DEPARTMENT OF HEALTH

Minnesota All Payer Claims Database Prescription Drug Public Use Files: A User Guide

JUNE, 2022

Table of Contents

MNAPCD All Payer Claims Database

DEPARTMENT OF HEALTH

Background

The Minnesota Department of Health (MDH) maintains the Minnesota All Payer Claims Database (MN APCD), a repository of health care claims data that supports statewide analyses of health care costs, quality, and utilization. Under legislative mandate, MDH releases publicly available summary information from the MN APCD in the form of public use files (PUFs). PUF data are delivered in spreadsheets with aggregated records that prevent the identification of individual members, providers, and health plans. As of June 2022, currently available MN APCD PUFs, derived from medical and pharmacy claims, contain summary data on health care services, health care utilization, primary diagnoses, provider specialties, members, and prescription drugs.[1] This document introduces the prescription drug PUFs, illustrates how to interpret PUF records, and includes technical instructions for users who wish to further aggregate PUF records.

Public Use File Overview

Two versions of MN APCD prescription drug PUFs are available:

- The *Detail* PUF contains retail pharmacy claims data that have been aggregated by the first two segments of the National Drug Code (NDC)
- The S*ummary* PUF contains retail pharmacy claims data that have been aggregated by nonproprietary drug name

PUF levels of aggregation are further explained in the "Definition of a Prescription Drug" section.

Summary and *Detail* PUFs are stratified by payer type (commercial, Medicare, and Minnesota Health Care Programs) and are available for 2012, 2013, 2014, 2016, 2017, and 2018.[2]

Prescription drugs administered in medical settings such as hospitals, infusion centers, nursing homes, or other medical offices—although often high in cost and significant drivers of growth—are not included in these PUFs. These drugs are generally billed in medical claims, as opposed to pharmacy claims, which were the basis for the PUFs.

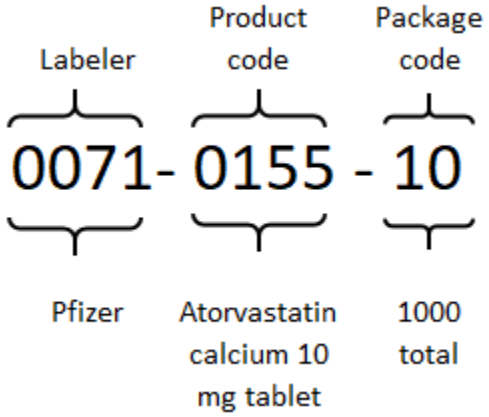
Costs in the PUFs represent health care transactions *before* any applicable rebates. Currently, data on rebates do not exist in a transparent manner and are not required reporting elements under state law that authorizes maintaining the MN APCD. Although these PUFs represent the single largest collection of prescription drug use data for Minnesota, they do not represent prescription drug use by every Minnesotan. For example, the MN APCD does not include claims for certain payers, and the volume of available commercial data has been affected by a recent Supreme Court ruling (see "Other Important Data Considerations" section). **Users must carefully consider their use and interpretation of the data.**

MDH developed the PUFs in partnership with Mathematica and welcomes questions from users at: health.APCD@state.mn.us. MDH appreciates user feedback about experience with the PUFs.

Definition of a Prescription Drug

Prescription drugs are broadly defined by active ingredient (nonproprietary drug name) or more narrowly by the specific product, containing the active ingredient, that a given pharmaceutical company produces. Each product is assigned a unique NDC, which consists of three segments (Figure 1). The first segment identifies the labeler (i.e., the pharmaceutical company). The second segment, which is specific to the labeler, identifies a distinct product in terms of active ingredient(s), active strength, and dosage form. The third segment is a package code, which indicates how a drug is packaged for sale to pharmacies. Package codes may vary with the first two segments of an NDC, but this variation is not relevant to individual prescriptions. Multiple NDCs can share a single nonproprietary drug name.

Figure 1. Illustration of three segments of a National Drug Code.



