

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

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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 publically 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.

Currently available MN APCD PUFs, derived from medical claims, contain summary data on health care services, health care utilization, and primary diagnoses.¹ To aid in the study of increasing prescription drug spending and use in Minnesota, MDH has prepared a new generation of PUFs from pharmacy claims. This document introduces these files, illustrates how to interpret individual records, and includes technical instructions for users who wish to further aggregate records.

A separate data short take has been prepared to illustrate potential uses of the PUFs. The data short take is available online: www.health.state.mn.us/healthconomics.

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 *Summary* 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 and 2016. These years were selected to allow for analysis of the most recent claims data across *all* payers in the MN APCD with a look back at five year change.

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.

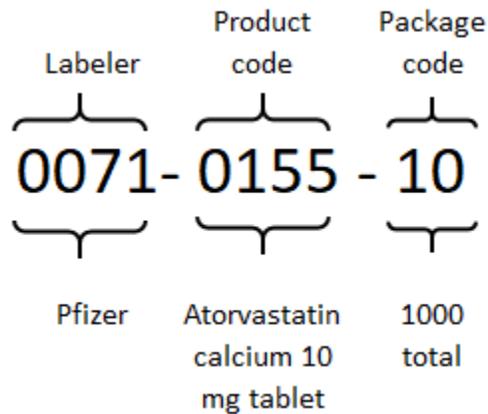
Costs in the PUFs represent health care transactions *before* any applicable rebates. Currently, data on rebates do not exist in a transparent manner and are not required reporting elements under state law that authorizes maintaining the MN APCD. Although these PUFs represent the single largest collection 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 range 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 Directory² and Medi-Span³) 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 and additionally on expert opinion from a contributing pharmacist. Therapeutic classes provide a helpful categorization with which to easily view and understand prescription drug data that spans 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 amount⁴

Additionally, the *Summary* PUF contains a variety of drug rankings (e.g., cost per prescription) and distributions of prescription 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 Table 1. Total claim counts and costs are the same at both levels of PUF aggregation for each year.

MN APCD PRESCRIPTION DRUG PUFs

Table 1. Pharmacy claims and costs in the MN APCD and PUFs, 2012 and 2016.

	2012 total	2012 %	2016 total	2016 %
Claims				
MN APCD Extract 22	56,951,055	100.0	56,498,305*	100.0
Excluded from PUFs	1,072,680	1.9	1,168,763	2.1
Included in PUFs	55,878,375	98.1	55,329,542	97.9
Costs				
MN APCD Extract 22	\$4,799,452,123	100.0	\$5,606,933,253*	100.0
Excluded from PUFs	\$152,324,314	3.2	\$281,559,244	5.0
Included in PUFs	\$4,647,127,809	96.8	\$5,325,374,009	95.0

* 2016 data reflect a loss of a subset of commercial claims from self-insured plans.

Descriptive Statistics

Table 2 reports payer specific claim counts, total costs, and cost sharing for each PUF year. These measures can serve as control totals for users. Table 2 shows 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.⁵

Table 2. PUF control totals.

	2012	2016
Total claims (N)		
Commercial*	26,480,741	18,731,074
Medicare	18,831,893	22,739,200
MN Health Care Programs	10,565,741	13,859,268
Total costs (dollars)		
Commercial*	2,563,399,370	2,226,729,176
Medicare	1,396,168,184	2,094,112,310
MN Health Care Programs	687,560,255	1,004,532,523
Cost-sharing (percentage)		
Commercial		
Insurer paid	80.3	84.4
Member paid	19.6	15.5
Other paid**	0.1	0.1
Medicare		
Insurer paid	82.6	85.1
Member paid	17.0	14.8
Other paid**	0.4	0.1
MN Health Care Programs		
Insurer paid	93.5	96.2
Member paid	1.6	1.5
Other paid**	4.9	2.3

*2016 data reflect a loss of a subset of commercial claims from self-insured plans.

**Includes payments from another source, such as a secondary insurer. Calculated in PUF records as the total paid minus the insurer paid and member paid.

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 certain prescription drug use, including:

- Drug claims from Tricare, Veterans Affairs, the Indian Health Service, and Workers' Compensation
- Drug spending by the uninsured (because there is no institutional payer reimbursing part of the cost and able to submit data)
- 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 PUFs include only retail pharmacy prescription drugs.

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 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.

- **What is the impact of de-identification?** Information collected in the MN APCD is required to be de-identified. In the process of data submission, payers hash certain data elements through a one-way encryption process and drop other data elements altogether. MDH’s data vendor then consolidates enrollment data and medical and pharmacy claims using the hashed variables from different data submitters. Because individuals’ names may appear differently across data submitters, the resulting hashed variables may not successfully link across all data submitters, which creates “new” unique enrollees. Though member transition across payers is moderate, it may be that individual level drug use is underestimated (because not all use is appropriately assigned, as some use is attributed to “new” unique users).
- **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 (Table 3). Summing commercial prescription counts and costs of 2016 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 are not expected to be impacted by the reduction in the data volume.

