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Concordance of Advertised Cigarette Prices with Purchase Receipts in the United States

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Abstract

Objectives—Researchers and regulators study the advertised price of tobacco products to evaluate compliance with minimum price policies, tax increases, and geodemographic marketing. However, few studies report reliability of advertised price and none address its concordance with receipt price.

Methods—In a sample of US tobacco retailers (N=1972), data collectors purchased the leading brand of non-menthol or menthol cigarettes, recorded advertised prices, whether sales tax was included and price was discounted. Intraclass correlation coefficients (ICCs) were computed for the same measures by different observers (reliability), and for receipt and advertised pack price (validity). Discrepancy between receipt and advertised price was modeled as a function of store type and presence of a discount.

Results—Advertised price was assessed reliably (ICCs = 0.74 to 0.87) and concordance with receipt price was near perfect (ICCs = 0.96 to 1.00). Prices were identical in 77.7% of stores for

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Human subjects statement

Stanford University School of Medicine IRB deemed this research did not involve human subjects.

Marlboro and 78.1% for Newport. Differences between receipt and advertised price were related to store type and presence of a discount for Marlboro, but not for Newport.

Conclusions—Findings validate a common measure of cigarette price in research on minimum price compliance, effects of tax increase and industry marketing.

Keywords

advertising; cigarette; point-of-sale; price promotion; taxation

INTRODUCTION

The price of tobacco products is the single largest determinant of tobacco use.¹ As a policy intervention, increasing price of is one of the most effective strategies to reduce tobacco consumption by youth and adults.^{2,3} However, the tobacco industry attempts to blunt the impact of tax increases by over- and under-shifting prices of cigarettes.⁴ Similarly, systematic variation in price by neighborhood demography is consistent with strategic attempts by tobacco companies or retailers to target specific market segments.^{5–8} For these reasons, national and multinational surveillance and monitoring systems for tobacco prices are recommended.^{1,9–11}

According to a systematic review of retail audit methods for tobacco marketing surveillance, nearly half (43%) of 38 studies examined cigarette price.¹² Various methods of measuring price are: (1) obtaining receipts for purchased products,^{13–16} (2) recording price from in-store advertisements,^{17,18} (3) requesting price from merchants, either in-person¹⁹ or by telephone.¹³ Although the gold standard would be to obtain price from purchase receipts, the costs associated with product purchase and disposal are obvious disadvantages. Recording advertised price is a common protocol and included in the Standardized Tobacco Assessment for Retail Settings (STARS) in the PhenX Toolkit for Tobacco Regulatory Research.^{12,20} Indeed, researchers and regulators have used advertised price to assess compliance with minimum price laws, evaluate the impact of tax increases, examine whether cigarettes cost less near schools, and investigate industry strategies for target marketing.^{14,16,21,22}

Few studies report the reliability of advertised price of tobacco products or address its validity.^{21,23–25} There are several reasons why data collectors' observations of advertised price might not match what consumers pay. For example, different prices for the same pack in the same store may be displayed whenever multi-pack discounts are present (eg, a special price when 3 or more packs are purchased). Such discounts were advertised in approximately 10% of California stores in 2011 and in 36% of US stores in 2012.^{26,27} Requiring data collectors to subtract on-pack discounts (eg, 50 cents off) from advertised price could introduce measurement error. Discrepancies would also exist if data collectors did not record the presence of sales tax accurately, which no previous studies assessed.

As an increasing number of jurisdictions pass minimum price laws for tobacco products, establishing consistency between sales receipt and advertised price is integral to assessing regulatory compliance.²⁸ A study of compliance with Boston's cigar packaging and pricing

regulation observed one discrepancy between advertised and receipt price in a sample of 34 stores.²¹ However, the study was limited to a single brand, conducted in small sample of stores in one city, and was not designed to evaluate concordance. The current study is the first to examine concordance between purchase receipt (the gold standard) and advertised price for cigarettes in a representative sample of US tobacco retailers. This study also examined inter-rater reliability of advertised price, and the extent to which discrepancy between receipt and advertised price was related to the presence of a discount and to store type.

