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# The role of travel distance and price promotions in tobacco product purchase quantity

Nathan J. Doogan[a,*], Sarah Cooper[a], Amanda J. Quisenberry[a], Theodore M. Brasky[a,c], Christopher R. Browning[b], Elizabeth G. Klein[a], Alice Hinton[a], Haikady N. Nagaraja[a], Wenna Xi[a], Mary Ellen Wewers[a]

[a] The Ohio State University College of Public Health, Cunz Hall, 1841 Neil Ave., Columbus, OH 43210, United States
[b] The Ohio State University Department of Sociology, Townshend Hall, 1885 Neil Ave. Mall, Columbus, OH 43210, United States
[c] The Ohio State University College of Medicine, 370W. 9th Ave., Columbus, OH 43210, United States

## ABSTRACT

*Introduction:* Rural Americans are particularly vulnerable to tobacco price reducing promotions are known to be directed to and used by vulnerable populations. Tobacco purchasing decisions, such as unit quantity purchased, may vary by rurality, by price promotion use, and possibly by the interaction between the two. Purchase decisions are likely to affect tobacco use behavior. Therefore, explanation of variation in tobacco purchase quantity by factors associated with rural vulnerability and factors that fall under the regulatory scope of the Tobacco Control Act (TCA) of 2009 could be of value to regulatory proposals intended to equitably benefit public health.

*Methods:* Our sample included 54 combustible tobacco users (298 purchase events) and 27 smokeless tobacco users (112 purchase events), who were asked to report all tobacco purchases on a smartphone application. We used an ecological momentary assessment methodology to collect data about tobacco users' purchasing patterns, including products, quantity purchased, and use of price promotions. A parent cohort study provided relevant data for home-outlet distance calculation and covariates. Our analysis examined associations between our outcome—purchase quantity per purchase event—and distance from participant's home to the nearest outlet, whether a price reducing promotion was used, and the interaction of these two factors.

*Results:* Combustible users showed an increased cigarette pack purchase quantity if they lived further from an outlet and used a price promotion (i.e., an interaction effect; RR = 1.70, 95% CI [1.11, 2.62]). Smokeless users purchased more units of snuff when they used price promotions (RR = 1.81, 95% CI [1.02, 3.20]).

*Conclusions:* Regulatory action that imposes restrictions on the availability or use of price promotions could alter the purchasing behavior of rural Americans in such a way that makes it easier to reduce tobacco use or quit. Such action would also restrict flexibility in the price of tobacco products, which is known as a powerful tobacco control lever.

## 1. Introduction

Rural areas are characterized by poorer health behaviors and poorer health outcomes compared with non-rural areas of the US (Mansfield et al., 1999; National Center for Health Statistics, 2011; Pettit and Nienhaus, 2010; Rural Health Reform Policy Research Center, 2014). Tobacco use, particularly cigarette and smokeless tobacco (SLT) use, are higher in rural areas (Roberts et al., 2016). The geographic disparity in the use of the most harmful tobacco product—cigarettes—appears to be growing, even after controlling for numerous sociodemographic characteristics of individuals (Doogan et al., 2017). Thus, other contextual factors may explain the growing disparity. For example, less support for tobacco control efforts and the difficulty of enforcing policies uniformly in sparsely populated rural areas with relatively low resources (National Cancer Institute, 2006; Stillman et al., 2003) could increase disparity. In general, rural residents have lower incomes than their urban counterparts (Doogan et al., 2017), which may mean they are more likely to be targeted with price promotions from the tobacco industry (Caraballo et al., 2014). The population sparsity in rural areas could have additional impacts. Diffuse geographic distribution of tobacco retail outlets, resulting in longer travel times for consumers to obtain tobacco products, could

* Corresponding author.
*E-mail address:* doogan.1@osu.edu (N.J. Doogan).

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alter purchasing patterns, and subsequent tobacco use behavior. This possibility has not been studied.

Why do purchasing patterns matter? The literature provides evidence that tobacco consumers use their tobacco products at a lower rate if they have a smaller supply on hand. According to marketing researchers, consumers of "vice goods" with concern about the long-term consequences of their continued use exhibit self-regulatory purchasing behaviors to control consumption behaviors (Wertenbroch, 1998; Jain, 2011). This research has included goods ranging from cookies and potato chips to alcohol and cigarettes (Wertenbroch, 1998). Similar findings have emerged within a behavioral economics framework; Marti and Sindelar found that some consumers will forgo quantity discounts and instead purchase premium-priced packs of 10 cigarettes (instead of 20) to constrain their product use (Marti and Sindelar, 2015). This behavior has been referred to as *pre-commitment*, (Ladouceur et al., 2012) as in the consumer pre-commits to a certain limit on tobacco use until the next purchase event by purchasing in a limited quantity despite an increased cost. This literature attributes consumer purchase quantity to concern about continued consumption. However, it seems to imply that purchasing patterns can affect use behavior regardless of health concerns. Theoretically, the limited supply and the increased transaction cost of renewing the supply are the factors altering consumption. These factors force the addicted consumer, who by definition of addiction has a reduced level of self-control over his or her use of the product, to think more carefully about use. Thus, factors that reduce purchase quantity may have the side effect of encouraging more judicious use of the product, regardless of the reason for limited quantity purchases.

