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Evaluating Alternative Benchmarks to Improve Identification of Outlier Drug Prices for Medical Expenditure Panel Survey Prescribed Medicines Data Editing

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I. Introduction

The Medical Expenditure Panel Survey (MEPS) Prescribed Medicines (PMED) file is a unique data resource sponsored by the Agency for Healthcare Research and Quality that provides detailed information on prescription drug use and expenditures for a nationally representative sample of people in the U.S. civilian, noninstitutionalized population. MEPS collects detailed information on drug acquisitions from pharmacies frequented by members of sampled households. This information, which is collected by a linked survey of pharmacies, includes quantity dispensed, total retail price, total amount paid by source of payment, and National Drug Code (NDC). Constructing MEPS PMED files using both household- and pharmacy-reported data involves many complex data editing and matching tasks (Hill et al. 2014). In this study, we undertake a detailed examination of one of these tasks: identifying and editing outliers in the retail prices reported by pharmacy providers.

Outlier prices may be caused by transcription errors in reported prices or quantities, the incomplete reporting of payments, or other reporting errors. The goal of editing drug prices in MEPS PMED files is to increase the overall quality of the data while maintaining the within-drug dispersion in prices that typically occurs in the retail market for drugs. To account for dispersion across drugs, it is useful to have a standard measure of price for each drug. The standard used to identify outlier prices in MEPS has been the average wholesale price (AWP). AWP is an NDC-level list price for drugs sold by wholesalers to retail pharmacies. Although in practice AWP does not necessarily reflect what pharmacists pay for drugs, it is widely available, and both public and private insurers have used it as the basis for payments to retail pharmacy providers (Congressional Budget Office 2007). To screen for price outliers, each retail unit price (RUP) in the MEPS pharmacy data is compared with the average wholesale unit price (AWUP) for that NDC. Outlier prices then receive an imputed price from a similar acquisition in MEPS (Hill et al. 2014).

There are four central motivations for reexamining the MEPS price editing approach. First, retail prices—especially for generics—are typically less than AWP, which is a list price, not an average of transaction prices (Miller et al. 2019). In fact, prices for generics are, at best, loosely related to AWP (Congressional Budget Office 2007, Levinson 2005, Sugerman-Broznan and Woolman 2009; Zodet et al. 2010). Second, after the editing rules were revised for the 2011 MEPS, the Centers for Medicare & Medicaid Services (CMS) developed another price benchmark, the

National Average Drug Acquisition Cost (NADAC). A CMS contractor surveys pharmacies to obtain their costs of acquiring drugs identified by their NDCs. Retail prices are likely higher than NADAC because of retail markup, including dispensing costs. However, NADAC is not available for all drugs, for example, those dispensed by specialty pharmacies. Therefore, we also use wholesale acquisition cost (WAC), which is a list price for drugs sold by manufacturers to wholesalers, but it also appears to be more strongly linked to RUP than AWP (Miller et al. 2019). Third, biologics, a small but growing share of drug fills, are typically expensive; correctly editing and imputing prices for these drugs is critical to obtaining nationally representative estimates of drug expenditures. MEPS editing rules were developed without separately considering biologics or other specialty drugs. Fourth, average prices in MEPS and in data collected from pharmacies by the company IQVIA were fairly close from 2004 through 2009, but the average price across all fills was about 12 percent higher in MEPS in 2019. Higher prices in MEPS might have reflected the greater salience to survey respondents and more consistent reporting of expensive drugs than, for example, cheap antibiotics. Elements of the MEPS editing and imputation process, however, could also have been a factor.

The purpose of this study was to evaluate potential improvements to the way that MEPS data on prescription drug prices are edited in MEPS. The central strategy of this exercise was to compare the distributions of RUPs in the 2019 MEPS data to the distributions of RUPs for fills obtained by people with private, employer-sponsored insurance, as reported in 2019 IBM MarketScan claims data. The MarketScan data contained private insurance claims data for about 16 million people in 2019. As a benchmarking exercise, these MEPS–MarketScan price comparisons represent an extension of ongoing quality control and improvement efforts in the editing of MEPS PMED data.[1] Our study took two additional steps. First, we proposed modifications to the MEPS price editing rules to use NADAC and other price benchmarks. Second, we examined the potential impact of rule modifications on average retail prices and on the distribution of retail prices for drugs in the MEPS data.

II. Methods

We performed a descriptive analysis of (1) the ratio of RUP to NADAC per unit, for simplicity, labeled "PRATION"; and (2) the ratio of RUP to wholesale acquisition unit cost (WAUC), labeled "PRATIOW." Using data from the MEPS Pharmacy Component (PC), we compared the distributions of these ratios to prescription drug claims for people with private, employer-sponsored insurance from the same year.

[1] Each year, the editing process includes a number of benchmarking exercises: MEPS estimates of aggregate drug expenditures are benchmarked to estimates from the National Health Expenditure Accounts (NHEA) and IQVIA; and lists of top-selling drugs in MEPS are compared with the IQVIA data. See also Hill et al. (2014) for a summary of other data improvements.

