

## Variation in Drug Prices at Pharmacies: Are Prices Higher in Poorer Areas?

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**Objective.** To determine whether retail prices for prescription drugs are higher in poorer areas.

**Data Sources.** The MyFloridarx.com website, which provides retail prescription prices at Florida pharmacies, and median ZIP code income from the 2000 Census.

**Study Design.** We compared mean pharmacy prices for each of the four study drugs across ZIP code income groups. Pharmacies were classified as either chain pharmacies or independent pharmacies.

**Data Collection.** Prices were downloaded in November 2006.

**Principal Findings.** Across the four study drugs, mean prices were highest in the poorest ZIP codes: 9 percent above the statewide average. Independent pharmacies in the poorest ZIP codes charged the highest mean prices.

**Conclusions.** Retail prescription prices appear to be higher in poorer ZIP codes of Florida.

**Key Words.** Pharmaceutical pricing, uninsured

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Prescription drug prices are a significant barrier to appropriate medication use. Cost-related underuse in the uninsured is common, and even small increases in drug prices can dramatically affect medication adherence among the poor (Steinman, Sands, and Covinsky 2001; Safran et al. 2005; Goldman, Joyce, and Zheng 2007). There are clear adverse health effects associated with decreased medication adherence, including poorer control of chronic diseases and higher rates of hospitalization and emergency room visits (Tamblyn et al. 2001; Heisler et al. 2004; Hsu et al. 2006).

If drug prices were higher for the poor, then disparities in medical care could be exacerbated. Small studies in New York City have suggested that pharmacy prices in lower-income areas may be higher than prices in wealthier areas (The Council of The City of New York 2004; Cave 2006). Beyond pharmaceuticals, prior studies of price variation in the United States

have found that for a variety of goods and services, poorer individuals often face higher prices than those who are wealthier. Lower-income families often pay higher insurance premiums and face higher interest rates for mortgages and other loans (Fellowes 2006). Grocery stores in poorer neighborhoods tend to be smaller and more expensive than in wealthier neighborhoods, and this effect may be mediated by the relative preponderance of independent grocers—rather than chain supermarkets—in poorer neighborhoods (Goodman 1968; Kaufman et al. 1997; Chung and Myers 1999; Fellowes 2006).

While many low-income individuals obtain prescription coverage through government programs and may receive relatively generous drug benefits, those who have no prescription coverage are required to pay the full retail price charged at their pharmacies. More than half of uninsured adults younger than 65 come from low-income families (Kaiser Family Foundation 2006). Because of discounts negotiated by insurance companies, cash-paying customers are charged higher prices for their drugs than their insured counterparts (Frank 2001; Anderson 2007; Congressional Budget Office 2007). The question remains, however, whether low-income patients who are uninsured face higher retail prices than wealthier uninsured individuals. Higher drug prices could impose additional barriers to access to prescription drugs for the poor who are uninsured.

We sought to explore whether uninsured customers in poor areas face higher average retail prices for their prescription medications than those in wealthier areas, analogous to the situation for other products and services. We used a publicly available database of prescription drug prices in Florida pharmacies to examine the association between retail pharmacy drug prices and median ZIP code income.

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## METHODS

### *Data*

We conducted a cross-sectional analysis of prescription prices in November 2006 from Florida's publicly available directory of drug prices charged by pharmacies: the MyFloridarx.com website. The website, which was created by the state legislature in 2005, is maintained by Florida's Agency for Health Care Administration in order to enable consumers to comparison shop for medications (Florida Office of the Attorney General 2005). The website lists retail prices (the price uninsured patients would be required to pay) for the 100 most commonly used drugs in Florida as well as pharmacy names and addresses. Pharmacies that have dispensed 1 of these top 100 drugs to a patient insured by Medicaid in a given reporting period are required by law to report the retail price for that drug for publication on the website. Data from a 2005 survey by the National Association of Chain Drug Stores found 3,601 community pharmacies in the state of Florida (M. Jackson, R.Ph., Florida Pharmacists Association June 18, 2007, personal communication). In total, 3,598 pharmacies were included in the website in November 2006, representing approximately 99 percent of the pharmacies in the state. The ZIP code-level data on median income and population size were obtained from the 2000 United States Census and merged with the pharmacy data, matching on the ZIP code of each pharmacy.

