



## Could a tax on unhealthy products sold for weight loss reduce consumer use? A novel estimation of potential taxation effects



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### ABSTRACT

Abuse of widely available, over-the-counter (OTC) drugs and supplements such as diet pills, laxatives, and diuretics by adolescents for weight control is well-documented, yet manufacturers and retailers can sell them to minors without restriction. The aim of our study was to estimate the effect of added taxation of OTC drugs and dietary supplements sold for weight loss on household purchases of these products. With data from 60,538 U.S. households in the 2012 waves of the Nielsen/IRI National Consumer Panel (NCP) and the Nielsen/IRI Retail Scanner (NRS) datasets, we conducted analyses in 2017 to tally annual quantities and expenditures on OTC drugs or dietary supplements making weight-loss, cleanse/detox, or diuretic claims. We estimated the percent reduction in household purchases due to a simulated 20% added tax on each category. Among the 14,151 households reporting at least one purchase in the three claims categories, a 20% higher average price of weight-loss products was associated with a 5.2% lower purchases of those products. Among households with children ages 12 to 17 years old present, purchases were 17.5% lower, and among households with a daughter present, purchases were 10.3% lower. Taxation may be an effective public health strategy to reduce purchasing of potentially dangerous OTC drugs and supplements sold for weight loss, especially for households that include children ages 12–17 years old or a daughter.

### 1. Introduction

Abuse of widely available, over-the-counter (OTC) drugs and supplements such as diet pills, laxatives, and diuretics by adolescents and adults for weight control is well-documented in the epidemiological literature (Blanck et al., 2007; Centers for Disease Control and Prevention, 2011; Neumark-Sztainer et al., 2002) and can signal the onset of eating disordered behaviors and symptoms (Roerig et al., 2010; Steffen et al., 2010). Nationally in the United States, it is estimated that 21% of women and 10% of men have used weight-loss supplements in their lifetimes, and young adult women ages 18–34 years have the highest prevalence of past-year use at 17% (Blanck et al., 2007). Laxatives, of which colon cleanse/detox supplements are a subtype, and diuretics are commonly abused in weight control attempts. The lifetime prevalence in the general U.S. population of laxative abuse for weight control has been estimated to be 4% (Neims et al., 1995). Among people with bulimia nervosa or other similar eating disorders, lifetime estimates of abuse of laxatives for weight control have ranged from

15% to as much as 62% (Roerig et al., 2010). A national study of U.S. adults found 1.9% of women and 1.4% of men report using diuretics as a weight-loss method (Kruger et al., 2004). Weight-loss products are widely used by men and women and boys and girls of all racial, ethnic, and socioeconomic groups (Blanck et al., 2007; Neumark-Sztainer et al., 2002). Furthermore, recent research shows that low-income U.S. households spend more than double on weight-loss supplements in terms of proportion of total annual household income compared to higher-income households (Austin et al., 2017a).

Importantly, none of these products are medically recommended for healthy weight control or maintenance for people of any age (Blanck et al., 2007; Golden et al., 2016; Heinrich, 2002; Roerig et al., 2003; Steffen et al., 2007), with the possible exception of the OTC diet pill alli®. But even alli® has approval from the Food and Drug Administration only for ages 18 years and older and concerns have been raised by eating disorders experts (Cumella et al., 2007; McMahan, 2009). The American Academy of Pediatrics recently issued a report strongly cautioning against adolescents using any diet pills regardless of weight

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status (Golden et al., 2016).

The caution from medical experts regarding these products is well-grounded in the research evidence. A recent study from the Centers for Disease Control and Prevention estimated nearly 23,000 emergency room visits each year in the United States can be attributed to illness and injury caused by dietary supplements, with fully a third of these adverse events attributable to those sold for weight loss (Geller et al., 2015). Weight-loss supplements have been found in multiple studies to be adulterated with dangerous and sometimes banned ingredients (Cohen et al., 2017 (Epub ahead of print); Grundlingh et al., 2011; Yen and Ewald, 2012) linked to serious health conditions and injury, such as tachycardia, hypertension, myocardial infarction, stroke, gastrointestinal impairment, and liver injury so severe it can require transplant or cause death (Abdel-Rahman et al., 2011; Fong et al., 2009; Guyda, 2005). Abuse of laxatives and diuretics for weight control similarly can be deadly (Roerig et al., 2003; Steffen et al., 2007).

Despite the clearly documented risks and absence of medical endorsement, industries producing products abused for weight control sell them to minors without restriction (Pomeranz et al., 2015; Pomeranz et al., 2013). Yet viable legal avenues to redress this problem are available. Two legal research studies (Pomeranz et al., 2015; Pomeranz et al., 2013) applied systematic evaluation of health and consumer law to generate recommendations for policy changes with strong potential both to withstand legal challenge from industry and to achieve high impact to protect the health of young people. These recommendations include: banning the sale to minors of OTC drugs and dietary supplements that make weight-loss claims; restricting minors' access to these products; or adding excise or sales taxes on OTC drugs and dietary supplements that make weight-loss claims to reduce consumer purchasing.