A. Data

MEPS data for this project came from the 2019 MEPS PC, which is a survey of pharmacy providers identified by household respondents during a series of MEPS Household Component (HC) interviews. For each round of the HC, respondents were asked to provide the name(s) of any prescribed medication that they or their family members had purchased or obtained during that round. MEPS HC collected additional information regarding reported medications: (1) the name(s) of any health problem(s) for which the medication was prescribed, (2) the number of times the medication was obtained/purchased, and (3) when the person first used the medication. MEPS HC also collected the names, addresses, and types of pharmacies that had filled the prescriptions. Sample members who had obtained drugs were asked to sign permission forms authorizing contact with these pharmacies and the release of their pharmacy records.

MEPS PC then contacted the pharmacies of sample members who granted this permission. These pharmacies could provide data electronically, by submitting detailed computer printouts, or through a telephone interview. The pharmacies were asked to provide information about each prescription filled or refilled for each patient listed. Requested data included (1) the date the prescription was filled or refilled; (2) the quantity dispensed; (3) sources of payment; (4) payment amount by source; and (5) either the NDC or the combined information of medication name, dosage form, and strength.

A key aspect of editing the price data is imputing missing payment information in the PC. Among the fills collected for 2019, 56 percent appeared to have complete payment data, 28 percent had out-of-pocket payments but were missing third-party payments, and 16 percent had no payment data. During the editing process, missing third-party payments and out-of-pocket payments were replaced by values imputed from fills deemed to have complete payment data.

Data collected from the pharmacies were matched to the prescribed medicines listed by HC respondents. Payment data obtained in the PC were the source of price information for the matched HC acquisitions. PC data were also used to impute payment data for HC acquisitions not matched to PC acquisitions. Hill et al (2014) provided detailed documentation on how HC and PC data were matched, as well as imputation strategies.

We used a production version of the 2019 MEPS PC file. This is an acquisition-level file (i.e., there is one record for each fill/refill of a prescription from the pharmacy). This file included the RUP, constructed as the sum of payments for the prescription divided by the quantity dispensed (e.g., number of pills or milliliters). The NADAC per unit, obtained from CMS data, was merged into the file along with the WAUC

and AWUP, obtained from Wolters Kluwer Health Medi-Span's Master Drug Database (MDDB).

The comparison data source was the 2019 IBM MarketScan Outpatient Pharmaceutical Claims data. The 2019 data contained 163.5 million adjudicated drug claims for approximately 13.6 million people. The data were comprised of enrollees in employer-sponsored health insurance plans offered predominantly by large private-sector employers. The administrative claims data were, however, a convenience sample. Patent status for the drugs in these claims was obtained from the IBM Micromedex RED BOOKTM. Because the original sample size of MarketScan drug claims was large, we randomly selected a 10 percent sample of the retail mail-order prescription or specialty pharmacy claims—that is, about 16.3 million drug fills. These were fully adjudicated claims, reflecting any payment adjustments made by the insurers to the pharmacies. Acquisition-level data included the price paid for the medication and the quantity dispensed. Recorded prices were the retail prices paid to pharmacies, which is the same price concept sought by MEPS PC.

To increase the comparability of the two data sources, MEPS PC data were limited to pharmacy acquisitions for the privately insured, and over-the-counter drugs were excluded (*N*=79,399).

The main limitation to this analysis was that neither data source was nationally representative.

B. Visualizing the Data

The analysis for this project was purely descriptive. Histograms were constructed to compare the distributions of PRATION and PRATIOW observed in MEPS PC to those observed in the MarketScan data.

First, we assessed the impact of the editing rules used up to 2019 by comparing the distribution of PRATION in the edited MEPS PC data with the distribution of PRATION in MarketScan. Second, we compared the distribution of PRATION from the unedited MEPS PC fills with partial payment data to the distribution observed in MarketScan. These distributions were examined separately for four groups biologics, nonbiologic single source brand name drugs, nonbiologic brand name drugs with generic competitors (originators), and nonbiologic generics. This process was repeated for PRATIOW.

Based on these observations, the MEPS drug price outlier editing rules were revised and reapplied to the data. We then assessed the similarities between the PRATIO distributions from the updated MEPS PC data and the MarketScan distributions.

C. Editing Rules

Editing rules used up to the 2019 MEPS focused on outliers in RUP relative to AWUP. All records were inspected for outliers in RUP. Since 1996, upper outliers had been defined as RUP≥10 times AWUP. As shown in table 1, the thresholds for lower outliers varied with patent status, the completeness of the payment data, whether the pharmacy reported discounts or coupons for the fill, and whether the fill was for a person with Medicare Part D who appeared to be in the donut hole. Fills with positive third-party payments were rarely flagged as lower outliers. A small fraction of fills with partial payment information were flagged as complete; for these few cases, missing third-party payments were set to zero. These rules were developed based on (1) a comparison of 2006 MEPS and MarketScan data (Zodet et al. 2010), (2) a verification study with matched Medicare Part D claims for 2006 and 2007 (Hill et al. 2011), and (3) additional refinements.

