Effect of Direct-to-Consumer Advertising on Asthma Medication Sales and Healthcare Use

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Abstract

Rationale: The United States is one of only two countries that permit direct-to-consumer advertising (DTCA) of prescription drugs, and many questions remain regarding its effects.

Objectives: To quantify the association between asthma-related DTCA, pharmacy sales, and healthcare use.

Methods: This was an ecological study from 2005 through 2009 using linked data from Nielsen (DTCA television ratings), the IMS Health National Prescription Audit (pharmacy sales), and the MarketScan Commercial Claims data (healthcare use) for 75 designated market areas in the United States. We used multilevel Poisson regression to model the relationship between DTCA and rates of prescriptions and use within and across designated market areas. Main outcome measures include (1) volume of total, new, and refilled prescriptions for advertised products based on pharmacy sales; (2) prescription claims for asthma medications; and asthma-related (3) emergency department use, (4)

hospitalizations, and (5) outpatient encounters among the commercially insured.

Measurements and Main Results: Four Food and Drug Administration–approved asthma medicines were advertised during the period examined: (1) fluticasone/salmeterol (Advair), (2) mometasone furoate (Asmanex), (3) montelukast (Singulair), and (4) budesonide/formoterol (Symbicort). After adjustment, each additional televised advertisement was associated with 2% (incident rate ratio, 1.02; 95% confidence interval, 1.01–1.03) higher pharmacy sales rate from 2005 through 2009, although this effect varied across the three consistently advertised therapies examined. Among the commercially insured, DTCA was positively and significantly associated with emergency room visits related to asthma (incident rate ratio, 1.02; 95% confidence interval, 1.01–1.04), but there was no relationship with hospitalizations or outpatient encounters.

Conclusions: Among this population, DTCA was associated with higher prescription sales and asthma-related emergency department use.

Keywords: direct-to-consumer advertising; asthma; healthcare use

The United States and New Zealand are the only countries in the world that permit direct-to-consumer advertising (DTCA) of prescription drugs (1). Prior to 1997, the bulk of DTCA for prescription drugs occurred through print media because of strict guidelines for television

advertisements (2, 3). In 1999, the Food and Drug Administration (FDA), which regulates the content of prescription drug advertising in the United States, allowed broadcast DTCA as part of the Federal Food, Drug, and Cosmetic Act (2–4). From 1998 to 2009, spending on DTCA quadrupled

from \$1.2 to \$4.7 billion per year (1, 5). The impact of DTCA on healthcare use has become the focus of intense debate between policy makers, the pharmaceutical industry, and medical professionals.

Proponents argue DTCA positively affects population health by increasing

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At a Glance Commentary

Scientific Knowledge on the

Subject: The United States is one of only two countries that permit direct-to-consumer advertising of prescription drugs, and many questions remain regarding its effects.

What This Study Adds to the

Field: In this study of household exposure to direct-to-consumer advertising for asthma medicines, we found positive and statistically significant associations between exposure to direct-to-consumer advertising, pharmacy sales, and rates of emergency department use.

awareness of medical conditions and promoting patient-provider communication, patients' medication knowledge, and adherence. Opponents of DTCA express concern regarding the quality of information that can be conveyed during a television commercial and overuse of healthcare services and prescription drugs (6, 7). Prior studies suggest that DTCA leads to increases in prescribing and spending for advertised drugs (8–10). DTCA also seems more likely to impact patient visits than physician drug choice and to primarily increase the overall market share of a therapeutic class rather than the market share of an individual product (11).

Despite several investigations regarding the effect of DTCA, many questions remain. For example, many studies of the effects of DTCA have used national-level pharmacy sales and advertising data; however, the intensity and impact of such advertising may vary across different geographic areas and commercial markets. Similarly, most studies have explored the effect of DTCA on prescription use, but fewer have examined how such advertising may impact nonprescription healthcare use, such as emergency department (ED) visits, hospitalizations, or outpatient encounters. We examined the association between DTCA, asthma medication sales, and asthma-related healthcare use by linking data capturing household exposure to DTCA to two separate datasets: the IMS Health National Prescription Audit

(pharmacy sales) and the MarketScan Commercial Claims database (prescription and nonprescription healthcare use). We focused on asthma because of its high prevalence and cost (12, 13). We hypothesized that DTCA exposure would be associated with increases in the market share for advertised drugs, expansion of the overall therapeutic class of advertised products, and increases in asthma-related healthcare use. Some of the results of these studies have been previously reported in abstract form (14).