Imposing excise or sales taxes has been shown to be a successful strategy to decrease consumption of other products known to have negative health effects, including sugar-sweetened beverages, alcohol, and tobacco, and can also be a revenue generator for government (Brownell and Frieden, 2009; Colchero et al., 2017; Cotti et al., 2015; Falbe et al., 2015; Fletcher et al., 2010; Lewitt et al., 1997; Wagenaar et al., 2010). One study found the price of tobacco was inversely related to the tobacco use (Harris and Chan, 1999). This relationship was the strongest for 15–17 year olds, with price having the most impact on the probability that these adolescents use tobacco. Another study estimated that a 10% increase in the price of sugar-sweetened beverages would lead to a 12.6% decrease in purchases of those drinks (Smith et al., 2010). Evidence from taxation studies in a number of countries examined in a recent review suggests that taxes on unhealthful foods do lead to reduced consumption of those foods, and the researchers recommend that taxes be set at 20% or above to have a meaningful impact (Mytton et al., 2012). There is a lack of data, however, on the effects that added taxes might have on the use of weight-control products. Given this gap in the literature, we carried out a simulation study to estimate the effect of a 20% added sales or excise tax on purchasing at the household level of products making weight-loss claims. We hypothesized the added taxes would be associated with reduced household purchases of these products and that households with adolescents or daughters present would show larger estimated reductions in purchasing than other households.

## 2. Methods

We use data from the 2012 waves of the Nielsen/IRI National Consumer Panel (NCP) and the Nielsen/IRI Retail Scanner (NRS) datasets, calculated (or derived) based on data from the Nielsen Company (US), LLC and marketing databases provided by the Kilts Center for Marketing Data Center at the University of Chicago Booth School of Business, Copyright© 2018 The Nielsen Company (US), LLC. All Rights Reserved (Nielsen/IRI, 2012). We carried out our analyses in 2017. The unit of observation for analysis is an NCP household, which was

aggregated from a panel of all purchases with scannable universal product codes (UPC) for each household in 2012, including those purchases made online. Neither database includes identifiable information; therefore, this study is not considered human subjects research. The authors have no financial conflicts of interest.

In order to enhance information about OTC drugs and dietary supplements purchased by participating households and therefore included in the NCP, we created an additional database documenting health-related claims made about these products through their packaging and advertising, including claims that the products have weight loss, cleansing/detox, and diuretic effects. We carried out web searches by product brand, description, and UPC and recorded health-related claims associated with the product. We then merged our new database with the NCP database so that we could analyze products in NCP by type of claim made about the product in packaging and advertising. The analytic sample consisted of 60,538 households, which is all households included in the 2012 panel year, and which forms a representative sample of the U.S. when accounting for survey weights.

We tallied annual quantities, expenditures on, and expenditure-weighted average unit prices of all dietary supplements products that have packaging or advertising making health-related claims in at least one the of the following categories: weight loss, cleansing/detox, or diuretic. Quantity units vary by product category, so we report percent changes in purchases.

Average prices can be calculated for only those products that a household purchases in the NCP; therefore, we replaced missing price data by merging in annual average UPC-level unit prices calculated from the NRS dataset. Each purchase was matched to the average of all recorded prices for each UPC in its given designated market area, thus re-creating as precisely as possible the price environment in which each household purchase decision was made. Because the very large NRS dataset includes prices from approximately 35,000 stores across the United States, representing > 50% of all food and drug transaction volumes in sampled markets, the resulting merged dataset offers substantial granularity in price environment for the product categories under study.

Elasticities describing the price-response relationships between product categories were estimated using the Quadratic Almost Ideal Demand System (QUAIDS), a frequently used structural model of demand (Banks et al., 1997). The model was modified to account for the relatively high censoring at zero for the product categories under analysis. We report the following estimated parameters: expenditure elasticities (percent change in a product category's purchases divided by a 1% increase in total household expenditure), uncompensated price elasticities (unadjusted percent change in a product category's purchases divided by a 1% increase in a product category's average price), compensated price elasticities (percent change in a product category's purchases divided by a 1% increase in a product category's average price, adjusted for constant utility). Own-price elasticities refer to the relationship between a product category's purchases and its own average price, while cross-price elasticities refer to the relationship between a product category's purchases and another category's average price. Estimation was conducted in accordance with the estimating equations developed in the Technical Appendix, using Stata version MP14.0 (StataCorp, College Station, Texas).

## 3. Results

Table 1 displays a summary of the demographic characteristics for the analytic samples. The listed demographic characteristics, which include household size, age composition of the household head(s), and the self-reported race/ethnicity of the household, were used as control variables when adjusting for censoring at zero purchases.

Before reporting results from the QUAIDS model estimation, we first display summary statistics of input parameters for the QUAIDS model in Appendix Tables 1 and 2, including those used to account for censored

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