Table 1. Lower Thresholds for Ratio of RUP to AWUP (Percentages of AWUP Below Which RUP Are Imputed)

Pharmacy Payment Data	Discount	Donut Hole	Patent Status		
			Single-Source	Originator	Generic
Complete	No	No	65%	20%	3%
Complete	Yes	No	40%	0%	0%
Complete	No or Yes	No	75%	70%	15%
Complete	No or Yes	Yes	20%	20%	3%
Complete	No or Yes	Yes	30%	30%	15%

Not all fills flagged as outliers were edited, for example, when the imputed price was less than the reported price, or when the RUP was high but the price per fill was low.

We sought to use a similar approach, but we replaced AWUP with NADAC per unit or WAUC, which required determining new thresholds for outliers.

III. Results

We found that the distribution of PRATION in MarketScan was very similar for biologics and other single-source brand name drugs, and the same was true for MEPS and PRATIOW in both data sets. Therefore, the results shown in this paper include biologics with other single-source brand name drugs.

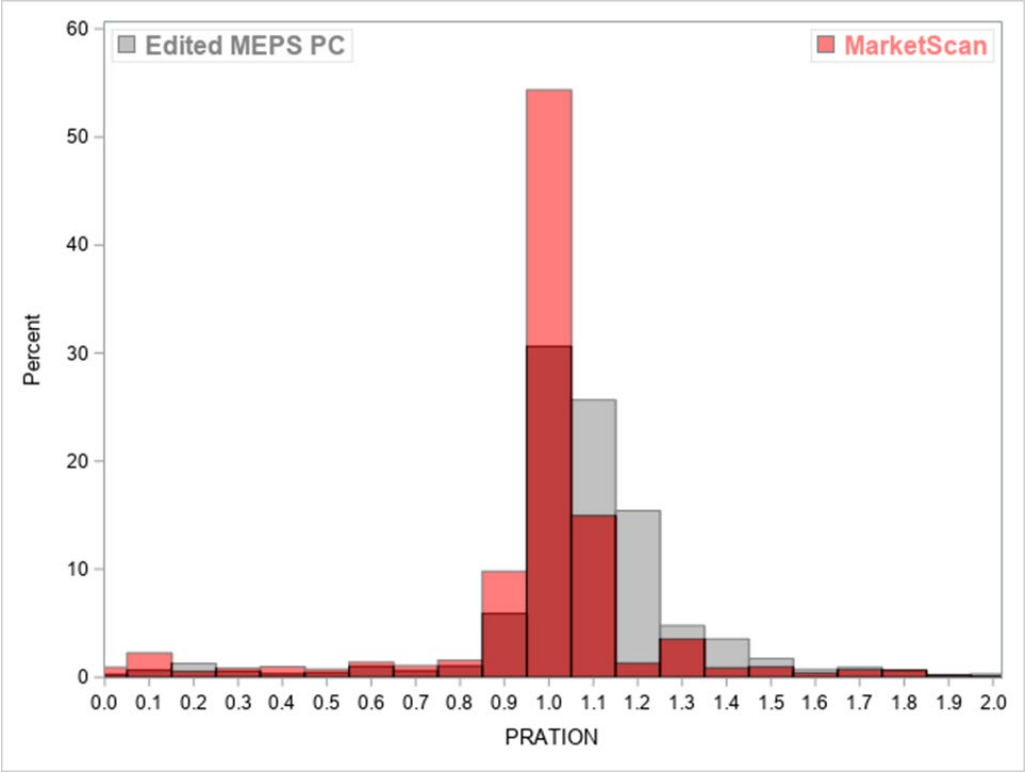
We present results for PRATION, because 93 percent of fills in MEPS PC had NDCs for which NADACs were available. Although positive WACs were available for

98 percent of fills, an empirical average is preferable to a list price for benchmarking. Similar analyses of PRATIOW were conducted and had qualitatively similar findings.

