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## The effects of direct-to-consumer advertising on medication use among Medicaid children with asthma

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### ABSTRACT

Asthma medication adherence is low, particularly among Medicaid enrollees. There has been much debate on the impact of direct-to-consumer advertising (DTCA) on health care use, but the impact on medication use among children with asthma has been unexamined. The study sample included 180,584 children between the ages of 5 and 18 with an asthma diagnosis from a combined dataset of Medicaid Analytic eExtract and national advertising data. We found that DTCA expenditure during the study period was significantly associated with an increase in asthma medication use. However, the effectiveness declined after a certain level.

### KEYWORDS

Adherence; asthma; direct-to-consumer advertising; Medicaid; medication

## Introduction

Asthma is a prevalent chronic disease that results in high mortality and morbidity rates, particularly among children (Akinbami, Moorman, Garbe, & Sondik, 2009; Akinbami, Moorman, & Liu, 2011; Bloom, Cohen, & Freeman, 2010; Masoli, Fabian, Holt, Beasley, & Global Initiative for Asthma, 2004). It is responsible for a large proportion of emergency department visits and hospitalizations among children, who have the highest rate of asthma. Asthma accounted for 3,404 deaths, 439,400 hospitalizations, and 1.8 million emergency department visits in 2010 (Akinbami et al., 2012; Coffey, Ho, Adamson, Matthews, & Sewell, 2006). The economic and social impact is far reaching with Medicaid bearing a large burden (Pleis, Lucas, & Ward, 2009).

Although the disease is incurable, a wide range of effective treatment options is available for individuals with asthma. A key component of controlling this chronic disease is appropriate monitoring and use of medication (National Heart, Lung, and Blood Institute Asthma Education and Prevention Program,

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2007). Patients' adherence to asthma medication improves health outcomes. Yet, according to previous studies, adherence rates remain low among all groups, especially children on Medicaid (Bender, 2002; Bratton, Roberts, Watson, & Cabana, 2002; Butz et al., 2006; Conn et al., 2005; David, 2004; Feehan, 2015; Finkelstein et al., 2000; Finkelstein, Lozano, Farber, Miroshnik, & Lieu, 2002; Gillisen, 2007; Piecoro, Potoski, Talbert, & Doherty, 2001).

There are a variety of factors contributing to patient nonadherence (Camargo, Ramachandran, Ryskina, Lewis, & Legorreta, 2007; Conn et al., 2005; David, 2004; Farber et al., 2003; Ivanova et al., 2008; Ponienman, Wisnivesky, Leventhal, Musumeci-Szabó, & Halm, 2009; Yoos, Kitzman, & McMullan, 2003). However, there is some evidence that direct-to-consumer advertising (DTCA) affects medication use. Since the Food and Drug Administration eased restrictions of prescription drug advertising to consumers in 1997, the effects have been widely debated. Critics have argued that DTCA is harmful as it may impair the physician–patient relationship by placing pressure on physicians to comply with patients' requests of advertised medication, increasing patient skepticism of diagnoses, and resulting in overprescribing and “medicalization” of normal human experiences (Kravitz et al., 2005; Mintzes, 2002; Morris, Gadson, & Burroughs, 2007). Proponents of DTCA on the other hand see many benefits such as increased awareness of diseases and appropriate treatments, patient involvement in care, and increased medication use (Allison-Ottey, Ruffin, Allison, & Ottey, 2003; Deshpande, Menon, & Perri, 2004; Murray, Lo, Pollack, Donelan, & Lee, 2003, 2004).

The literature on DTCA and its relation to health care use is sparse. Prior studies have shown evidence that DTCA may increase health awareness and doctor's visits, may result in changes in prescribing, and can have an effect on health behavior (Adeoye & Bozic, 2007; Allison-Ottey et al., 2003; Calfee, 2002; Morris et al., 2007). Several studies by Bradford and colleagues have shown that DTCA affects prescribing and health behavior. In one study they found that at high levels of both national and local DTCA spending on three major statin medications, patients were more likely to attain low-density lipoprotein cholesterol blood-level goals (Bradford, Kleit, Nietert, & Ornstein, 2006). In another study Bradford, Kleit, Nietert, and Ornstein (2006) examined the effects of DTCA on prescribing behavior for osteoarthritis patients for Vioxx and Celebrex, and found a significant positive effect of DTCA on the prescribing rates of Vioxx (Bradford, Kleit, Nietert, Steyer, et al., 2006).