Methods

Data

We used data from four main sources to conduct an ecological study of the effects of DTCA in the top 75 designated market areas (DMAs) in the United States from January 2005 through December 2009.

DTCA. First, we obtained information on monthly DTCA through television advertising ratings from Nielsen Media Research (Nielsen) for each DMA of interest. DMAs are regions typically centered on large cities, where the population receives the same television and radio offerings. DTCA is measured using gross ratings points, a standard metric for quantifying advertising intensity that reflects the product of the percentage of the target audience reached and the frequency of exposure. Thus, an advertisement that aired five times reaching 65% of the audience each time it aired would achieve 325 gross ratings points ($5 \times 65\%$). We summed gross ratings points for each drug of interest within the same DMA and month, and then divided this value by 100 to obtain the average number of monthly advertisement exposures per household in each DMA. Thus, a one-unit increase in advertising exposure in our regression models is equivalent to an average one additional advertisement exposure per household within the DMA.

Some of the medicines we examined were FDA-approved and advertised for more than one indication, such as Advair, which was advertised for both asthma and chronic obstructive pulmonary disease in more than half of the time. In our main analyses, we examined the advertising for the product regardless of the indication for which it was advertised, because our data

regarding pharmacy sales were not indication-specific and our commercial claims data provided limited means to identify the precise clinical indication for each product.

Pharmacy sales. We used the IMS Health National Prescription Audit to obtain monthly sales data for the products of interest within the top 75 DMAs. The National Prescription Audit collects prescription dispensing data from a national random sample of approximately 60,000 retail pharmacies, nongovernmental mail service pharmacy outlets, and long-term care pharmacies. Prescriptions from all payers, including private insurance, Medicare, Medicaid, and self-pay, are captured. Sampling weights are then applied to estimate national pharmacy claims (15). IMS categorizes claims into new prescriptions, which reflect the initial claim for a specific medicine, and refills, which reflect additional dispensing from an existing prescription. Our unit of analysis is doses dispensed, which represents the total number of asthma medicine dispensed in tablets (solids), micrograms (powders), or milliliters (liquids).

Commercial claims and prescriptions.

We used the Truven Health Analytics MarketScan Commercial Claims and Encounters database to quantify asthma-related prescription and nonprescription healthcare use. The MarketScan database includes individual-level clinical use, prescriptions, expenditures, and enrollment data across inpatient and outpatient settings paid for by employer-sponsored fee-for-service, fully capitated, or partially capitated plans. Claims from employees and their dependents as well as individuals and dependents receiving plans as part of early retirement packages and Consolidated Omnibus Budget Reconciliation Act are also included.

We included patients of all ages with any asthma-related diagnoses in any International Classification of Diseases-9 position during the study period (any asthma 493.xx, extrinsic asthma 493.0x, intrinsic asthma 493.1x, chronic obstructive asthma 493.2x, other forms of asthma 493.8x, asthma unspecified 493.9x). We used the same diagnosis codes for each of the three nonprescription healthcare use outcomes examined. We excluded patients with diagnoses related to emphysema, chronic obstructive

pulmonary disease, cystic fibrosis, and acute respiratory failure. We included all provider types when examining outpatient office visits, and we used all continuously enrolled individuals within the MarketScan database in each DMA of interest to derive a denominator for our analyses, allowing us to calculate rates of dispensing and healthcare service use for a fixed population. We matched advertising intensity with prescription dispensing and claims data based on the month in which they occurred in each DMA.

Contextual characteristics of DMAs.

We used the Health Resources and Services Administration's Area Resource File to derive the annual median age, median income, and physician density for each DMA of interest. The Area Resource File provides these annual county-level data on a variety of measures related to healthcare services by integrating data from organizations, such as the American Hospital Association, the American Medical Association, the American Osteopathic Association, the Bureau of the Census, and the Centers for Medicare and Medicaid Services. We used the Selected Metropolitan/Micropolitan Area Risk Trends of Behavioral Risk Factor Surveillance System to derive the annual asthma prevalence and smoking prevalence for each DMA. Similarly, we derived the annual number of insured individuals per DMA from the U.S. Census Bureau's Small Area Health Insurance Estimates. We then used these data to account for contextual features of DMAs that might confound the primary associations of interest.