### *Study Sample*

Prices for 1-month supplies of three commonly used drugs for chronic conditions and one antibiotic for acute administration were included in this analysis: esomeprazole (Nexium; AstraZeneca, London) 40 mg for peptic ulcer disease (30 tablets), fluticasone/salmeterol (Advair 250/50; GlaxoSmithKline, London) for asthma, clopidogrel (Plavix; Sanofi-aventis, Paris) 75 mg for cardiovascular disease (30 tablets), and azithromycin 250 mg for bacterial infections (six tablets). These four drugs were chosen a priori to represent some of the most widely prescribed drugs in the country, which are also on the formulary for Medicaid in Florida (necessary for the medication to be included in the database). Esomeprazole, fluticasone/salmeterol, and clopidogrel were the third, fifth, and sixth best-selling medications in the United States by sales in 2005, respectively (Herper 2006). We thought it important to also study a short-term medication that is commonly prescribed, such as the antibiotic azithromycin (Z-Pak; Pfizer, New York). All four of these medications are commonly prescribed by physicians in current clinical practice, are filled by

patients, and were not sold in generic form at the time of the study. The number of pharmacies reporting prices for esomeprazole, fluticasone/salmeterol, clopidogrel, and azithromycin were 1,743, 1,345, 1,435, and 1,647, respectively, with 2,328 unique pharmacies overall in our sample.

To analyze the effect of chain pharmacies on prices, we categorized pharmacies as being part of a large chain if they were any of the following: CVS, Wal-Mart, Walgreens, Winn-Dixie, Publix, Kmart, or Target. These were the seven largest pharmacy chains in the database and collectively comprise approximately 75 percent of the pharmacies in our sample. We categorized pharmacies that were not part of these large chains as “independent” pharmacies.

### *ZIP Code Income Characterization*

Within each ZIP code, median household income from the 2000 Census was used as a measure of area wealth. The use of ZIP code-level census data has been used previously as an area-based measure of socioeconomic status and has been correlated with census tract-based data (Krieger 1992; Gornick et al. 1996; Thomas et al. 2006; Chernew et al. 2008). The median income of each ZIP code was categorized a priori into four categories: <\$20,000, \$20,000–\$40,000, \$40,000–\$60,000, and >\$60,000. To test the sensitivity of our findings to different income cutoffs, we repeated our unadjusted analysis with income categorized into multiples of the federal poverty level (\$16,895) and into quartiles of ZIP code median income, with qualitatively similar results that were statistically significant (Florida Legislature Office of Economic and Demographic Research 2002).

### *Data Analysis*

Mean pharmacy prices for each of the four drugs were compared across income categories using analysis of variance (ANOVA). For ease of presentation, we also combined prices across the four study drugs, calculating standardized prices as the ratio of each pharmacy’s price on a given drug to the statewide mean price for the same drug. These standardized prices were then averaged across all four drugs within each income category.

To model the potentially confounding effect of chain versus independent pharmacies on the relationship between ZIP code median income and drug prices, we constructed a multivariable random intercept model predicting the price of each drug. In each model, the primary predictor of interest was the ZIP code income category. A binary predictor was included to indicate whether each pharmacy was part of chain, and an interaction term between

chain and income category was also included to account for possible variance in the chain effect on drug prices across the income categories. To account for drug price clustering within each ZIP code, we included ZIP code as a random effect. All analyses were carried out using SAS version 9.1 (SAS Institute, Cary, NC).

## RESULTS

### *Characteristics of the Sample*

Prices were reported in November 2006 by 2,328 unique pharmacies for at least one of the four study drugs, representing 64.7 percent of all pharmacies in Florida's online database. Table 1 shows the characteristics of the four ZIP code income groups. There were 627 ZIP codes represented, and poorer ZIP codes were generally more populous, with lower shares of chain pharmacies.