A. Edited MEPS PC and MarketScan

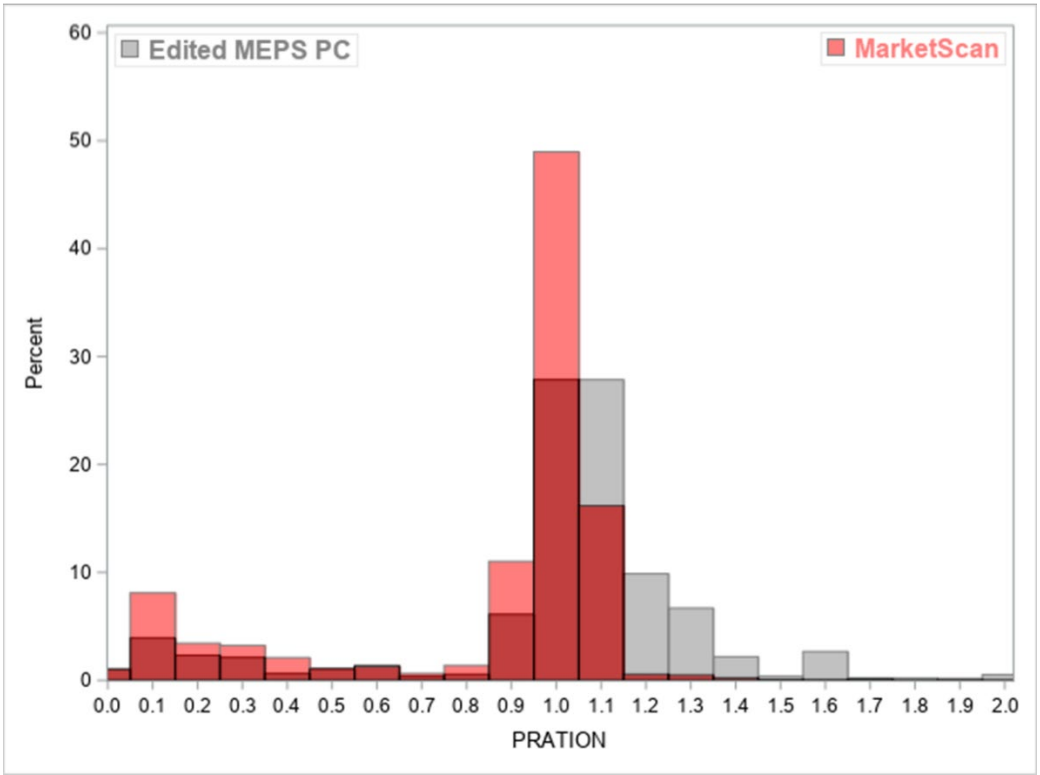
The comparisons of PRATION distributions in edited MEPS PC and MarketScan data for the three types of drugs (i.e., single-source, originator, generic obtained from Wolters Kluwer Health Medi-Span's MDDB) are shown in figures A1–A3. Whereas MEPS and MarketScan data shared the same modes, MEPS edited prices tended to be somewhat higher than those in MarketScan. For example, for single-source drugs, the MarketScan distribution was much more concentrated around the mode of 1, and the MEPS distribution had more mass just above the mode (figure A1). Similarly, for originators, the brand name drugs that had lost patent protection and faced generic competition, showed a distribution of PRATION in edited MEPS data with more mass above 1 (figure A2). For generics, the MEPS distribution had a thicker tail than the MarketScan distribution (shown in figure A3 with a different scale for PRATION than in the prior figures).

Figure A1. Distributions of PRATION for Single-Source Brand Name Drugs



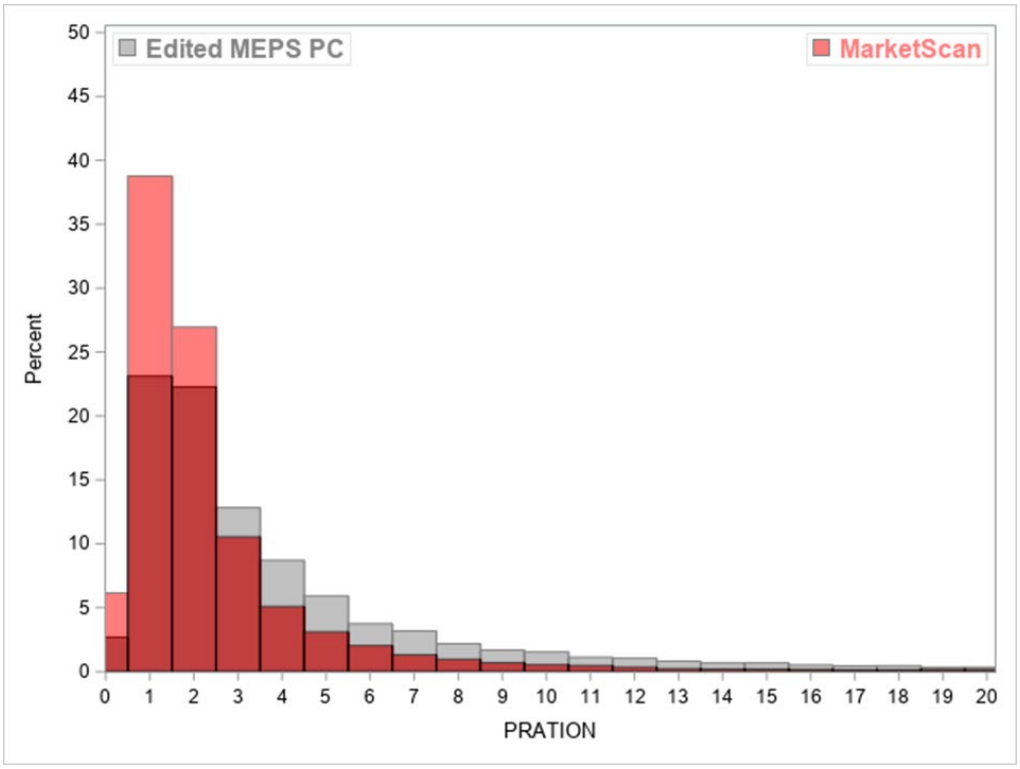
Note: 2 percent and 3 percent of single-source brand name drugs had a PRATION>2.0 in MarketScan and edited MEPS PC data, respectively.