Analysis

We linked the advertising exposure data to two separate datasets (pharmacy sales and commercial claims) and analyzed these two datasets separately. Next, we used visual displays to examine trends in DTCA for asthma medications and monthly pharmacy sales. Then, we examined the correlations between DTCA and these sales. We then used Poisson regression models to examine the association between DTCA and pharmacy sales while accounting for nesting within and across DMAs (16). In our time-adjusted and fully adjusted models, we focused on drugs that were consistently advertised throughout the study period (Advair, Singulair,

Symbicort). The time-adjusted model of the different outcomes of interest included month as a categorical variable along with the exposure (DTCA). The fully adjusted models accounted for month as a categorical variable in combination with median age, median income, asthma prevalence, smoking prevalence, physician density, and population insured. We used the Area Resource File-derived total population as our denominator when examining pharmacy sales.

We conducted similar Poisson regressions to examine the association between DTCA and drug and nondrug healthcare use using the MarketScan Commercial Claims database. To do so, we defined our outcomes of interest as monthly prescription claims for asthma medications and asthma-related ED use, hospitalizations, and outpatient encounters, and we defined our denominator as the number of continuously enrolled patients within the MarketScan database.

Sensitivity analyses. We conducted a variety of analyses to examine the sensitivity of our results to different analytic approaches. First, we compared our results when examining asthma-specific advertising versus advertising of the products of interest for asthma and other FDA-approved indications. Second, we examined whether our findings using pharmacy claims varied when focusing on new, refilled, or mail-order prescriptions. Third, because the effects of DTCA may not be immediate, we also tested the effects of DTCA on pharmacy sales using 1- and 2-month lags. In all cases, the substantive results and interpretation of these analyses were similar to our primary findings and are not reported herein.

Results

Trends in DTCA and Asthma Medication Sales

Four asthma medications were advertised directly to consumers during the time period of interest: (1) fluticasone/salmeterol (Advair), (2) montelukast (Singulair), (3) budesonide/formoterol (Symbicort), and (4) mometasone furoate (Asmanex). DTCA for these medicines fluctuated substantially over time with most advertising campaigns airing in all 75 DMAs simultaneously. In addition to

asthma, fluticasone/salmeterol, montelukast, and budesonide/formoterol were advertised for chronic obstructive pulmonary disease and seasonal allergies. Of the four asthma medications with any advertising from 2005 through 2009, only Advair and Singulair were available and advertised consistently during the time period with magnitudes varying across DMAs (see Figure E1 in the online supplement). DTCA for Symbicort was first observed in March 2008, despite being available in the United States since June 2007.

Pharmacy sales for Advair, Singulair, Symbicort, and Asmanex steadily increased from 2005 through 2009 within the top 75 DMAs (see Figure E2). The average rate of doses dispensed per 100,000 insured individuals within each DMA increased from 392,000 per DMA in January 2005 to 483,000 in December 2009. Dispensing rates for Symbicort, which entered the market roughly 1 year after its approval, varied. However, dispensing for Advair and Singulair, which were consistently available and captured most of the market, remained stable.

Correlation and Multivariate Association between DTCA and Pharmacy Sales

DTCA for Advair, Singulair, Symbicort, and Asmanex was moderately correlated with new, refilled, and total dispensing rates of those drugs (Table 1). Correlation coefficients ranged from $r = 0.46$ ($P < 0.001$) for product refills to $r = 0.51$ ($P < 0.001$) for new fills. Symbicort accounted for a substantial part of the observed correlation between DTCA and dispensing for all asthma drugs; DTCA and new prescriptions of Symbicort were strongly correlated ($r = 0.72$; $P < 0.001$).

Table 2 depicts the univariate and multivariate associations of interest between total DTCA for asthma drugs with consistent advertising (Advair, Singulair, Symbicort) and pharmacy sales. In unadjusted analyses, an average of one additional advertisement exposure per household within a DMA was associated with a 5% (incidence rate ratio [IRR], 1.05; 95% confidence interval [CI], 1.03–1.06) higher rate of total prescriptions dispensed among insured individuals residing within the DMA that month. After adjusting for DMA

Table 1. Correlation between Direct-to-Consumer Advertising and Pharmacy Sales

	Advertising		Medication Sales		
	Asthma-Only Indication	All Indications*	New Sales	Refill Sales	All Sales
Advertising for asthma indications	1.00				
Advertising for any indication*	0.67	1.00			
New sales	0.28	0.51	1.00		
Refill sales	0.21	0.46	0.95	1.00	
Total sales	0.24	0.48	0.98	0.99	1.00

Data from Nielsen Media Research (36) and the IMS Health National Prescription Audit, 2005–2009 (37).

