, the most intrusive intervention (i.e. restricting availability of high-calorie choices) led to more low-calorie choices (39% vs. 78%), while less intrusive interventions (i.e. calorie labelling, increasing accessibility of low-calorie choices, and increasing prices of high-calorie choices) did not. Intervention acceptance and choice evaluations were equally high across the four intervention types.

Overall, the results suggest that restricting high-calorie options is a promising route to stimulate healthier choices from vending machines. As such, the present study provides intervention opportunities in the combat against obesity for governments and their potential allies, such as food manufacturers and the food service industry.

### 1. Introduction

In an environment where tasty, convenient, and inexpensive high-calorie foods are present in abundance (Ni Mhurchu et al., 2013), consumers in many countries worldwide increasingly struggle to adequately manage their caloric intake (Cohen et al., 2010). Mainly because of this systematic imbalance between calorie intake and calorie expenditure, currently more than 1.5 billion people are overweight or obese (Swinburn et al., 2011). Intervention strategies that stimulate consumers to choose low- rather than high-calorie food products are therefore seen as indispensable tools, and scholars stress that widespread governmental policy measures should be implemented to enforce lasting improvements in dietary behaviours (Nestle and Jacobson, 2000; Waterlander et al., 2010).

An increasingly large proportion of people's daily caloric intake originates from snacking (Popkin and Duffey, 2010), which is the

consumption of foods and beverages apart from breakfast, lunch, and dinner. Vending machines are an important point of purchase for these foods and beverages; they provide snacking opportunities at numerous locations such as work- and school canteens, sport canteens, and train stations (Kocken et al., 2012). Vending machine density is particularly high at high schools and universities: around 75% to 80% of these institutions facilitate snack foods and beverages through one or more vending machines (Larson and Story, 2010; Mikolajczak et al., 2012). Since vending-machine use is associated with detrimental dietary behaviours (e.g. Wiecha et al., 2006), implementing interventions that stimulate low-calorie choices in vending machines is a promising avenue to lower caloric intake through snacking.

Previous research on vending-machine interventions show mixed results. A variety of vending-machine interventions to stimulate healthier choices<sup>1</sup> have been studied, as two recent reviews illustrate (Grech and Allman-Farinelli, 2015; Hua and Ickovics, 2016). The interventions

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<sup>1</sup> (Un)healthy choices and low/high-calorie choices are used interchangeably in this paper, as this study operationalizes healthiness based on caloric values.

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varied from providing nutrition information (Dingman et al., 2015), using promotional materials (Fiske and Cullen, 2004), reducing prices of healthier items (French et al., 1997), increasing the (relative) proportion of healthier items in the assortment (Wilbur et al., 1981), or a combination of these approaches (Grech and Allman-Farinelli, 2015). Grech and Allman-Farinelli (2015) reviewed twelve experimental studies on the efficacy of vending-machine interventions that included behavioural measures (mostly sales data). Eight studies examined the use of nutrition information in the form of interpretative nutrition labels (e.g. colour codes) or other promotional materials (e.g. 'Better Choice' labels). Results of these studies show limited or no effects. For example, Dingman et al. (2015) affixed a poster board with nutrition information (nutrition-fact panels and 'Better Choice' options) to nine vending machines at a university and compared the average calories per snack sold and the proportions of 'Better Choice' snacks sold relative to the sales from nine control vending machines. No significant differences between the experimental and control vending machines were found. In contrast, interventions that increase the availability of healthier snacks were found to more likely increase sales of these items. Five out of six reviewed interventions that enlarged the proportion of healthy snacks were successful in increasing sales of healthier items while maintaining sales volume or profits. Price interventions in five studies were similarly successful in diverse settings, in which larger price reductions showed larger effects on sales of healthier items. For example, an intervention at an university in which prices of low-fat snacks were reduced by 50%, increased sales of these products substantially without affecting overall sales volume (French et al., 1997). A recent narrative review of vending-machine studies conducted in the United States could not identify a single intervention type ensuring changes in purchase patterns of healthier products, although price reductions seemed most effective (Hua and Ickovics, 2016). A combination of approaches (i.e. increased availability, price reductions, promotional signs for healthy products) was recently tested in a randomized factorial trial using 56 university campus vending machines (Hua et al., 2017). Results showed that increasing availability of healthier options was effective for beverages. Price reductions alone had no effects, although the interaction between availability and promotional sign increased revenue of healthier snacks.