Additional studies show an association between DTCA and depression therapy and (Donohue, Berndt, Rosenthal, Epstein, & Frank, 2004; Hansen, Chen, Gaynes, & Maciejewski, 2010). Donohue and colleagues reported that there was an increase in the initiation of treatment therapy for depression during periods of high DTCA spending for a class of antidepressant drugs, and a small increase in the number of patients who received antidepressant medication for at least four months. Brand-specific DTCA and physician

detailing had no effect on adherence of antidepressants (Donohue et al., 2004). In the study by Hansen and colleagues, they reported that patients who received antidepressants during periods of promotional spending directed towards physicians (detailing) and phases of higher DTCA spending were more likely to be adherent in the long term (Hansen et al., 2010). A study by Wosinska also found that DTCA had a small effect on adherence to cholesterol-reducing drugs (Wosinska, 2005). Similar to the study by Donohue and colleagues there were no brand-specific effect.

To date however, the effects of DTCA on asthma medication adherence, in particular on the Medicaid population, have not been studied. In this article we studied this issue by examining a popular class of prescription drugs: asthma long-term medication such as Flovent and Singulair, which accounted for two of the most heavily, advertised drugs during the study period 1999–2002. In particular, we examined the impact of DTCA spending of a class of asthma medication drugs on adherence among Medicaid children, a group that has not been previously studied. We also examined the effect of DTCA spending on short-term rescue medication, albuterol.

## Data and methods

This study utilized data from the Medicaid Analytic eXtract (MAX) dataset combined with data of advertising expenditures on long-term asthma prescription drugs from 1999–2002, the years of available Medicaid claims data. We assessed the impact of DTCA spending on asthma medication use for children covered by Medicaid from 1999–2002.

### Data

The MAX data provide Medicaid claims reports on health care utilization of children in all 50 states, and includes inpatient file, prescription drug file, and the personal summary file. These files provide demographic data such as date of birth, gender and race, health care utilization summary, and prescription drug claims. We focused on the six long-term (controller) asthma prescription drugs which were included in the advertising data set: Flovent (Fluticasone), Serevent (Salmeterol), Singulair (Montelukast), Advair (Fluticasone and Salmeterol), Accolate (Zafirlukast), and Qvar (Beclomethasone). We also studied the short-term (rescue) medication, albuterol. The Medicaid data were merged with advertising data using county identifiers.

The advertising data include national and local advertising spending reported in thousands of dollars on long-term asthma medications and the number of times the ads appeared in major metropolitan cities. The dataset provides information on which products were advertised and how many dollars were spent on advertising at each month. The data included advertising

spending for the major metropolitan areas, the top local media markets, in the United States. We selected asthma medications that were advertised more frequently through the study period. The drugs included Advair (Fluticasone and Salmeterol), Flovent (Fluticasone), Serevent (Salmeterol), and Singulair (Montelukast). As a measure of DTCA spending, the aggregated DTCA spending was summed across quarters by counties. Advertisements at the national level, along with radio, Internet, and newspaper advertisements, were excluded from the sample. The local television advertisements were included since they contained information at the county level.

The advertising data was obtained from Competitive Media Reporting, Inc., a market research company which collects data on advertising spending of all products, including pharmaceuticals in the United States and internationally. This data set has been used in several studies on DTCA (Bradford, Kleit, Nietert, & Ornstein, 2006; Bradford, Kleit, Nietert, Steyer, et al., 2006; Donohue et al., 2004; Wosinska, 2005). The use of these data was approved by the UAB Institutional Review Board and by the Centers for Medicare and Medicaid Services Privacy Board.