*Includes asthma, allergy, asthma and chronic obstructive pulmonary disease, asthma and allergy, asthma and unknown.

characteristics, each additional average advertisement exposure per household within a DMA was associated with a 2% higher rate of total prescriptions dispensed within the population of interest (IRR, 1.02; 95% CI, 1.01–1.03).

Table 3 presents the association between DTCA for specific asthma medications and pharmacy sales of each product. This association was strongest for Singulair (IRR, 1.11; 95% CI, 1.06–1.15) and Symbicort (IRR, 1.09; 95% CI, 1.05–1.14). After adjusting for DMA characteristics, rate ratios changed from 11 to 5% for Singulair and from 9 to 6% for Symbicort (Table 3).

We found no discernible effect of DTCA for one product on the use of a competitor product. For example, in adjusted analyses, each additional 10 average advertisement exposures for Symbicort per household within a DMA were not associated with changes in the rate of total dispensed Advair prescriptions dispensed (IRR, 1.06; 95% CI, 0.80–1.39). Similarly, there was no statistically significant evidence that DTCA for Advair

was associated with changes in Symbicort prescriptions (IRR, 1.08; 95% CI, 0.87–1.33).

Association between DTCA and Outcomes among Commercially Insured

Table 4 depicts the association between DTCA and prescription drug use among the commercially insured. After adjustment for potentially confounding covariates, each additional average advertisement exposure per DMA household was associated with a 2% higher rate of Singulair claims in the concurrent month. There were no statistically significant associations between DTCA for the other products examined and pharmacy claims at the individual and therapeutic class-level among this population of commercially insured patients.

Table 5 characterizes the association between DTCA and nonprescription drug healthcare use among this population of commercially insured. After adjustment for potentially confounding covariates,

each additional average advertisement exposure per DMA household was associated a 2% higher rate of ED visits (IRR, 1.02; 95% CI, 1.01–1.04) in the concurrent month, whereas there was no statistically significant association between DTCA exposure and the volume of outpatient office visits or asthma-related hospitalizations.

Discussion

In this study of household exposure to DTCA for asthma medicines, we found positive and statistically significant associations between exposure to such advertising, pharmacy sales, and prescription drug claims for the advertised products among the overall U.S. population and the commercially insured. DTCA was not associated with increases in prescription claims for broader therapeutic classes representing both advertised and nonadvertised products (therapeutic class size), but was associated with modestly higher rates of ED use. These results were

Table 2. Bivariate and Multivariate Association between Direct-to-Consumer Advertising and Pharmacy Sales*

	Total Prescriptions		New Prescriptions		Refilled Prescriptions		Total and Mail Order Prescriptions	
	Crude [†]	Adjusted [‡]	Crude [†]	Adjusted [‡]	Crude [†]	Adjusted [‡]	Crude [†]	Adjusted [‡]
Advertising	1.05 (1.03–1.06)	1.02 (1.01–1.03)	1.04 (1.02–1.06)	1.02 (1.01–1.04)	1.05 (1.03–1.07)	1.02 (1.01–1.03)	1.05 (1.03–1.07)	1.02 (1.01–1.04)
Median age	—	1.01 (0.99–1.02)	—	0.99 (0.98–1.01)	—	1.02 (1.00–1.03)	—	1.01 (0.99–1.02)
Median income	—	1.00 (1.00–1.00)	—	1.00 (1.00–1.00)	—	1.00 (1.00–1.00)	—	1.00 (1.00–1.00)
Asthma prevalence	—	1.00 (0.98–1.02)	—	0.99 (0.97–1.00)	—	1.02 (1.00–1.04)	—	1.00 (0.99–1.02)
Smoking prevalence	—	1.03 (1.02–1.04)	—	1.03 (1.02–1.04)	—	1.03 (1.01–1.04)	—	1.03 (1.02–1.04)
Physician density	—	1.00 (1.00–1.00)	—	1.00 (1.00–1.00)	—	1.00 (1.00–1.00)	—	1.00 (1.00–1.00)
Population insured	—	1.00 (1.00–1.00)	—	1.00 (1.00–1.00)	—	1.00 (1.00–1.00)	—	1.00 (1.00–1.00)

Values represent incidence rate ratio (95% confidence interval).

Data from Nielsen Media Research (36) and the IMS Health National Prescription Audit, 2005–2009 (37).

*Includes fluticasone/salmeterol (Advair), montelukast (Singulair), and budesonide/formoterol (Symbicort).

[†]Predictors include advertising as average views per household and time (months as categorical variable 0–60).