Data Elements

The PUFs include a number of data elements, including drug characteristics, utilization measures, calculated metrics and rankings, and summary data on the demographics of prescription drug users. NDCs allow linking of descriptive drug characteristics from reference datasets (Food and Drug Administration (FDA) National Drug Code Directory[3] and Medi-Span[4]) to measures of prescription drug use and spending from claims data. Drug characteristics in the PUFs, which differ between *Summary* and *Detail* files (Figure 2), include:

- Nonproprietary name
- Proprietary name
- Brand/generic classification
- Therapeutic class
- Labeler name
- Drug launch year
- Dosage form (e.g., tablet, cream, injection)
- Active strength (e.g., a numerical value)
- Active ingredient unit (e.g., milligrams, milligrams per milliliter)

Figure 2. Example of select drug characteristic variables in *Detail* PUF.

Nonproprietary name	Proprietary name	Brand / generic	Therapeutic Class	Labeler	Form	Strength	Unit
ACETAMINOPHEN	UP & UP ACETAMINOPHEN	Generic	Analgesics & Anesthetics	TARGET	TABLET	500	MG/ 1

The assignment of therapeutic classes to drugs relied on the Medi-Span reference dataset. Therapeutic classes provide a helpful categorization with which to easily view and understand prescription drug data that span thousands of drugs.

At both the *Summary* and *Detail* level, the PUFs provide measures of the number of prescriptions and the number of unique members with a prescription, as well as calculated metrics of mean, median, and standard deviation for:

- Days' supply
- Quantity dispensed
- Health plan paid amount
- Member paid amount
- Total paid amount[5]

Additionally, the *Summary* PUF contains drug rankings by a number of dimensions (e.g., cost per prescription) and distributions of prescription drug user demographic characteristics, including:

- Member age group
- Member sex
- Rural/urban classification of member home ZIP code

Metadata

Exclusions

MN APCD retail pharmacy claims meeting any of the following criteria were excluded from the PUFs in order to optimize the analytic usefulness of the files:

- Duplicate or denied claim
- Member with out-of-state residence
- Member with unknown sex
- Negative quantity dispensed
- Negative paid amounts

Additionally, claims with an NDC that could not be matched to either the FDA National Drug Code Directory or to Medi-Span (reference databases) were excluded. After claims were aggregated to the unit of analysis for each PUF, rows with fewer than 11 unique members or 5 unique prescribers were removed to prevent identification and comply with applicable statutes and data use agreements. The percentage of MN APCD pharmacy claims and costs included in the PUFs are in Tables 1A and 1B. Total claim counts and costs are the same at both levels of PUF aggregation for each year.

Table 1A. Pharmacy claims and costs in the MN APCD and PUFs, 2012–2014.

	2012 total	2012 %	2013 total	2013 %	2014 total	2014 %
Claims						
MN APCD	59,343,505	100.0	61,582,635	100.0	63,865,957	100.0
Excluded/redacted	1,617,344	2.7	1,411,578	2.3	1,560,004	2.4
Included in PUF	57,726,161	97.3	60,171,057	97.7	62,305,953	97.6
Costs						
MN APCD	$4,783,431,982	100.0	$4,972,450,437	100.0	$5,448,826.58	100.0
Excluded/redacted	$153,971,557	3.2	$161,110,057	3.2	$200,648,801	3.7
Included in PUF	$4,629,460,425	96.8	$4,811,340,380	96.8	$5,248,177,779	96.3

Table 1B. Pharmacy claims and costs in the MN APCD and PUFs, 2016–2018.

	2016 total	2016 %	2017 total	2017 %	2018 total	2018 %
Claims						
MN APCD	57,450,133	100.0	56,412,669	100.0	55,626,364	100.0
Excluded/redacted	1,585,138	2.8	1,389,969	2.5	846,506	1.5
Included in PUF	55,864,995	97.2	55,022,700	97.5	54,779,840	98.5
Costs						
MN APCD	$5,626,992,080	100.0	$5,712,694,476	100.0	$5,842,952,607	100.0
Excluded/redacted	$285,241,410	5.1	$304,473,797	5.3	$310,031,155	5.3
Included in PUF	$5,341,750,670	94.9	$5,408,220,679	94.7	$5,532,921,452	94.7

Note: 2016–2018 data reflect a loss of a subset of commercial claims from self-insured plans.

Descriptive Statistics

Tables 2A and 2B report payer specific claim counts, total costs, and cost sharing for each PUF year. These measures can serve as control totals for users. The tables show that a substantial share of total costs is paid by insurers. However, as noted, rebates paid to pharmacy benefit managers (PBMs) and insurers by the pharmaceutical companies, which partially offset insurer costs, are not included in the MN APCD.[6]

Table 2A. PUF totals, 2012–2014.