Figure A2. Distributions of PRATION for Originators



Note: 0.2 percent and 2 percent of originators had a PRATION>2.0 in MarketScan and edited MEPS PC data, respectively.

Figure A3. Distributions of PRATION for Generics

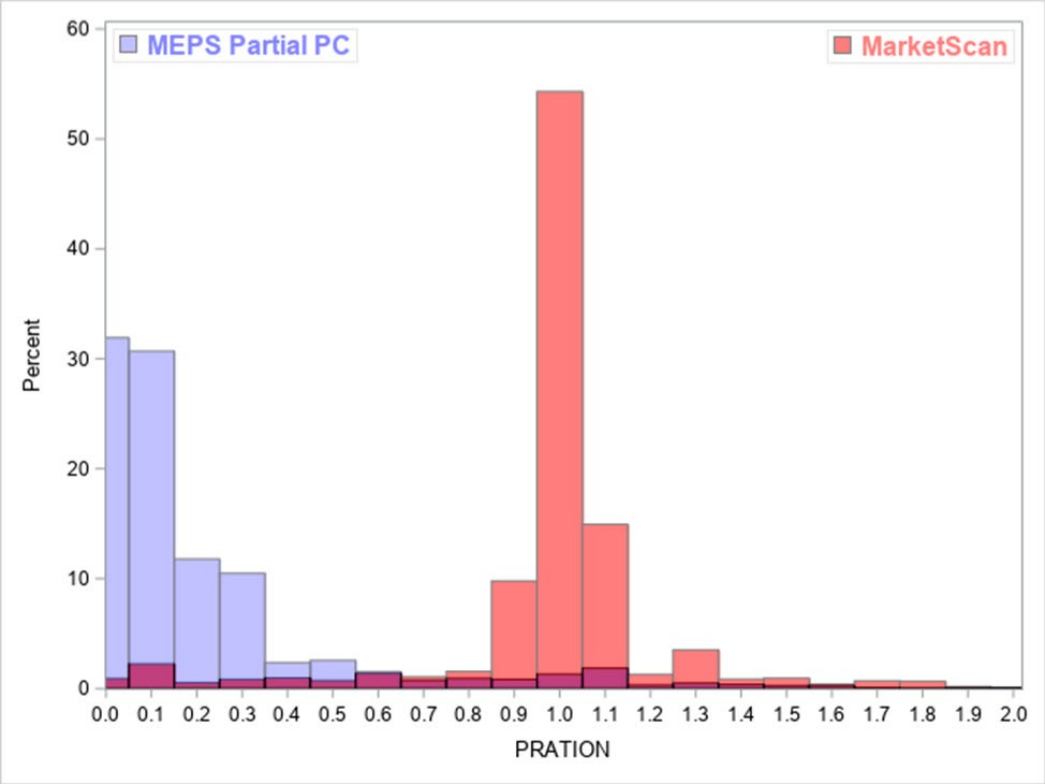


Note: 2 percent and 6 percent of generics had a PRATION>20 in MarketScan and edited MEPS PC data, respectively.