[‡]Predictors include advertising ratings for any indication per 100 views, months as categorical variable 0–60, median age, median income, asthma prevalence, smoking prevalence, physician density, and population insured.

Table 3. Bivariate and Multivariate Association between Direct-to-Consumer Advertising for Specific Asthma Medications and Pharmacy Sales of Each Product

	Total Prescriptions		New Prescriptions		Refilled Prescriptions		Total and Mail Order Prescriptions	
	Crude*	Adjusted†	Crude*	Adjusted†	Crude*	Adjusted†	Crude*	Adjusted†
Advair	1.04 (1.02–1.06)	1.01 (0.99–1.02)	1.04 (1.02–1.06)	1.01 (1.00–1.03)	1.04 (1.02–1.07)	1.00 (0.99–1.02)	1.05 (1.02–1.07)	1.01 (0.99–1.03)
Singulair	1.11 (1.06–1.15)	1.05 (1.03–1.07)	1.09 (1.04–1.15)	1.06 (1.03–1.09)	1.12 (1.08–1.16)	1.05 (1.03–1.07)	1.11 (1.06–1.15)	1.05 (1.03–1.07)
Symbicort	1.09 (1.05–1.14)	1.06 (1.03–1.09)	1.10 (1.05–1.14)	1.07 (1.04–1.11)	1.12 (1.05–1.20)	1.05 (1.00–1.10)	1.11 (1.06–1.16)	1.08 (1.04–1.11)

Values represent incidence rate ratio (95% confidence interval).

Data from Nielsen Media Research (36) and the IMS Health National Prescription Audit, 2005–2009 (37).

*Predictors include advertising as average views per household and time (months as categorical variable 0–60).

†Predictors include advertising ratings for any indication per 100 views, months as categorical variable 0–60, median age, median income, asthma prevalence, smoking prevalence, physician density, and population insured.

robust to a number of sensitivity analyses, including models that incorporated contextual features of DMAs, advertising for other FDA-approved indications, stratified outcomes by new versus refilled prescriptions, and varied the lag periods examined.

Our study adds to a growing evidence base regarding the impact of DTCA. Although there is considerable variation in the results from prior studies based on differences in analytic approach and definitions of exposures and outcomes, the preponderance of evidence suggests that DTCA is associated with increases in consumer demand (17), physician diagnoses (9), the number of prescriptions (3, 8–10), prescription sales (10), therapeutic class size (18), and physician visits (19, 20). Despite the insights from these prior studies, most examined DTCA exposure based on national expenditures, and many examined a single aggregated outcome, such as prescription volume alone. In contrast, we used a unique measure of DTCA exposure, examined both prescription and nonprescription healthcare use, combined data from

pharmacy audits and administrative claims from a large commercially insured population, and adjusted for a variety of potentially important explanatory covariates in our models.

Although our study was not designed to characterize the mechanism explaining the associations between DTCA and ED visits for asthma, DTCA may increase patient demand for medicines and patient awareness of potentially life-threatening asthma symptoms requiring emergency care (17, 21, 22). Asthma contributed to 1.8 million ED visits in 2010 (23) and is a leading cause of such visits and hospitalizations among children (24). Because the ED is an important safety net and source of primary care for many patients with this common chronic disease (25, 26), increased disease awareness from consumer-directed advertising may result in increased ED use. Such a demand-effect may not necessarily translate into a commensurate increase in office visits in ambulatory practice, which may serve as less of a safety net, nor hospitalizations, which are restricted to only a subset of all patients with asthma that are more acutely and severely ill.

The magnitude of effects that we document should be interpreted in the context of how we defined our advertising exposure, as well as the broader evidence base regarding the effects of advertising for prescription drugs. The unit of exposure in these analyses represents an average of one additional advertisement viewing per household, and our outcome also reflects a population-level average rate of prescription and healthcare use. The magnitude of effect that we describe is difficult to compare with that derived from other studies, because most ecological studies quantifying the impact of DTCA have used national advertising expenditures, rather than a measure of exposure, such as Nielsen household viewing ratings that indicate advertising frequency. Although not directly comparable, the effect we describe seems larger than that in a previous study examining the effect of advertisement exposures on the prevalence of tobacco use (27). In another study that quantified the marginal effect of a sales representative visit for a given month, each visit was associated with a positive and statistically

Table 4. Bivariate and Multivariate Association between Direct-to-Consumer Advertising and Prescription Drug Claims among Commercially Insured

	Individual Products			Therapeutic Class Inhaled Steroid Combinations (Advair and Symbicort)
	Advair	Singulair	Symbicort	
Crude*	1.01 (0.99–1.02)	1.03 (1.02–1.05)	1.02 (1.00–1.04)	1.01 (0.99–1.02)
Adjusted†	1.00 (0.98–1.01)	1.02 (1.01–1.03)	1.01 (0.99–1.02)	1.00 (0.99–1.01)

Values represent incidence rate ratio (95% confidence interval) using no lag.