	2012	2013	2014
Total claims	57,726,161	60,171,057	62,305,953
Commercial	26,470,095	26,722,751	27,017,834
Medicare	20,642,694	22,381,607	22,528,843
MN Health Care Programs	10,613,372	11,066,699	12,759,276
Total costs	$4,629,460,425	$4,811,340,380	$5,248,177,779
Commercial	$2,548,889,586	$2,555,726,140	$2,655,714,754
Medicare	$1,421,732,228	$1,563,743,981	$1,722,806,315
MN Health Care Programs	$658,838,610	$691,870,259	$869,656,710
Cost-sharing (percentage)			
Commercial			
Insurer paid	80.28%	82.30%	83.95%
Member paid	19.67%	17.64%	15.99%
Other paid	0.05%	0.06%	0.06%
Medicare			
Insurer paid	81.02%	82.31%	82.86%
Member paid	18.55%	17.25%	16.91%
Other paid	0.43%	0.44%	0.22%
MN Health Care Programs			
Insurer paid	92.46%	92.58%	94.30%
Member paid	1.54%	1.44%	1.15%
Other paid	6.01%	5.98%	5.45%

Table 2B. PUF totals, 2016–2018.

	2016	2017	2018
Total claims	55,864,995	55,022,700	54,779,840
Commercial	18,755,517	18,256,378	17,489,243
Medicare	23,182,943	22,945,419	23,243,218
MN Health Care Programs	13,926,535	13,820,903	14,047,379
Total costs	$5,341,750,670	$5,408,220,679	$5,532,921,452
Commercial	$2,215,106,268	$2,253,652,114	$2,246,946,669
Medicare	$2,107,143,922	$2,157,877,038	$2,228,990,469
MN Health Care Programs	$1,019,500,480	$996,691,526	$1,056,984,314
Cost-sharing (percentage)			
Commercial			
Insurer paid	84.44%	85.32%	84.85%
Member paid	15.48%	14.59%	14.38%
Other paid	0.08%	0.10%	0.78%
Medicare			
Insurer paid	84.93%	84.61%	83.37%
Member paid	14.92%	15.26%	15.75%
Other paid	0.14%	0.13%	0.87%
MN Health Care Programs			
Insurer paid	93.86%	95.01%	94.95%
Member paid	1.49%	1.36%	1.32%
Other paid	4.64%	3.63%	3.73%

Note: 2016–2018 data reflect a loss of a subset of commercial claims from self-insured plans.

Other Important Data Considerations

Minnesota policymakers structured the requirements for data submission under the MN APCD to focus on payers under its jurisdiction and payers who represent the primary volume of health care services in the state. As such, the MN APCD was not designed to capture pharmacy (or medical) claims for individuals who are covered by Tricare, Veterans Affairs, the Indian Health Service, or Workers' Compensation. Additionally, the the MN APCD does not include:

- Prescription drug use or spending by Minnesotans who are uninsured
- Claims for services provided by plans that do not cover general medical care, such as accident-only, vision, or dental plans
- Low-volume submitters of pharmacy claims, defined as having less than $300,000 in claims volume (exempt from submission to the MN APCD)
- Written prescriptions that were never filled

As noted earlier, prescription drugs administered in medical settings such as hospitals, infusion centers, nursing homes, or other medical offices *are* submitted to the MN APCD. However, the Prescription Drug PUFs include only prescription drugs obtained through a retail pharmacy.

There are a number of additional data characteristics that PUF users should consider. We have referred to most of these characteristics throughout the document but provide additional details here:

- **What price data are available?** Pricing for prescription drugs is opaque and complex. It evolves from negotiations between multiple parties across the supply chain and is influenced by a range of incentives. Absent robust transparency laws, the final price—paid by Medicaid, Medicare, or as a whole or by individual commercial payers—is a closely guarded trade secret. Data systems like the MN APCD generally capture the paid amount *before* rebate transactions occur. This means the actual transacted price is overstated for many drugs in the PUFs.

  Similarly, the MN APCD and the PUFs do not capture the influence of coupons or other discounts from list prices that pharmaceutical manufacturers selectively grant members. Interpretation of cost per prescription should consider supply measures such as quantity dispensed and days' supply.