### *Prices across ZIP Codes*

The mean price of each of the four drugs was highest in the poorest ZIP codes (Table 2). Results were qualitatively similar with the different income cutoffs, and the main findings remained statistically significant. Overall, the standardized mean price in the poorest ZIP codes for these four drugs was 9 percent above the statewide average (95 percent confidence interval [CI]: 6, 12 percent). The majority of the variation in pharmacy price, however, was due to prices in independent pharmacies, where across the four drugs, prices were 15 percent higher (95 percent CI: 11, 19 percent) in the poorest areas compared with the statewide average. Chain pharmacies exhibited little price variation across ZIP code income categories.

Table 1: Demographic Characteristics of the Florida ZIP Codes Included in the Study, Arranged by Median Income

	<i>ZIP Code Median Income Categories</i>			
	<i>&lt; \$20,000</i>	<i>\$20,000–\$40,000</i>	<i>\$40,000–\$60,000</i>	<i>&gt; \$60,000</i>
Number of ZIP codes	10	351	221	45
Number of pharmacies	44	1,356	820	108
% of pharmacies that are chains	43	71	80	91
Median household income (\$)	17,664	32,452	45,637	66,238
Median population/ZIP code	35,659	26,140	28,264	23,821

*Source:* Authors' analysis of data from the 2000 United States Census and Florida pharmacy prescription prices from the MyFloridaRx.com website.

Table 2: Mean Price (Standard Deviation) for Drugs in Florida Pharmacies, by ZIP Code Income

Drug (No. of Pills)	ZIP Code Median Income				p-Value
	< \$20,000	\$20,000-40,000	\$40,000-60,000	> \$60,000	
Esomeprazole (30)	\$176 (\$26)	\$162 (\$12)	\$162 (\$12)	\$160 (\$8)	<.001
Fluticasone/Salmeterol	213 (30)	201 (15)	201 (15)	198 (11)	<.001
Clopidogrel (30)	163 (26)	148 (14)	148 (14)	149 (11)	<.001
Azithromycin (6)	55 (9)	51 (8)	50 (4)	50 (2)	<.001

\*p-value represents the results of ANOVA testing.

Source: Authors' analysis of data from the 2000 United States Census and Florida pharmacy prescription prices from the MyFloridarx.com website.