Literature on intervention strategies for healthy food choices brings forward three concepts (see the right-hand side of Fig. 1) as important conditions for both enactment of interventions and long-term intervention effectiveness. First, there needs to be evidence of short-term

effectiveness; if there is no indication that interventions lead to the desired behaviour in the short term, long-term effectiveness is unlikely (Traill et al., 2010). Second, interventions are ideally accepted by both consumers and food manufacturers (Kelly et al., 2009), because a lack of intervention acceptance potentially (though not necessarily) may lead to discontinuation or non-enactment of (proposed) policies (Diepeveen et al., 2013). Third, interventions should not lead to frustration or dissatisfaction when consumers make food choices, as these negative choice evaluations potentially lead consumers to search for alternative purchase locations in which the intervention has not been implemented (Proudfoot and Kay, 2014).

Interventions can be categorised in many different ways, one of the more prominent and relevant in the present context is their level of "intrusiveness", contingent upon the extent of individual responsibility and freedom in the construction of one's personal life (Nuffield Council on Bioethics, 2007). In their comprehensive review on acceptance of government interventions to change health-related behaviours, Diepeveen et al. (2013) conclude that acceptance is strongly influenced by interventions' level of intrusiveness. Interventions that are less intrusive, such as providing information, enjoy higher acceptance than those that are more intrusive, such as taxing unhealthy choices or restricting unhealthy choices. Additionally, Diepeveen et al. (2013) identify stage of implementation, also referred to as level of absoluteness, as an additional determinant of an intervention's acceptance, with interventions seemingly becoming more acceptable after they have been introduced. This suggests that consumer responses to hypothetical interventions may differ from those towards actually implemented and experienced ones.

Research on the cognitive process involved in acceptance of food choice interventions identified that the relation between intervention intrusiveness and acceptance is mediated by two intervention-specific beliefs: the perceived effectiveness and the perceived fairness (Bos et al., 2015). The perceived effectiveness refers to whether people think interventions will be successful in stimulating healthy food choices, thereby differentiating between effectiveness for themselves and for society as a whole. The perceived fairness, on the other hand, refers to the extent to which people perceive interventions to be a fair way of stimulating healthy food choices. Bos et al. (2015) conclude that perceptions of personal and societal effectiveness only differ marginally across different levels of intrusiveness. However, the more intrusive interventions become, the less they are perceived as fair. Bos et al. (2015) furthermore conclude that acceptance of interventions is

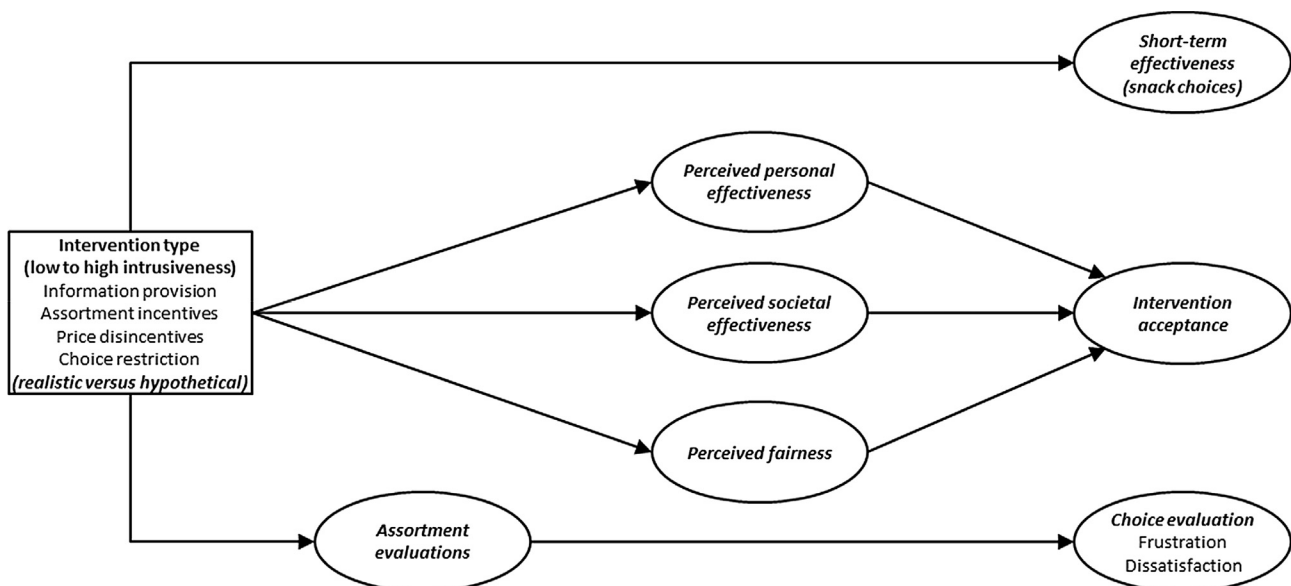


Fig. 1. Conditions for long-term intervention effectiveness and their determinants.

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