- **Are self-insured claims part of the data?** In a decision released on March 1, 2016, the U.S. Supreme Court upheld a lower court's ruling that self-insured health plans, or large employers who retain the insurance risk for their employees, could not be required to submit claims data to a state's APCD (Gobeille v. Liberty Mutual Insurance Co.). The court found that requiring private self-insured plans to participate in state APCDs was preempted by the Employee Retirement Income Security Act (ERISA). The ruling does not prohibit the voluntary submission of self-insured plan data to the MN APCD, a decision that rests with employers themselves and not their brokers.

  Although Minnesota is working with self-insured employers and brokers to encourage reporting and create conditions that are conducive to doing so without additional burden, the court's ruling resulted in a substantial reduction in the volume of commercial claims beginning in the spring of 2016. Summing commercial prescription counts and costs of 2016 (and later) data in the PUFs would therefore result in a considerable underestimate of use and spending across the whole commercial market. To the extent that the demographics of fully and self-insured employees differ, user characteristics could also be affected. The calculation of averages or per-unit measures for commercial enrollees are not expected to be materially impacted by the reduction in the data volume.

Appendix B: Interpreting PUF Data

The following tables show subsets of data from the *Summary* and *Detail* PUFs to illustrate how to interpret key data elements. The sample *Detail* PUF data are derived from three records representing a single two segment NDC and all payer types. The two segment NDC, 60505-2580, is for a generic version of atorvastatin calcium (nonproprietary name), which is used to treat high cholesterol and sold under the brand name Lipitor. This particular NDC, a tablet containing 40 milligrams of the active ingredient and produced by Apotex, accounted for more prescriptions of atorvastatin calcium in 2016 than any other NDC, having grown from a relatively minor contributor in 2012.

Detail PUF

Table 3A shows a variety of mean paid amounts across payer types for the selected NDC in 2012 and 2018. Commercial insurers in 2012 accounted for 13,517 scripts with a mean days' supply of 57.1. The insurers paid an average of $31.92 per script while members paid an average of $15.30, or about half as much. The mean total amount paid was $47.24, which includes a very small amount paid by another source (not shown separately). Medicare accounted for 16,192 scripts with a mean days' supply of 61.2, slightly higher than the commercial average. Medicare paid an average of $32.56 per script while members paid an average of $15.40. The mean total amount paid was $48.22. Minnesota Health Care Programs (MHCP) accounted for many fewer scripts than the other two payers at 1,540 with a mean days' supply of 30.2, about half that of the commercial insurers and Medicare. Minnesota Health Care Programs paid an average of $21.46 per script while members paid an average of $1.63. The mean total amount paid was $23.46.

Table 3A. Select mean cost statistics for two segment NDC 60505-2580 by payer type, 2012 and 2018.

Year	Product NDC	Payer	Number scripts	Days supply mean	Insurer paid mean	Member paid mean	Total paid mean
2012	60505-2580	Commercial	13,517	57.1	$31.92	$15.30	$47.24
2012	60505-2580	Medicare	16,192	61.2	$32.56	$15.40	$48.22
2012	60505-2580	MHCP	1,540	30.2	$21.46	$1.63	$23.46
2018	60505-2580	Commercial	59,151	68.2	$8.82	$9.20	$18.40
2018	60505-2580	Medicare	137,976	60.5	$10.96	$5.87	$17.03
2018	60505-2580	MHCP	36,177	29.7	$7.03	$1.14	$8.21

Comparing the calculated mean amounts across years—for example, calculating the unit or the percent change—is, in general, straightforward. All mean (or average) values can be compared directly. For example, as shown in Table 3B, the mean days' supply in 2018 was higher for commercial payers, lower for Medicare, and much lower Minnesota Health Care Programs. The

mean total price paid declined substantially between 2012 and 2018, dropping nearly two-thirds for each payer. The average insurer-paid amounts declined much faster than the average member-paid amounts, especially among commercial payers and Minnesota Health Care Programs.

Comparing sum values—specifically, the number of scripts as shown in Table 3A, or the amounts paid—is more complicated, but only for commercial payers. Recall that commercial scripts are understated in 2016, 2017, and 2018 due to unreported self-insured commercial claims. The total volume of commercial scripts can be estimated only among the 2012, 2013 and 2014 prescription drug PUFs. However, sum values for Medicare and Minnesota Health Care Programs can be compared across all PUF years—with the caveat that underlying enrollment in those programs has changed due the numbers of Minnesotans becoming eligible (in particular, for Medicare) and Minnesota Health Care Program changes that affect eligibility.