Data from Nielsen Media Research (36) and the Truven MarketScan Commercial Claims Database, 2005–2009 (38).

*Predictors include advertising as average views per household and time (months as categorical variable 0–60).

†Month as category and the following designated market area-level items from the Area Resource File: median age, median income, prevalence of asthma, prevalence of smoking, and number of healthcare providers.

Table 5. Crude and Adjusted Multivariate Association between Direct-to-Consumer Advertising and Healthcare Use among Commercially Insured

	Outpatient Visits		Emergency Department Visits		Hospitalizations	
	Crude*	Adjusted	Crude*	Adjusted	Crude*	Adjusted
Advertising Time	1.00 (0.97–1.02)	1.00 (0.98–1.01)	1.03 (1.01–1.05)	1.02 (1.01–1.04)	0.99 (0.97–1.01)	0.99 (0.98–1.01)
Median age	—	Type III $P=0.087$	—	Type III $P=0.092$	—	Type III $P=0.102$
Median income	—	1.01 (0.97–1.04)	—	0.99 (0.97–1.01)	—	0.98 (0.96–1.01)
Asthma prevalence	—	1.00 (1.00–1.00)	—	1.00 (1.00–1.00)	—	1.00 (1.00–1.00)
Smoking prevalence	—	1.05 (1.02–1.07)	—	1.02 (0.99–1.06)	—	1.03 (0.99–1.06)
Healthcare provider density	—	1.00 (0.98–1.02)	—	1.02 (1.01–1.04)	—	1.01 (0.99–1.03)
	—	1.00 (1.00–1.00)	—	1.00 (1.00–1.00)	—	1.00 (1.00–1.00)

Values represent incidence rate ratio (95% confidence interval) using no lag.

Data from Nielsen Media Research (36) and the Truven MarketScan Commercial Claims Database, 2005–2009 (38).

*Advertising represents average views per household, time is months 0–60.

significant effect on the number of prescriptions written by the physician; however, the effects of detailing were noted to be modest (28).

Our analysis was not designed to distinguish between clinically appropriate use and overuse of the medicines examined, because data that would allow for such inferences (e.g., detailed information regarding patients' histories, diagnoses, comorbid conditions, treatment failures, and preferences) were not available to us. Both underuse and overuse of therapies, such as those that we examined, have been previously documented (12, 29), and as with provider-targeted pharmaceutical advertising, the evidence regarding DTCA's impact is mixed (30). Despite this, the preponderance of evidence suggests that pharmaceutical advertising is associated with increased prescribing frequency, higher costs, or lower quality as assessed by concordance with clinical guidelines (7, 31).

Our analysis has several limitations. First, DTCA represents a small

proportion of all pharmaceutical marketing and promotion, and in some cases may be correlated with provider-targeted outreach, such as office-based detailing and the distribution of free samples. Despite this, sensitivity analyses varying the inclusion of provider-targeted promotion yielded substantively similar findings, in two of the three products studied we did not find such correlations, and any such correlation present would bias toward the null and thus lead us to underestimate the true strength of the associations examined. Second, commercially insured individuals may respond differently to DTCA than the general population. Third, we limited our analyses to televised DTCA. Although approximately two-thirds of all DTCA is televised (32) and such advertising may be more effective than other forms of DTCA (33, 34), prescription drugs may also be advertised directly to consumers by radio, the Internet, or other marketing and promotional channels (35). Finally, televised pharmaceutical advertisements

vary greatly in content (i.e., graphics, animation, celebrity endorsements, warnings, side effects), and our analyses were not designed to discern the differential impact of these components on sales.

Conclusions

It has been more than a decade since the FDA clarified its rules governing DTCA, which led not only to a large increase in the advertising of prescription drugs directly to consumers, but also to considerable criticism of this practice. Since that time, an evolving evidence base has developed to inform policy makers regarding the potential benefits and harms that may result as a consequence. Our study adds to this literature, and using household viewing data on specific prescription drugs, demonstrates the association between DTCA and both prescription and nonprescription asthma-related healthcare use. ■

Author disclosures are available with the text of this article at www.atsjournals.org.

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