B. MEPS PC Records With Partial Payment Data and MarketScan

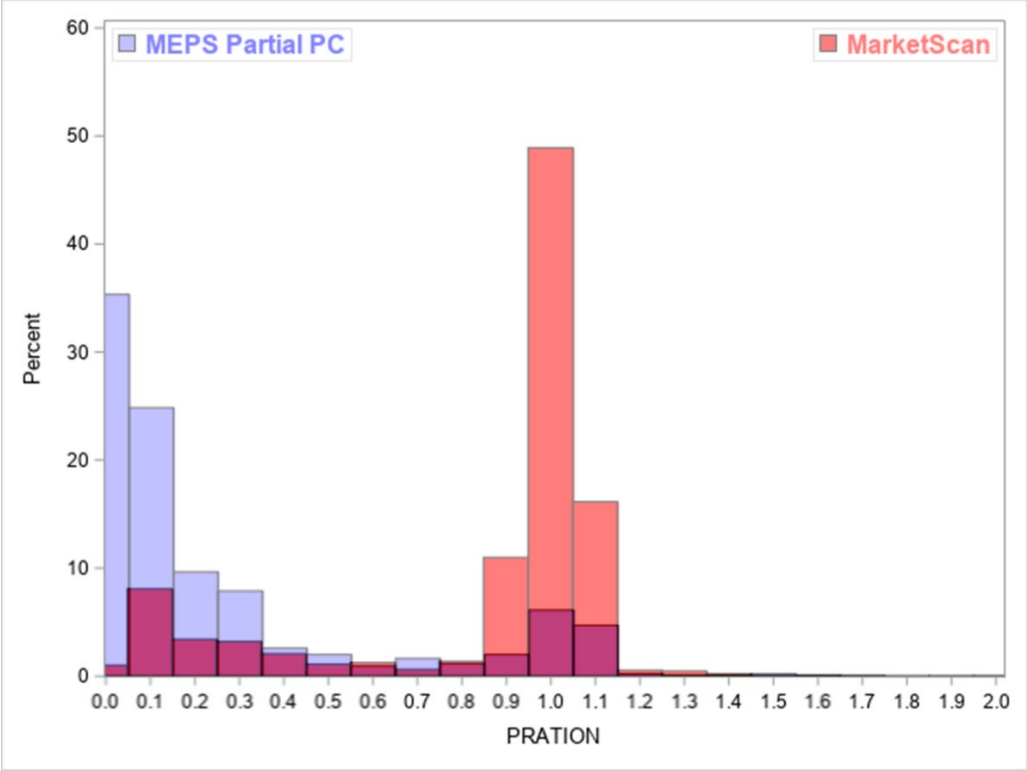
Comparisons of PRATION distributions in unedited MEPS PC fills with partial payment data and MarketScan by type of drug are shown in figures B1–B3. For single-source brand name drugs and originators, fills with partial payment data did not reflect the prices found in the MarketScan data (figures B1 and B2). For generics, however, the distributions were similar, but the unedited MEPS data had more mass at low values of PRATION than in the MarketScan data (figure B3). Most of the reported out-of-pocket amounts appeared to be reasonable total prices (not shown), and the missing third-party payments could be zeros for generics. In the 2019 MEPS PC, some pharmacy chains reported missing third-party payments for all but a few generic fills. Many of these missing values would likely be zeros, because 47 percent of generics in MarketScan data had no third-party payments and were paid entirely by out-of-pocket payments. This is a sharp change in the interpretation of missing values for generics. In the validation study using Medicare Part D claims data from 2006 and 2007 (Hill et al. 2011), partial payment fills almost always had positive third-party payments in the claims data. Relative to the rapid changes in the pharmaceutical market, those earlier findings are quite old, and much has changed since 2007.

Figure B1. Distributions of PRATION for Single-Source Brand Name Drugs



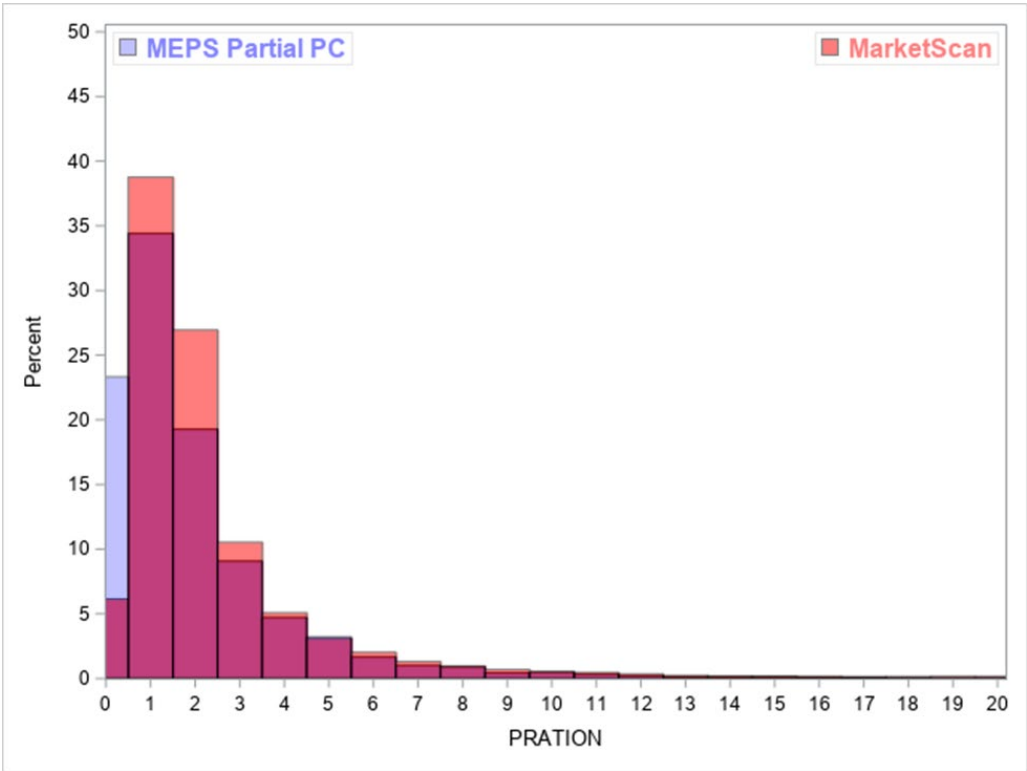
Note: 2 percent and 1 percent of single-source drug fills had a PRATION>2 in MarketScan and MEPS Partial PC data, respectively.