Table 3B. Select percentage change cost statistics for two segment NDC 60505-2580 by payer type, 2012–2018.

Year	Product NDC	Payer	Number scripts	Days supply mean	Insurer paid mean	Member paid mean	Total paid mean
2012–2018	60505-2580	Commercial	N/A*	19.4%	-72.4%	-39.9%	-61.1%
2012–2018	60505-2580	Medicare	752.1%	-1.1%	-66.3%	-61.9%	-64.7%
2012–2018	60505-2580	MHCP	2249.2%	-1.7%	-67.2%	-30.1%	-65.0%

*The total number of commercial-payer scripts cannot be compared among the 2016, 2017, and 2018 PUFs or with earlier PUF years due to unreported self-insured commercial claims in 2016–2018.

Additional statistics for the same NDC are shown in Tables 4 and 5, focusing on average costs per user, script, and days' supply. For most patients, the cost per user is probably an annual cost. The exceptions are patients who started or stopped taking the drug during the year or were switched to a different NDC or changed payer during the year.[7][1] In 2012, the cost per user was about twice the cost per script—for example, among commercial payers, $98.00 per user compared with $47.24 per script. This implies that on average the users of this NDC filled two scripts during the year. The cost per script in Table 4 is identical to the mean total paid in Table 3A (which is calculated per script). The cost per days' supply is more uniform across payers than the previous two measures: in 2012, $0.83 for commercial payers, $0.79 for Medicare, and $0.78 for Minnesota Health Care Programs. The cost per unit dispensed—in this case a single 40 milligram tablet—is slightly more varied at $0.88 for commercial payers, $0.84 for Medicare, and $0.77 for Minnesota Health Care Programs. That the costs per unit are slightly higher than

[1] Patients continuing with the same NDC but changing payer type will appear in one row of the PUF for part of the year and another row for the rest of the year.

the cost per days' supply implies that the average days' supply is somewhat less than one tablet.

Table 4. Select unit cost statistics for two segment NDC 60505-2580 by payer type, 2012 and 2018.

Year	Product NDC	Payer	Number scripts	Cost per user	Cost per script	Cost per days supply	Cost per unit dispensed
2012	60505-2580	Commercial	13,517	$98.00	$47.24	$0.83	$0.88
2012	60505-2580	Medicare	16,192	$104.13	$48.22	$0.79	$0.84
2012	60505-2580	MHCP	1,540	$57.70	$23.46	$0.78	$0.77
2018	60505-2580	Commercial	59,151	$52.83	$18.40	$0.27	$0.26
2018	60505-2580	Medicare	137,976	$58.66	$17.03	$0.28	$0.28
2018	60505-2580	MHCP	36,177	$35.67	$8.21	$0.28	$0.28

The reduction in costs for this NDC between 2012 and 2018, which we saw in comparing across years in Table 3A, is echoed in the reduction in cost per days' supply and cost per unit shown in Table 4. These costs are more uniform across payer in 2018 than in 2012. The average cost per days' supply was $0.27 for commercial payers and $0.28 for Medicare and Minnesota Health Care Programs. The cost per unit was identical to the cost per days' supply for Medicare and Minnesota Health Care Programs, and just a penny more for commercial payers. The similarity of these costs implies that the average days' supply is closer to a full tablet in 2018 than 2012.

Another change between 2012 and 2018 was an increase in the ratio of average cost per user to the average cost per script. This ratio equals the estimated number of scripts per user. For commercial payers the cost per user was 2.87 times the cost per script, implying that users filled slightly less than 3 scripts of this NDC on average in 2018. For Medicare, the cost per user in 2018 was 3.44, implying that users of this NDC filled about 3.5 scripts on average in 2018. For Minnesota Health Care Programs the cost per user was 4.34 times the cost per script, although (as we saw in Table 3A), the mean days' supply for scripts covered by these programs was much less: 29.7 days in 2018 compared with more than 60 days for commercial payers and Medicare.

Summary PUF

Table 5 shows selected cost statistics from the *Summary* PUF for all atorvastatin calcium scripts in the MN APCD in 2012 and 2018 (including the NDC used to populate Tables 3 and 4.) Grouping by nonproprietary name combines brand and generic formulations of the drug, as well as all dosage forms and active strengths for the drug sold in Minnesota in each year.