### **Sample**

A sample of Medicaid-enrolled children between the ages of 5 and 18 who had an asthma diagnosis based on ICD-9 493.xx codes at any time during the study period was extracted from the MAX dataset. We excluded children under the age of 5 from the sample since asthma is difficult to diagnose in that age group according to the National Heart, Lung, and Blood Institute Asthma Education and Prevention Program (2007). There are no reliable or validated measures for asthma symptoms in this age group (Knorr et al., 2001). Additionally, asthma therapies such as inhaled agents required for preschool children are difficult to administer (Knorr et al., 2001). Asthma diagnosis was defined based on three of four of the Healthcare Effectiveness Data and Information Set (HEDIS) criteria for persistent asthma: (a) at least one emergency department visit with asthma as the principal diagnosis, (b) at least one hospital admission with asthma as the principal diagnosis, or (c) at least four ambulatory visits with asthma as the principal diagnosis (Berger et al., 2004). Given the correlation with the primary outcome of interest, the HEDIS medication use criterion of at least four asthma medication dispensing events was not used in this study. Children not residing in counties with DTCA advertising were excluded from the sample.

The final Medicaid sample included 180,584 children between the ages of 5 and 18. There were 44 states including the District of Columbia and 496 counties in which there were children with an asthma diagnosis. Montana, Wyoming, North Dakota, South Dakota, Vermont, Idaho, and Alaska were excluded from the sample because they had no reported DTCA of asthma medication during the study period.

## Variables

The dependent variable in the study is asthma medication use (1 = yes, 0 = no). Asthma medication use includes both short-term asthma rescue medication (albuterol) and long-term asthma controller medication to prevent asthma attacks. It is measured by examining filled claims for all prescription asthma medications. We examined the impact of DTCA on both long-term medication and rescue medication combined and separately.

The key independent variable of interest is DTCA. It is defined as expenditures on local advertising for asthma controller medication that is directed to the patient. We measured DTCA as prescription spending per quarter by county. A squared term for DTCA spending was also created to examine the nonlinear effects of DTCA. Covariates race, age, and gender were included to control for predisposing factors that may influence medication use according to the Andersen model (Andersen, 1995), which suggests that external and internal factors affect the use of health care. A study by Yang et al. (2010) suggested that DTCA provides information that may change beliefs and attitudes about medical conditions and treatment therapy. The majority of the children in the sample were non-Hispanic Blacks and non-Hispanic Whites. There was not a substantial percentage of the other races hence we used the race classification as White, Black, and other. Age is a continuous variable and is classified as age at baseline. The data were structured as repeated observations for each child in each quarter.

## Statistical models

Three models were estimated to determine the effect of DTCA on medication use: (a) Medicaid children on any asthma medication, (b) Medicaid children on asthma-controller medication, and (c) Medicaid children on asthma rescue medication. The panel variable is the Medicaid children's identification number and the time variable is quarter. This was a balanced panel dataset containing observations on multiple individuals who had measures in every quarter during the study period. The individuals are observed over 16 quarters in the 4-year study period, 1999–2002. All analyses were performed using version 10 of STATA. The models were estimated using xtlogit with a generalized estimating equation model population-averaged model. This effectively controlled for time-invariant variables and omitted variable bias. Odds ratios were included and marginal effects were then obtained to determine the marginal impact that DTCA has on medication use.

## Results

The descriptive statistics are presented in [Table 1](#). A total of 180,584 children between the ages of 5 and 18 were included in sample. The average age of the

**Table 1.** Sample characteristics of medicaid children with asthma ( $N = 180,584$ ).

| Variables                                               | <i>M</i> | %    |
|---------------------------------------------------------|----------|------|
| Demographics                                            |          |      |
| White                                                   |          | 43.9 |
| Black                                                   |          | 32.6 |
| Other                                                   |          | 23.3 |
| Male                                                    |          | 56.5 |
| Age (years)                                             | 9.1      |      |
| Medication utilization                                  |          |      |
| Short-term rescue drugs                                 |          | 35.5 |
| Controller drugs                                        |          | 28.7 |
| DTCA spending                                           |          |      |
| Average quarterly advertising expenditures <sup>a</sup> | 2,900    |      |

Note. <sup>a</sup>Advertising expenditures are in thousands of dollars by county of residence per quarter.