Figure B2. Distributions of PRATION for Originators



Note: 0.2 percent and 0.2 percent of originators had a PRATION>2 in MarketScan and MEPS Partial PC data, respectively.

Figure B3. Distributions of PRATION for Generics



Note: 2 percent and 0.3 percent of generics had a PRATION>20 in MarketScan and MEPS Partial PC data, respectively.

C. Fills Paid Entirely Out of Pocket

People with private insurance may pay for a fill entirely out of pocket, depending on the characteristics of the prescription drug coverage through their health plans. Examples of this are when (1) the purchase is made before a deductible has been met, (2) the copayment is at least the price of the drug, and (3) the health plan does not cover the drug. Table 2 shows the percentage of fills paid entirely out of pocket by patent status and data source. For generics, the unedited MEPS PC and MarketScan data are fairly similar, 44.7 percent and 47.1 percent, respectively, but the edited MEPS PC data showed that only 38.3 percent of fills were paid entirely out of pocket. This difference suggests that the editing rules used up to 2019 MEPS data may have imputed third-party payments to too many fills that had missing third-party payment amounts. The difference for originators is less extreme than for generics, but it also suggests possible excessive imputation. For single-source brand name drugs, the similarity of percentages between the MarketScan and edited MEPS PC data suggests that the approach used up to the 2019 MEPS data worked well. The higher rate for single-source drugs in the unedited MEPS PC data suggests that sometimes, when pharmacies report no third-party payments, there might actually be missing third-party amounts, a conclusion reached in a previous validation study (Hill et al. 2011).

Table 2. Percentage of Fills Paid Entirely Out of Pocket, by Patent Status and Data Source

Data Source	Brand Name		Generic
	Single-Source	Originator	
MarketScan	7.7%	27.5%	47.1%
Edited MEPS PC	8.5%	21.8%	38.3%
Unedited MEPS with complete payment data	13.3%	25.8%	44.7%

Source: Authors' calculations from Medical Expenditure Panel Survey Pharmacy Component, 2019, and MarketScan Outpatient Pharmaceutical Claims, 2019.

D. Additional Characteristics Investigated

We also investigated other drug characteristics and found the following:

- The distribution of PRATION for other dosage forms (e.g., inhaler, cream, pen, kit) did not differ from pills', except that the distribution of PRATION for liquids had a thicker tail.
- It was difficult to assess drugs with orphan indications because many had orphan and nonorphan indications, and we could not readily identify the drugs with exclusively orphan indications.

- The distributions of PRATION and PRATIOW in MarketScan data were very similar for biologics and other single-source brand name drugs. The same was true for MEPS data. Therefore, the results for single-source brand name drugs presented in this paper include biologics.

IV. Evidence-Based Modifications to the Editing Rules

A. New Editing Rules

We developed new editing rules so that (1) the distribution of drug prices in MEPS would better benchmark to MarketScan overall and by drug patent status, and (2) drug prices in MEPS would continue to benchmark to NHEA and IQVIA's National Prescription Audit data. Like the old editing rules, the new rules for drug price outlier editing vary by patent status. Here are the main changes:

- NADAC replaces AWP, but WAC is used when NADAC is unavailable, and AWP is a last resort. NADAC and WAC will better identify which prices are outliers
- Generic drugs with missing third-party payment information were more likely to have a third-party payment amount set to zero rather than to have received an imputed third-party payment.
- To better identify which fills with partial payment data were in need of price imputation, we set minimum prices per fill in addition to minimum PRATIONs, the ratio of retail unit price to NADAC per unit. These also varied by drug patent status.
- New editing rules for Medicaid fills reflect how most states reimburse pharmacies. Most states pay for retail drugs primarily based on NADAC plus a dispensing fee. Only one state has a dispensing fee of less than $8. Prices will be imputed for Medicaid fills with reported payments of less than NADAC per unit×quantity+$8. However, the dispensing fee may not be relevant for partial fills, so we excluded fills with six or fewer pills from this screener for outliers.

A few additional minor adjustments were made to reflect, for example, the longer tail in the distribution of PRATION for single-source liquid drug fills. Fills will be deemed to have prices that are too high when the RUP exceeds 50 times the NADAC per unit for generics, 8 times the NADAC per unit for single-source liquids, and 4 times the NADAC per unit for all other drugs among fills priced at $16 or more per fill (table 3). These thresholds minimize the amount of editing for fills with complete payment data. Rules for identifying low unit prices based on NADAC are summarized in table 4. Rules for identifying low prices among the drugs without NADAC but with WAC are presented in table 5. Both tables include rules for factors present in MEPS but either not seen in the MarketScan data for private insurance (the Part D donut hole) or rarely found in MarketScan data (over-the-counter drugs and supplies). Differences between the thresholds in tables 4 and 5 reflect

differences in the distributions of RUP relative to NADAC per unit compared with RUP relative to WAUC.