Table 5. Select mean cost statistics for atorvastatin calcium by payer type, 2012 and 2018.

Year	Payer	Number scripts	Days supply mean	Insurer paid mean	Member paid mean	Total paid mean	Cost per days supply
2012	Commercial	325,615	58.2	$111.29	$28.79	$140.15	$2.41
2012	Medicare	277,747	58.5	$97.68	$23.03	$121.31	$2.07
2012	MHCP	24,312	30.3	$54.08	$1.60	$56.97	$1.88
2018	Commercial	471,437	69.4	$10.64	$7.86	$18.73	$0.27
2018	Medicare	806,169	68.7	$11.88	$7.02	$19.08	$0.28
2018	MHCP	247,928	30.0	$7.68	$0.70	$8.43	$0.28

In 2012, commercial payers accounted for the largest number of atorvastatin calcium scripts (325,615), followed by Medicare (277,747) and Minnesota Health Care Programs (24,312). Scripts paid by commercial payers or Medicare averaged slightly less than a 60-day supply, while scripts paid by Minnesota Health Care Programs averaged just 30.3 days. The insurer paid, member paid, and total paid amounts were higher for commercial payers than for Medicare (for example, $111.29 versus $97.68 for the average insurer paid amount), and substantially less for Minnesota Health Care Programs. The cost per days' supply was $2.41 for commercial payers, $2.07 for Medicare, and $1.88 for Minnesota Health Care Programs.

In 2018, Medicare paid for nearly three times as many atorvastatin calcium scripts (806,169) as in 2012 (277,747), while Minnesota Health Care Programs paid for 10 times as many scripts (247,928 in 2018, compared with 24,312 in 2012). From 2012 to 2018, the mean days' supply rose modestly for commercial payers and Medicare (to about 70 days) but remained about the same for Minnesota Health Care Programs (at about 30 days). Mean costs (per script) declined sharply from 2012 to 2018—for example for commercial payers, the mean insurer-paid amount dropped from $111.29 in 2012 to $10.64 in 2018, the mean member-paid amount dropped from $28.79 to $7.86, and the mean total cost dropped from $140.15 to $18.73. Members across all payers paid a larger share of the costs of this drug than their insurers in 2018 compared to 2012 (percent shares not shown). The total cost per days' supply was nearly equal across payers: $0.27 for commercial payers, and $0.28 for Medicare, and Minnesota Health Care Programs.

Appendix C: User Calculations

Means for Alternative Units

The mean costs reported on each PUF are calculated over the number of prescriptions filled. Users may also wish to calculate average expenditures over different units—for example, per unique member, per days' supply, or per unit dispensed. Means for alternative units have already been computed in each PUF for the total paid amount, but it can also be calculated for the member-paid or insurer-paid amounts. For example, the average member cost per script can be calculated by dividing the total member cost by the number of scripts, and the average member cost per member can be calculated by dividing the total member cost by the number of unique members. Similarly, the average member cost per days' supply can be calculated by dividing the mean member cost by the mean days' supply, and the average member cost per unit dispensed can be calculated by dividing the mean member cost by the mean quantity dispensed.

Examples of these cost calculations are shown in Table 6 for the single NDC 60505-2580 used in the earlier illustrations, by payer type in 2018. The average cost per member is calculated by dividing the sum of the member paid amounts by the number of unique members. The average member cost per day is calculated by dividing the mean member paid amount by the mean days' supply.

Table 6. Select unit cost statistics for two segment NDC 60505-2580 by payer type, 2018.

Year	Payer	Unique members	Member paid sum	Cost per member	Days supply mean	Member paid mean	Member cost per day
2018	Commercial	20,599	$543,915.40	$26.41	68.2	$9.20	$0.13
2018	Medicare	40,064	$809,704.50	$20.21	60.5	$5.87	$0.10
2018	MHCP	8,326	$41,365.15	$4.97	29.7	$1.14	$0.04

Aggregating Records

Users may wish to aggregate PUF records across payer type or combine selected drugs. Aggregation methods vary by type of statistic.