Medicaid-enrolled children in the sample was 9 years. Males (56.5%) accounted for a larger proportion of the sample compared to females. The study included a higher percentage of Whites (43.9%) compared to Blacks (32.6%). Of the sample, 35.5% used controller medication and 28.7% used rescue medication. The average spending per quarter per county was \$2,900 dollars.

Table 2 presents results from our regression models using the entire sample of patients who used albuterol (rescue medication) or controller asthma medication. The use of all asthma medication is likely to increase as DTCA spending increases among Medicaid-enrolled children with both controller medication and rescue medication ( $OR = 1.56$ ,  $p < .001$ ), among children with only controller medication ( $OR = 1.29$ ,  $p < .001$ ) and among children with only rescue medication ( $OR = 3.60$ ,  $p < .001$ ). However, as DTCA spending increases, use of all asthma medication is likely to decrease ( $OR = 0.69$ ,  $p < .001$ ) as well as controller medication ( $OR = 0.83$ ,  $p = .005$ ), and rescue medication ( $OR = 0.28$ ,  $p < .001$ ). Both black and white children enrolled in Medicaid during the study period were less likely to use both asthma controller and rescue medication combined ( $OR = 0.91$ ,  $p < .001$  and  $OR = 0.98$ ,  $p < .001$ , respectively). When we examined use of only controller medication, Black and White children are less likely to use the medication ( $OR = 0.89$ ,  $p < .001$  and  $OR = 0.96$ ,  $p < .001$ , respectively). However, rescue medication drug use was

**Table 2.** Predicting asthma prescription medication use.

| Variables                  | All prescription drugs |              | Controller drugs |              | Rescue drugs |              |
|----------------------------|------------------------|--------------|------------------|--------------|--------------|--------------|
|                            | <i>OR</i>              | 95% CI       | <i>OR</i>        | 95% CI       | <i>OR</i>    | 95% CI       |
| DTCA spending              | 1.56***                | [1.40, 1.74] | 1.29***          | [1.14–1.47]  | 3.60***      | [2.63–4.93]  |
| DTCA spending <sup>2</sup> | 0.69***                | [0.61, 0.76] | 0.83***          | [0.73, 0.94] | 0.28***      | [0.19, 0.39] |
| Black                      | 0.91***                | [0.89, 0.92] | 0.89***          | [0.87, 0.91] | 1.02         | [0.97, 1.08] |
| White                      | 0.98***                | [0.96, 0.99] | 0.96***          | [0.94, 0.98] | 1.08**       | [1.03, 1.13] |
| Age                        | 0.96***                | [0.95, 0.96] | 0.99***          | [0.98, 0.99] | 0.76***      | [0.76, 0.77] |
| Male                       | 1.03***                | [1.02, 1.05] | 1.04***          | [1.03, 1.06] | 0.99         | [0.96, 1.04] |

Note. \*\* $p \leq .05$ ; \*\*\* $p \leq .001$ .

**Table 3.** Marginal effects of DTCA on asthma medication use.

|               | All prescription drugs | Controller drugs | Rescue drugs |
|---------------|------------------------|------------------|--------------|
| DTCA spending | .009***                | .004***          | .004***      |

Note. \*\*\* $p \leq .001$ .

more likely among White Medicaid-enrolled children ( $OR = 1.08$ ,  $p = .003$ ). Younger children are less likely to use both controller medication and rescue medication combined ( $OR = 0.96$ ,  $p < .001$ ), controller medication ( $OR = 0.99$ ,  $p < .001$ ), and rescue medication ( $OR = 0.76$ ,  $p < .001$ ). Male children enrolled in Medicaid are more likely to use both controller medication and rescue medication combined and rescue medication ( $OR = 1.03$ ,  $p < .001$  and  $OR = 1.04$ ,  $p < .001$ , respectively). Table 3 reflects the marginal effects of DTCA spending on asthma medication use. A \$100,000 increase in DTCA expenditure is associated with a .9% increase in the use of all prescription medications ( $p < .001$ ), .4% increase in the use of asthma controller medication and rescue medication separately ( $p < .001$ ).