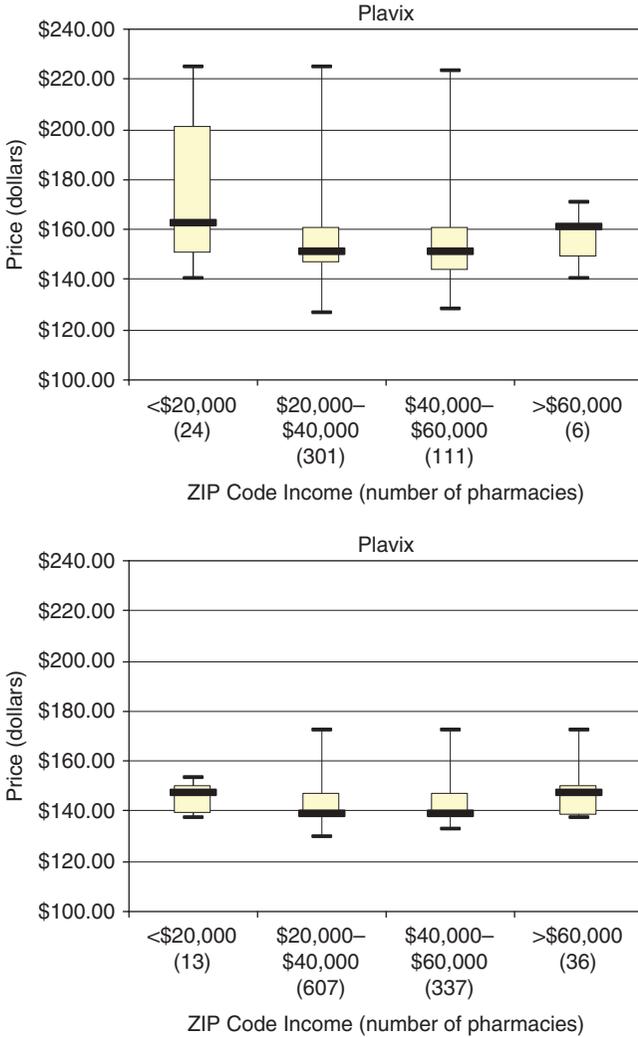
### Chain versus Independent Pharmacies

Figure 1 shows the price and variation in price for clopidogrel (Plavix). The other three drugs have similar price distributions. At each income level, chain pharmacies are less expensive and less variable in price than independent pharmacies. The wide variation in drug price seen at the lowest income levels in independent pharmacies was present for each of the drugs, with less variation in wealthier areas. The mean predicted price (with confidence interval) for each of the eight interaction terms from the multilevel model are presented in Table 3. For independent pharmacies, each drug's predicted price is significantly higher in the poorest areas than in wealthier areas, but among chain pharmacies there are no significant differences across the income categories.

## DISCUSSION

This analysis of retail drug prices in Florida shows that independent pharmacies in the poorest ZIP codes charge the highest prices for four commonly prescribed drugs. This variation in prescription prices is of real importance to the uninsured poor who struggle to pay for their medications. The number of such patients is significant: there were 46.1 million nonelderly Americans lacking health insurance in 2005, and more than half of the uninsured come from low-income families (Kaiser Family Foundation 2006; Dubai, Holahan, and Cook 2007). In addition, there remain four million Medicare beneficiaries who lack creditable prescription coverage and may be paying retail prices (Kaiser Family Foundation 2007). In Florida, one in four of the state's residents younger than 65 were uninsured in 2006 (Florida Health Insurance Advisory Board 2007).

Figure 1: Price of Clopidogrel (Plavix) at Independent (Top) and Chain (Bottom) Pharmacies in Florida



Note: The thick bars represent median price, and the remaining bars represent the minimum, 25 percent percentile, 75 percent percentile, and maximum price

We are not aware of any other studies formally documenting this kind of variation in prescription prices and association with area income. In a 1997 letter to the editor in the *British Medical Journal*, the authors reported on their

Table 3: Least Square Means of Drug Price in Florida in Each ZIP Code Income Category for Independent and Chain Pharmacies\*

	<i>Least Square Means (95% Confidence Interval)</i>			
	<i>Esomeprazole</i>	<i>Fluticasone/Salmeterol</i>	<i>Clopidogrel</i>	<i>Azithromycin</i>
Independent pharmacies				
< \$20,000	\$187 (\$182, \$192)	\$221 (\$214, \$227)	\$173 (\$167, \$178)	\$58 (\$55, 61)
\$20,000–\$40,000	167 (165, 168)	206 (205, 208)	156 (155, 158)	54 (53, 55)
\$40,000–\$60,000	168 (166, 170)	207 (204, 210)	157 (155, 159)	52 (51, 53)
> \$60,000	163 (152, 173)	207 (190, 224)	159 (146, 167)	50 (37, 63)
Chain pharmacies				
< \$20,000	\$162 (\$157, \$167)	\$201 (\$193, \$209)	\$145 (\$137, \$152)	\$51 (\$47, \$54)
\$20,000–\$40,000	159 (158, 160)	198 (197, 199)	144 (143, 145)	50 (49, 50)
\$40,000–\$60,000	160 (158, 161)	199 (197, 201)	144 (143, 146)	50 (49, 50)
> \$60,000	160 (157, 164)	197 (192, 203)	148 (144, 152)	49 (48, 51)

\*These are predicted prices from interaction terms of the random intercepts model.  
*Source:* Authors' analysis of data from the 2000 United States Census and Florida pharmacy prescription prices from the MyFloridarx.com website.

small investigation of 62 chemist shops in Bath, U.K., in which they found that the price charged for a month's supply of donepezil (Aricept; Eisai Inc, Woodcliff Lake, NJ) ranged from £68 to £120, and in general they found lower prices quoted by chemists that were not part of a chain (Jones, Mann, and Saunders 1997). More recently, Redelmeier et al. (2000) surveyed 66 hospitals from every large city in the United States and Canada and documented variation in hospital charges to individuals paying out of pocket; the price to an uninsured patient for filling a prescription for fluoxetine varied fourfold among hospital pharmacies, ranging from \$26 to \$93.