Conversely, individuals who purchase in larger quantities may exhibit relatively high rates of product use because they lack the same supply limit as those who purchase in smaller quantities. Such consumers may purchase in larger quantities because they lack the motivation to restrict their use. Even if the consumers do have a motivation to restrict use, they may have been enticed with quantity discounts, which they deemed valuable enough to overwhelm a health-related motivation. These consumers could be seen to be committing to the product, or at least they are not committing to controlling their product use through their purchasing decisions. Marketing research suggests that consumers who have a larger supply of a product on hand may use it more liberally. This could be because they perceive the unit cost to be lower either because it *is* lower due to quantity discounts, or because of a misperception of cost due to an increased supply (Wansink, 1996; Wansink and Cheney, 2005). Indeed, economic tobacco control literature clearly shows an inverse relationship between price and consumption (Chaloupka and Warner, 2000). In sum, the reviewed literature provides ample evidence that purchase quantity can affect use behavior, which raises the importance of identifying factors that are related to tobacco product purchase quantity. However, this area of tobacco control is not well studied.

One factor that could be related to purchase quantity is geographic accessibility of products. The density of tobacco retail outlets is relatively low in rural areas. As such, rural tobacco users are more likely to incur a higher average transaction cost than urban consumers. These consumers may therefore have a larger incentive to minimize their transaction costs than consumers who live close to an outlet. Given previous research linking purchase quantity to tobacco use behavior, (Marti and Sindelar, 2015; Ladouceur et al., 2012) larger purchase quantities by individuals residing relatively far from a tobacco retail outlet could imply that these consumers have a *decreased* incentive to limit their tobacco use. Such a finding could complement ongoing research aimed at identifying the factors associated with increased tobacco use in rural areas of the United States relative to non-rural areas (Roberts et al., 2016; Doogan et al., 2017; Roberts et al., 2017).

Tobacco price promotions (e.g., discount coupons and reduced price multi-pack buys) may also be an important factor in the context of purchasing behavior. Cornelius and colleagues found that between 2002 and 2011, multi-pack purchases increased in popularity, likely because they balance the high total entry cost of carton-buying and the premium per-pack cost of single-pack purchases (Cornelius et al., 2015). The US Food and Drug Administration (FDA) has authority, through the Family Smoking Prevention and Tobacco Control Act (TCA) of 2009, to regulate the sale and promotion of tobacco products (FSPTCA, 906(d)), which could include limitations on price promotions that reduce price, (Chaloupka and Warner, 2000) increase purchase quantity, or both. Therefore, research on the associations between price promotions and purchase quantity could be valuable to those generating tobacco control policies within the FDA's regulatory scope. With regard to relatively high rural tobacco product use, price promotions may be a particularly attractive way to offset travel costs involved in purchasing tobacco.

This study examined variation in tobacco purchase quantity of a subcohort of tobacco consumers living in urban and Appalachian rural areas of Ohio. Using repeated observations of purchase events collected from tobacco users enrolled in an ecological momentary assessment (EMA) study, the purpose of the reported analysis was to test the associations of contextual and purchase related factors with the quantity of tobacco products purchased. Specifically, one explanatory focus was the distance between a participant's home and the nearest tobacco retail outlet. While this work is broadly premised on a disparity in rural tobacco use, our conceptual framework implies that travel distance is an underlying factor that determines the transaction cost, and therefore the extent to which bulk purchasing could offset that cost. We therefore do not focus on rural residential status, but more directly on distance. Our second explanatory focus was the use of price reducing promotions, which may affect purchase quantity directly by requiring a multi-pack purchase or indirectly by reducing the price of single packs. Additionally, the combination of a large travel distance and a price promotion could provide a uniquely strong incentive to purchase in larger quantities. We hypothesized that distance, the use of a price promotion during purchase, and the interaction between the two would be positively associated with purchase quantity.

## 2. Method

### 2.1. Sampling and design

The sample was drawn from a cohort of rural and urban adult tobacco users established as part of a parent study entitled "Tobacco User Adult Cohort" (TUAC; P50CA180908). The study was designed for surveillance and to examine long-term dynamics of tobacco-related variables in participants classified as one of four types of tobacco users—exclusive combustible, exclusive SLT, or exclusive electronic cigarette, and dual use (described in more detail below)—living in urban and rural areas of Ohio. The TUAC study is a 36-month longitudinal prospective cohort design, which uses face-to-face interviews about tobacco use, consumption patterns, cognitive and affective factors, and purchasing factors. The investigators began enrollment for the cohort in October of 2014 using an address-based random sampling design. Details of the study and a description of the cohort can be found elsewhere (Brasky et al., 2018).

The EMA study reported here was designed to collect data about tobacco purchasing factors among a subset of the TUAC cohort. The study used a special application installed on a smartphone for data collection in the context of participants' normal daily routines. Enrolled participants agreed to participate for 7–10 days, once per year, for a total of three years. At present, two of the three years of data collection are complete, and this study utilizes the data from both.

Participant sampling for the EMA study involved a quota sampling