METHODS

This study describes a subset of data from tobacco marketing surveillance conducted for Advancing Science and Policy in the Retail Environment (ASPiRE), funded by the National Cancer Institute's State and Community Tobacco Control Initiative. The sample and methods are summarized below and described in detail elsewhere.²⁷

Sample

Two-stage sampling selected 100 counties (with minimal replacement) in proportion to population size from all counties in the contiguous US states, then randomly selected tobacco retailers. A sampling frame was created by purchasing addresses with a primary business code for likely tobacco retailers from two vendors (Reference USA and Dun & Bradstreet, Inc.) because the combined sources improved coverage.^{29,30} After merging lists and removing duplicates and retail chains that do not sell tobacco (eg, Target, Whole Foods), the resulting list was a sampling frame of 92,167 likely tobacco retailers for 97 counties in 40 states. Cigarette availability and street address were verified by telephone for a randomly selected subset of 24 stores in each county. In the total sample (N=2345), 7 counties had fewer than 24 eligible stores.

Data collection

Using a customized survey application on iPads, trained data collectors conducted marketing surveillance between June and October, 2012. The study sample consisted of 2164 stores (completion rate=96.8%). From one to 7 weeks after the initial observation (M=5.5, SD=0.7), different data collectors purchased the assigned cigarette brand and recorded advertised prices in a subset of 160 stores.

Measures

Following an established protocol,³¹ data collectors recorded the advertised price for a single pack, indicated whether sales tax was included and whether the price was discounted (eg, 50 cents off or other special). If the single-pack price was not advertised, data collectors asked a sales clerk. Receipt price was obtained by purchasing either Marlboro (non-menthol) or Newport (menthol), which were the brand leaders in 2012.³² When the randomly assigned brand was unavailable (3.9% of stores), data collectors purchased the other brand. Receipts were tagged with a unique number for each store, and location data were linked to local sales tax data.

Analysis

Of the 2201 stores with complete observations, we excluded stores that were missing receipts (N=213) or information about sales tax for advertised price (N=17). The analysis sample represents 91.1% of all stores in which receipt and advertised price were obtained for the same brand, Marlboro (N=1004) or Newport (N=967).

Store type recorded by data collectors was collapsed into 7 categories: convenience stores with and without gasoline; liquor stores; pharmacies; supermarkets and grocery stores; tobacco stores; warehouse clubs; and other. Discount department store (N=4), automotive repair (N=9), and newsstands (N=6) were combined with other establishments (N=28). These 47 stores were included in analyses of the total sample, but excluded from analyses by store type because of heterogeneity within the category.

All analyses examined price before sales tax for consistency with previous research.^{8,31} We report descriptive statistics by brand from both sources (receipt price and advertised price). An independent, two-sample t-test examined the difference between receipt price for Marlboro and Newport.

Analyses used the intraclass correlation coefficient (ICC) both for inter-rater reliability and concordance. To assess inter-rater reliability, we computed ICCs for the advertised prices by brand from the subset of 160 stores with repeat visits from different data collectors. In this approach, ICC indicates the extent to which the same measurement used by different data collectors yielded consistent results in the same stores (reliability).^{33,34} For the concordance analysis of receipt and advertised price (validity), cigarette price was conceptualized as a single construct that was measured twice in each store. ICCs were computed for the 2 measures within each store, with higher values indicating greater concordance between receipt and advertised prices. The ICC can be interpreted as the proportion of price variability that is between stores as opposed to within stores.³³ ICCs that assess concordance were computed for separately by brand and store type.

For the subset of stores without identical prices, ordinary least squares regression models were used to examine discrepancy (absolute value of the difference between receipt and advertised price for each brand) as a function of store type and whether the advertised price was discounted. All analyses were performed using IBM SPSS Statistics for Windows, version 24.0.