MN APCD PRESCRIPTION DRUG PUFs

Table 3. Monthly MN APCD pharmacy claim count by payer type, 2016.

Month	MN Health Care			Total*
	Medicare	Programs	Commercial	
January	1,837,631	1,170,266	1,809,134	4,871,718
February	1,799,007	1,150,439	1,819,895	4,825,263
March	1,954,429	1,254,137	1,614,431	4,884,502
April	1,855,125	1,169,405	1,469,333	4,551,865
May	1,903,752	1,193,040	1,477,287	4,633,872
June	1,928,089	1,158,403	1,472,277	4,618,656
July	1,838,373	1,082,301	1,393,996	4,370,918
August	1,996,890	1,189,602	1,522,849	4,771,469
September	1,927,335	1,164,218	1,500,687	4,652,201
October	1,958,264	1,152,834	1,575,046	4,745,467
November	1,927,275	1,144,928	1,590,867	4,723,594
December	1,971,404	1,130,398	1,686,400	4,848,780
Total	22,897,557	13,959,971	18,932,202	56,498,305

*Includes claims with unknown payer type.

Note: Data are from the enhanced pharmacy table in MN APCD Extract 22.

¹ At this point, all PUFs are available free of charge to the user community. PUFs may be downloaded online by completing a request form: <https://www.health.state.mn.us/data/apcd/publicusefiles/about.html>.

² The National Drug Code Directory is available here: <https://www.fda.gov/drugs/drug-approvals-and-databases/national-drug-code-directory>.

³ Copyright ©2018 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.

⁴ As noted earlier, all paid amount variables in the PUFs represent pre-rebate transactional payments.

⁵ 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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Appendix A: Demographic Distributions

Table 4. Demographics of Minnesota population.

Characteristic	Percentage of population
Age	
≤19 years	26.2
20 to 44 years	32.7
45 to 64 years	26.9
65+ years	14.3
Sex	
Female	50.3
Male	49.7
RUCA class	
Urban core	61.6
Suburban	11.4
Micropolitan	11.4
Rural/small town	15.3
Unassigned	0.3

Source: 2012-2016 American Community Survey 5-Year Estimates.

Table 5. Demographics of Minnesota commercially insured population.

Characteristic	Percentage of population
Age	
≤18 years	24.1
19 to 44 years	39.9
45 to 64 years	33.7
65+ years	2.3
Sex	
Female	50.0
Male	50.0
RUCA class	
Urban core	63.2
Suburban	13.2
Micropolitan	13.9
Rural/small town	9.7
Unassigned	0.1

Source: MN APCD extract 22 estimates, 2016.

Table 6. Demographics of Minnesota Medicare population.

Characteristic	Percentage of population
Age	
≤18 years	0.0
19 to 44 years	1.3
45 to 64 years	6.7
65+ years	92.0
Sex	
Female	53.0
Male	47.0
RUCA class	
Urban core	53.4
Suburban	11.2
Micropolitan	14.1
Rural/small town	21.3
Unassigned	0.0

Source: MN APCD extract 22 estimates, 2016.

Table 7. Demographics of Minnesota Health Care Program population.

Characteristic	Percentage of population
Age	
≤18 years	43.4
19 to 44 years	38.7
45 to 64 years	16.7
65+ years	1.3
Sex	
Female	52.9
Male	47.1
RUCA class	
Urban core	63.3
Suburban	8.3
Micropolitan	12.1
Rural/small town	15.9
Unassigned	0.5

Source: MN APCD extract 22 estimates, 2016.

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 8 shows a variety of mean paid amounts across payer types for the selected NDC in 2012. Commercial insurers in 2012 accounted for 13,000 prescriptions with a mean days' supply of 63.26. Commercial insurers paid an average of \$35.33 per prescription, while members paid an average of \$16.08. The mean total paid amount was \$51.43. Medicare accounted for 15,189 prescriptions with a mean days' supply of 66.01, slightly higher than the commercial average. Medicare paid an average of \$36.68 per prescription, while members paid an average of \$16.19. The mean total paid amount was \$53.13. Minnesota Health Care Programs (denoted MHCP in the table) accounted for 1,421 prescriptions, significantly fewer than the other two payers, with a shorter mean days' supply of 35.05. Minnesota Health Care Programs paid an average of \$25.19 per prescription while members paid an average of just \$1.66. The mean total amount paid was \$27.22

Table 8. Select mean cost statistics for two segment NDC 60505-2580 by payer type, 2012.