Table 3. Upper Threshold for the Ratio of RUP[1] to Drug Price Benchmarks

Ratio	Patent Status and Dose Form		
	Single-Source Liquids	All Other Brand Name Drugs	Generics
PRATION[2]	8	4	50
PRATIOW[3]	4	2	20
PRATIO[4]	10	10	10

[1]RUP stands for retail unit price.
[2]PRATION is the ratio of RUP to National Average Drug Acquisition Cost (NADAC) per unit.
[3]PRATIOW is the ratio of RUP to wholesale acquisition unit cost (WAUC).
[4]PRATIO is the ratio of RUP to average wholesale unit price (AWUP), used in the old editing rules.

Table 4. Lower Thresholds for Ratio of RUP[1] to NADAC[2] per Unit

Pharmacy Payment Data	Any Third-Party Payment, Discounted, in Donut Hole, or OTC[3]	Donut Hole	Patent Status		
			Single-Source	Originator	Generic
Complete	Yes		.01	.01	.01
Complete	No		.85	.01	.01
Partial		No	.95	.95	.42
Partial		Yes	.45	.45	.42

[1]RUP stands for retail unit price.
[2]NADAC stands for National Average Drug Acquisition Cost.
[3]OTC stands for over-the-counter medications.

Table 5. Lower Thresholds for Ratio of RUP[1] to WAUC[2]

Pharmacy Payment Data	Any Third-Party Payment, Discounted, in Donut Hole, or OTC[3]	Donut Hole	Patent Status		
			Single-Source	Originator	Generic
Complete	Yes		.01	.01	.01
Complete	No		.85	.01	.01
Partial		No	.85	.85	.12
Partial		Yes	.4	.4	.12

[1]RUP stands for retail unit price.
[2]WAUC stands for wholesale acquisition unit cost.
[3]OTC stands for over-the-counter medications.

B. Simulation Methods

We applied the new editing rules to identify outliers in the unedited 2019 MEPS PC data. We used these rules for all acquisitions, regardless of a person's insurance status. Even though the rules were developed by benchmarking people with private insurance, we found in the MEPS PC that the distributions of PRATION for people with Medicaid and Medicare drug coverage were very similar to the distributions of PRATION for people with private insurance. The new editing rules modify the donor pool for imputing prices, but we did not account for that in this simulation, because the change in donor pool composition was relatively small. We then merged the new prices into household reported prescription fills using the links developed to produce the 2019 PMED file.

C. Impact of New Rules on 2019 MEPS Data

Overall, the changes attributed to improved price outlier identification described in this paper affected 18.4 percent of total drug fills in the 2019 PMED data, and better identification of outliers improved the quality of the microdata. For example, after applying the new editing rules, only 3 percent of about 173,000 generic drug fills in 2019 MEPS PC data had a PRATIO (including PRATION and PRATIOW)>20, compared with more than 6 percent of generics having a PRATION>20 in MEPS PC data before applying the improved editing rules (please refer to the footnote of figure A3). Among the fills with any payment data, approximately 94 percent had the same outlier status classification before and after the rule change.

By drug patent status, 15.8 percent of single-source brand name drug fills, 10.5 percent of originators, and 19.7 percent of generic drug acquisitions had a change in drug price per fill after applying the new editing rules. Among single-source brand name drug fills, the average price per fill decreased by $8.68 compared to the price from the 2019 PMED production file. Similarly, the average price per fill decreased by $8.62 among generic drug fills after the improved editing (table 6). By contrast, there was almost no change in the average price per fill for originators, and only 2 percent of the total drug fills in PMED data were originators. The decrease in average price per fill of single-source brand name drugs and generics resulted in a 5.8 percent decrease in total drug spending in the 2019 PMED data.

Table 6. Average Price per Fill in 2019 MEPS PMED Data Before and After Improving Price Outlier Identification

Measure	Patent Status and Dose Form		
	Single-Source	Originator	Generic
Percentage of total drug fills	14%	2%	84%

Price edited using AWUP to identify price outliers	$732.90	$446.49	$40.87
Price reedited using improved methods, especially NADAC, to identify outliers	$724.22	$446.51	$32.25
Difference in average price per fill	-$8.68	$0.02	-$8.62

Source: Authors' calculations from 2019 Medical Expenditure Panel Survey Prescribed Medicines (PMED) file before and after this improvement task on editing outlier drug prices.

V. Conclusion

In this paper, we used 2019 MarketScan prescription drug data to benchmark 2019 MEPS prescription drug data for people with private insurance. We used new metrics to better account for the wide dispersion in unit prices among drugs. The rules for identifying outliers developed in this paper were used to edit MEPS drug price data starting with the 2020 data year.

Additional data quality assessments are planned for the future. Staff at the Center for Financing, Access and Cost Trends (CFACT) plan to use matched Medicaid claims data to validate MEPS use and expenditure data. The quality improvement processes undertaken by CFACT staff enhance the quality of MEPS data for research and policy analysis.

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