RESULTS

Table 1 summarizes descriptive statistics for purchase receipt and advertised prices for Marlboro and Newport, by store type and overall. Inter-rater reliability of advertised price was ICC=0.74 (N=144) for Marlboro and ICC=0.87 (N=122) for Newport. Cigarette prices were typically advertised without sales tax (eg, “plus tax”): 90.0% for Marlboro and 89.4% for Newport. Agreement about whether advertised price included sales tax was 84.0%. The average receipt price (before sales tax) was \$6.21 (SD=\$1.36) for Marlboro and \$6.55 (SD=\$1.43) for Newport. In addition, Newport cost significantly more than Marlboro ($t=4.85$,

$p<0.01$), which is consistent with results from previous studies.^{22,23,35} The advertised price was discounted in 19.8% of stores for Marlboro and in 24.7% for Newport.

Receipt and advertised prices (before sales tax) were identical in 77.7% of stores for Marlboro and in 78.1% for Newport (see Table 1). Pharmacies had the lowest concordance to \$0.01: 69.7% for Marlboro and 64.2% for Newport (see Table 1). As another measure of concordance between receipt and advertised prices, ICCs were at least 0.96, which suggests that 96% of the variation in price was attributable to differences between stores as opposed to differences within stores (see Table 1).

The mean difference in price (receipt minus advertised) was \$0.06 (SD=\$0.29) for Marlboro and \$0.02 (SD=\$0.23) for Newport. In the subset of 432 stores where receipt and advertised price were not identical, the mean absolute difference was \$0.46 (SD=0.43) for Marlboro and \$0.35 (SD=0.36) for Newport. For Marlboro, the discrepancy was greater when advertised price was discounted (eg, an absolute difference of \$0.13 on average, $p=0.04$, see Table 2). In addition, the discrepancy between receipt and advertised price was smaller in liquor stores, pharmacies, and supermarkets than in convenience stores (p -values <0.01). As shown in Table 2, neither discount nor store type was related to size of discrepancy between receipt and advertised price for Newport.

CONCLUSIONS

This study is the first we are aware of to validate a common source of cigarette prices in retail marketing surveillance and compliance research. The results confirm that advertised price of Marlboro and Newport can be measured reliably. Findings were consistent with the few previous studies that reported inter-rater reliability for Marlboro, Newport, and the lowest pack price advertised on store windows (for ICCs ranging from 0.72 to 1.00).^{19,23,25} Concordance of receipt price with advertised price was also high for both cigarette brands, indicating that observational measures of advertised price are valid substitutes for obtaining price by purchasing products. In stores where receipt and advertised prices were not concordant, the presence of a discount and store type were related to discrepant prices for Marlboro but not for Newport. For Marlboro, discrepancies between receipt and advertised price were significantly smaller in liquor stores, pharmacies and supermarkets compared to convenience stores. Studying where advertised and receipt price were not identical highlighted retail contexts that warrant additional training in future research. Data collectors should be vigilant when surveying convenience stores, which constitute approximately half of all tobacco retailers and where price discounts are prevalent.^{27,31,36} Use of standardized instruments, training materials and field practice are recommended to improve reliability.^{37,38} Future research should confirm that the same procedure could be used to obtain reliable data for price of other tobacco products. In addition, research should consider whether adequate reliability can be obtained from other types of data collectors, including adult and youth volunteers as well as mechanical turks coding photographs of retail advertising. Knowing whether such methods are as reliable as professional data collection would increase cost-efficiency and capacity to inform tobacco regulatory science.^{19,39}

Almost all advertised prices for Marlboro and Newport excluded sales tax, perhaps because this strategy is more appealing to price-sensitive consumers. With limited resources, coding whether tax is included and obtaining relevant local sales tax rates may be unnecessary.¹⁶ Sensitivity analyses could be conducted to confirm whether conclusions about compliance or differential prices by neighborhood demography are the same regardless of whether outcome measures include sales tax.

Strengths of this study include a large national sample and observations for the most popular brands of menthol and non-menthol cigarettes. However, the study was limited to single-pack prices for the leading premium brands, and therefore results may not generalize to discount brands or to volume pricing, such as cartons or multi-pack discounts.

A limitation of recording advertised price is that it captures a snapshot of price in a sample of stores on particular days. Indeed, concerns about temporal variation in price have motivated some studies to collect all observations of advertised prices within very few days.¹³ In this study, results from 160 stores visited twice within one to 7 weeks indicate that receipt price for premium-brand cigarettes was stable: ICCs were 0.83 for Marlboro and 0.85 for Newport. However, further research with contemporary data is needed to better document temporal stability and seasonal variation in prices for cigarettes and other tobacco products.