Counts

Counts of prescriptions filled and paid amounts can be summed across PUF records directly; however, summing counts of unique members across PUF records is more complex. Depending on the rows being summed, a given member may appear in more than one PUF record – most commonly by obtaining prescriptions for more than one drug. In such cases, the sum will overstate the number of unique members by counting some individuals more than once. Summing unique members across payer type within the same NDC or nonproprietary drug is

less likely to produce an overestimate of unique members than is summing across drugs, but changes in payer type within a given year do occur.

Means

When records in the PUF are aggregated, the mean of the aggregate record (i.e., the grand mean for the set of records) can be calculated as the weighted average of the means of the individual records, where the weights are the numbers of prescriptions. This calculation is illustrated in Table 7 using data from the three 2018 records in Table 3. This represents an aggregation of records for a single NDC over payer types.

Table 7. Calculation of mean for an aggregate of PUF records (grand mean)

PUF record	Number of scripts	Mean total paid	Number of scripts x mean total paid	Grand mean
1	59,151	$18.40	1,088,378.40	N/A
2	137,976	$17.03	2,349,731.28	N/A
3	36,177	$8.21	297,013.17	N/A
Sum	233,304	N/A	3,735,122.85	$16.01*

*3,735,122.85 / 233,304

Medians

Calculating the exact median of a measure requires access to the underlying microdata (i.e., individual claims). Unlike means, the weighted median of a set of individual PUF records is not the median of the aggregate PUF record. However, with a large number of PUF records, none of which having a substantially greater number of claims, the weighted median of the individual record medians provides a good approximation of the median of the aggregate record. The calculation illustrated in Table 7 can be used to obtain the approximate median for an aggregate of PUF records by substituting the variable median total paid for mean total paid.

Standard Deviations

Calculating the standard deviation for an aggregate of PUF records is more complex than calculating the mean, as it requires performing several computational operations on the data from the individual records. The operations described below are illustrated in the corresponding numeric columns in Table 8. Columns with non-numeric names represent PUF data.

(1) Square the standard deviation from each record and multiply it by the number of scripts. Summing these products across records yields the *within group sum of squares*.[a]

(2) Calculate the difference between each record mean and the grand mean (see Table 7 for grand mean calculation) and square this difference.

(3) Multiply the squared difference from (2) by the number of scripts. Summing these values across records yields the *between group sum of squares*.[b]

(4) Sum the *within group sum of squares* and the *between group sums of squares*, and divide the result by the total number of scripts in the aggregate record to calculate a mean squared deviation or variance. Take the square root of the variance to obtain the standard deviation of the aggregate record.

Table 8. Calculation of standard deviation for an aggregate of records.

PUF record	Number of scripts	Total paid SD	(1)	Total paid mean	(2)	(3)	(4)
1	59,151	$13.91	11,445,014.60	$18.40	5.72	338,343.72	N/A
2	137,976	$13.84	26,428,695.71	$17.03	1.04	143,495.04	N/A
3	36,177	$27.57	27,498,314.97	$8.21	60.82	2,200,285.14	N/A
Aggregate	233,304	N/A	65,372,025.28[a]	$16.01	N/A	2,682,123.90[b]	17.08

[a]*within group sum of square*
[b]*between group sum of squares*

Example column calculations in Table 8:

(1) $13.91^2 * 59{,}151 = 11{,}445{,}014.60$

(2) $(18.40 - 16.01)^2 = 5.72$

(3) $5.72 * 59{,}151 = 338{,}343.72$

(4) $\sqrt{\frac{65{,}372{,}025.28 + 2{,}682{,}123.90}{233{,}304}} = 17.08$ (standard deviation of aggregate record)

[1] At this time, all PUFs are available free of charge to the user community. PUFs may be downloaded online by completing a survey form: https://survey.vovici.com/se/56206EE333F13F0F.

[2] Prescription drug data for 2015 are not currently available in the PUFs.

[3] The National Drug Code Directory is available here: https://www.fda.gov/drugs/drug-approvals-and-databases/national-drug-code-directory.

[4] Copyright ©2022 Wolters Kluwer Clinical Drug Information Inc. Publication of research findings or reference to Medi-Span in these PUFs does not constitute an endorsement by Wolters Kluwer Clinical Drug Information Inc.

[5] As noted earlier, all paid amount variables in the PUFs represent pre-rebate transactional payments.

[6] More information on prescription drug rebates is available here: https://www.milliman.com/-/media/Milliman/importedfiles/uploadedFiles/insight/2018/prescription-drug-rebates.ashx.

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