Our findings on the differences in price between chain and independent pharmacies suggest a potential mechanism for geographic price variability in prescriptions that deserves further investigation. The preponderance of independent high-cost pharmacies in poorer areas explains much of the observed variation in price, much as the presence of small, higher-priced grocery stores explains in many cases the higher price of groceries in poorer neighborhoods (Fellowes 2006). However, despite higher mean prices among independent pharmacies, the poorest areas also contain some independent pharmacies with prices similar to those charged by chain pharmacies. This finding suggests that even in the poorest ZIP codes, motivated consumers who shop around can find independent pharmacies that are as inexpensive as chain pharmacies. Because the ability of consumers to compare prices may be more limited in

economically deprived settings, where finances, health literacy, and transportation are barriers, interventions to assist consumer choice could be warranted if large numbers of the uninsured purchased prescriptions at high prices.

It is possible that the higher prices at independent pharmacies could represent better value if, for example, these pharmacies offered home delivery or other specialized services that might improve adherence. Additionally, for those with insurance, independent pharmacies may improve access to medications because of their location and personal service, despite higher retail prices. The nationwide market share for independent pharmacies has declined (Congressional Budget Office 2007) and while we would not suggest making policy decisions about market interventions based solely on our study, our analysis of the data does raise questions about high-priced independent pharmacies.

Our results must be interpreted in the context of the study design and data sources. First, while previous research has shown that ZIP code-level census income is strongly associated with individual socioeconomic status, our study measures prices charged by pharmacies in poorer ZIP codes and not the actual prices paid by poor individuals. We also do not model income heterogeneity within ZIP codes or other demographic characteristics. Individuals may purchase drugs at pharmacies outside of the ZIP codes in which they reside, or they may avoid purchasing drugs from high-priced pharmacies and may substitute lower-priced related drugs. We are not able to measure the volume of purchasing by the uninsured at these pharmacies, and thus we cannot comment on any truly causal link between pharmacy type and the price patients pay for their prescriptions; nonetheless, we believe the findings raise important questions about geographic variability in retail prescription prices that deserve further investigation.

Second, our data represent only those pharmacies that filled a prescription for one of the four study drugs for at least one Medicaid patient in November 2006. A number of pharmacies in the state (and mail-order pharmacies) are therefore not included in our analysis. These pharmacies either did not fill any prescriptions for the drug in question during the reporting period, in which case the price available is not a relevant issue for comparison, or they filled only prescriptions for non-Medicaid patients, which is unlikely to substantially alter our results as the main driver of our findings is high-priced independent pharmacies in poor ZIP codes. We were not able to provide any detail on pharmacies that were not included in our sample or any additional detail on the characteristics of independent pharmacies. Third, we analyzed price data for only four drugs. However, the relationship between price and area income was remarkably consistent across all four drugs, and we

have no reason to suspect that a different relationship would exist for other drugs. Finally, we considered only one state and our results may not be generalizable, although this relationship could exist in other states and deserves study.

## CONCLUSION

The uninsured, despite in many cases having lower disposable income and poorer health, are burdened with high out-of-pocket costs for many services and face higher prices than the insured (Anderson 2007; Dubay, Holahan, and Cook 2007). We have presented evidence that retail pharmacy prices in Florida for four commonly used drugs are higher in poorer ZIP codes than in wealthier ZIP codes, and these higher prices are due to the preponderance of high-priced independent pharmacies in the poorest areas. While insuring the uninsured is a priority, efforts to reduce disparities in care between socioeconomic groups could be strengthened by ensuring that America's most vulnerable patients are not charged more for essential medications.

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Appendix SA1: Author Matrix.

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