IMPLICATIONS FOR TOBACCO REGULATION

The tobacco industry spends the vast majority of annual marketing budget (90.4% of \$8.9 billion in 2015)⁴⁰ to lower prices for cigarettes, particularly in store neighborhoods where there are higher proportion of price-sensitive consumers, such as African Americans, low-income residents and youth.^{8,17,41} Thus, monitoring the price of tobacco products is recommended for tobacco control surveillance.^{9,11} This study demonstrates that advertised price can be a reliable and valid measure. Observational data about tobacco prices may be particularly helpful in jurisdictions where other sources of information, such as retail scanner data or self-reported purchase price from smokers, are inaccessible, cost prohibitive, or provided only at an aggregate market level. Validating observational measures of cigarette price is also important to refute tobacco industry criticisms about studies of compliance with state and local minimum price policies as well as the geography of price and promotion that inform target marketing strategies.

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Table 1

Concordance of Receipt and Advertised Cigarette Prices (Before Sales Tax): USA, June–October 2012

Store Type and Brand	Prices		Concordance	
	Receipt	Advertised	Identical	ICC
Convenience store				
Marlboro (N=522)	\$6.08 (1.21)	\$5.99 (1.23)	78.4%	0.960
Newport (N=557)	\$6.32 (1.21)	\$6.27 (1.23)	78.1%	0.989
Liquor store				
Marlboro (N=98)	\$6.45 (1.18)	\$6.44 (1.18)	81.6%	0.994
Newport (N=84)	\$6.70 (1.16)	\$6.70 (1.17)	84.5%	0.994
Pharmacy				
Marlboro (N=119)	\$5.93 (1.50)	\$5.94 (1.50)	69.7%	0.992
Newport (N=109)	\$6.57 (1.71)	\$6.62 (1.68)	64.2%	0.989
Supermarket				
Marlboro (N=175)	\$6.59 (1.54)	\$6.55 (1.56)	80.0%	0.991
Newport (N=163)	\$7.18 (1.70)	\$7.18 (1.70)	78.5%	0.992
Tobacco shop				
Marlboro (N=32)	\$5.95 (1.23)	\$5.96 (1.36)	78.1%	0.983
Newport (N=32)	\$6.39 (1.62)	\$6.40 (1.63)	98.3%	0.999
Warehouse				
Marlboro (N=23)	\$6.72 (1.71)	\$6.71 (1.68)	73.9%	0.989
Newport (N=16)	\$6.78 (0.92)	\$6.78 (0.92)	100.0%	1.000
Overall				
Marlboro (N=1004)	\$6.21 (1.36)	\$6.16 (1.38)	77.7%	0.989
Newport (N=967)	\$6.55 (1.43)	\$6.53 (1.44)	78.1%	0.989

Note. ICC=Intraclass correlation coefficient; higher values indicate greater concordance for receipt and advertised price within stores. The overall category includes "other" store types. The inter-rater reliability ICC was (N=144) 0.736 for Marlboro and (N=122) 0.874 for Newport.

Table 2

Association of Store Type and Price Discount with Receipt-Advertised Price Discordance: USA, June–October 2012

	Absolute Value of Price Difference (Receipt Minus Advertised)			
	Marlboro N=221		Newport N=221	
	Coefficient	p-value	Coefficient	p-value
Intercept	0.54	<0.001	0.37	<0.001
Store Type				
Convenience Stores	Reference	Reference	Reference	Reference
Liquor Stores	−0.31	0.005	−0.13	0.243
Pharmacies	−0.31	<0.001	−0.03	0.664
Supermarkets	−0.22	0.007	−0.07	0.341
Tobacco Stores	−0.18	0.269	−0.12	0.653
Warehouses	−0.20	0.245	NA, 100% concordance	
Advertised price was discounted	0.13	0.038	0.01	0.842

Note: Coefficients and p-values from ordinary least squares (OLS) regressions for absolute value of price difference regressed on store type and whether advertised price was discounted in the subsample of 432 stores that were not concordant to \$0.01.