## Discussion

Asthma affects millions of children in the United States (Akinbami et al., 2012; Coffey, Ho, Adamson, Matthews, & Sewell, 2006). There is low adherence to the guidelines, particularly among Medicaid children (Bender, 2002; Bratton et al., 2002; Butz et al., 2006; Conn et al., 2005; David, 2004; Finkelstein et al., 2000; Finkelstein et al., 2002; Gillisen, 2007; Piccoro et al., 2001), the focus of this study. DTCA is controversial with argument against and arguments in favor of it (Allison-Ottey et al., 2003; Kravitz et al., 2005; Mintzes, 2002; Morris et al., 2007). One of the chief arguments in support of DTCA is that it has some benefits to society as it increases the number individuals who seek care for chronic conditions and can ultimately influence behavior.

The primary goal of this study was to examine the association between DTCA and asthma medication use. The results from this study suggest that DTCA spending may be associated with a greater likelihood of using both long- and short-term asthma medication combined and individually. This is supported by previous studies indicating that DTCA has an effect on medication use and prescribing rates (Bradford, Kleit, Nietert, Steyer, et al., 2006). Of interest is the use of controller medication—particularly inhaled corticosteroid, which is the cornerstone treatment for asthma (National Heart, Lung, and Blood Institute Asthma Education and Prevention Program, 2007). In this study, the controller asthma medications were examined as a class of drugs that included some inhaled corticosteroids. The overall findings on the class of controller drugs in the study is supported by previous findings on the effect of DTCA on increased prescribing rate among a class of drugs rather than individual drugs (Bradford, Kleit, Nietert, & Ornstein, 2006).

Additionally, evidence of the impact of DTCA on controller medication is supported by studies that link DTCA and adherence to antidepressant drugs (Donohue et al., 2004; Hansen et al., 2010). Additionally, the findings show a greater impact of DTCA on asthma medication use up to a certain level. However, at higher spending the effect begins to decrease. This is supported by previous studies (Bradford, Kleit, Nietert, & Ornstein, 2006; Bradford Kleit, Nietert, Steyer, et al., 2006).

The results of the impact of the race and gender are consistent with previous findings that Blacks are less likely to be adherent to asthma medication (Finkelstein et al., 2002). However, the slight differences between Blacks and Whites may be due to the fact that these are Medicaid-enrolled children with similar socioeconomic backgrounds (Avery, Kenkel, Lillard, Mathios, & Wang, 2008; Lee & Begley, 2010).

Our findings have policy implications. Medicaid spending on health care utilization is high and will continue to increase with the proposed Medicaid expansion through the Affordable Care Act legislature. Increased asthma medication use has shown to decrease health care use and ultimately associated costs. The findings from this study suggest the importance of disease and treatment options awareness, particularly through DTCA and also educational intervention in treating asthma.

There are some limitations in this study. First, the Medicaid claims data present limitations related to potential inaccuracies related to coding, missing information, and other factors associated with administrative data sources. Nevertheless, Medicaid claims data provide a large national sample that is representative of asthmatic children and a rich set of information on asthma and health care utilization among children. Second, the time period covered in this study was chosen due to the availability of Medicaid data that matched with the available DTCA data covering 1999–2002. Since the asthma drugs studied were introduced during this time period, spending on advertising may have changed since the study period. Additional studies on recent years are needed.

Limitations are also present with the advertising data. The data did not provide information on pharmaceutical detailing or marketing efforts directed towards physicians. This type of advertising makes up a large portion of the pharmaceutical marketing efforts such as medication samples other than DTCA advertising. It is possible that DTCA and pharmaceutical advertising efforts had a combined effect, implying the potential for omitted variable bias. However, the use of the fixed-effects models controls for this type of bias. Future study on the comparison of the effects between DTCA expenditures and advertising efforts directed toward the physicians may provide more insight to the findings of this study.

This study highlights the need for creative measures to combat the associated health, economic, and social costs of the increasing burden of asthma. The

results from this study may be valuable in mitigating these related costs and should be carefully considered when addressing policy issues.

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