Year	Product NDC	Payer	Number scripts	Days' supply mean	Insurer paid mean	Member paid mean	Total paid mean
2012	60505-2580	Commercial	13,000	63.26	\$35.33	\$16.08	\$51.43
2012	60505-2580	Medicare	15,189	66.01	\$36.68	\$16.19	\$53.13
2012	60505-2580	MHCP	1,421	35.05	\$25.19	\$1.66	\$27.22

Table 9 shows paid amounts for the selected NDC in 2016. The number of prescriptions filled for this NDC rose substantially between 2012 and 2016, reaching 57,537 for commercial payers, 119,741 for Medicare, and 28,059 for Minnesota Health Care Programs. The mean days' supply was slightly higher in 2016 for the first two payers and slightly lower for Minnesota Health Care Programs. The mean total paid amount declined substantially between 2012 and 2016, dropping by approximately two-thirds for each payer. The reduction in the average amounts paid by insurers was more substantial, with the commercial average dropping to a level near Minnesota Health Care Programs (\$6.84 vs. \$6.44), while Medicare paid \$11.44 on average. The reduction in the average member price was more modest. Members with commercial insurance

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paid an average of \$10.78 in 2016 compared to \$7.13 for members with Medicare and \$1.53 for members covered by Minnesota Health Care Programs.

Table 9. Select mean cost statistics for two segment NDC 60505-2580 by payer type, 2016.

Year	Product NDC	Payer	Number scripts	Days' supply mean	Insurer paid mean	Member paid mean	Total paid mean
2016	60505-2580	Commercial	57,537	66.30	\$6.84	\$10.78	\$17.62
2016	60505-2580	Medicare	119,741	68.72	\$11.44	\$7.13	\$18.61
2016	60505-2580	MHCP	28,059	30.38	\$6.44	\$1.53	\$7.99

Table 10 presents additional statistics for the same NDC, focusing on average costs for alternative units: users, prescriptions, and days' supply. The cost per user is typically the annual cost, except for members who started or stopped taking the drug midway through the year or switched to a different NDC. In 2012, the cost per user in this example was more than twice the cost per prescription (\$105.45 per user vs. \$51.43 per prescription for commercial payers), implying that on average the users of this NDC filled two prescriptions during the year. The cost per prescription in Tables 10 and 11 is identical to the mean total paid in Tables 8 and 9, as the latter average cost is calculated per prescription. The 2012 cost per days' supply is more uniform across payers than the previous two per unit measures at \$0.81 for commercial payers, \$0.80 for Medicare, and \$0.78 for Minnesota Health Care Programs. The cost per unit dispensed (40 milligram tablet) was slightly more varied at \$0.92 for commercial payers, \$0.87 for Medicare, and \$0.79 for Minnesota Health Care Programs. The higher cost per unit as compared to the cost per days' supply implies that the average days' supply was less than one tablet.

Table 10. Select unit cost statistics for two segment NDC 60505-2580 by payer type, 2012.

Year	Product NDC	Payer	Number scripts	Cost per user	Cost per script	Cost per days' supply	Cost per unit dispensed
2012	60505-2580	Commercial	13,000	\$105.45	\$51.43	\$0.81	\$0.92
2012	60505-2580	Medicare	15,189	\$111.57	\$53.13	\$0.80	\$0.87
2012	60505-2580	MHCP	1,421	\$64.80	\$27.22	\$0.78	\$0.79

The reduction in costs for this NDC between 2012 and 2016, seen in comparing Tables 8 and 9, is echoed in the reduction in cost per days' supply and cost per unit seen in comparing Tables 10 and 11. These per unit costs are more uniform across payers in 2016 as compared to 2012. The average cost per days' supply was \$0.27 cents for commercial payers and Medicare and \$0.26 for Minnesota Health Care Programs. The cost per unit is identical to the cost per days' supply for commercial payers and one cent higher than the cost per days' supply for Medicare and the Minnesota Health Care Programs. The similarity of these costs implies that the average

days' supply was closer to a full tablet in 2016 than in 2012. Note that the ratio of average cost per user to the average cost per prescription was higher in 2016 than in 2012. For both commercial payers and Medicare, the cost per user in 2016 was more than three times the cost per prescription, implying that users of this NDC filled more than three prescriptions, on average, in 2016. For Minnesota Health Care Programs, the cost per user was five times the cost per prescription; however, Table 9 showed that the mean days' supply for prescriptions covered by these programs was 30.38 days in 2016 compared to over 60 days for commercial payers and Medicare, meaning more prescriptions would be warranted for members covered by Minnesota Health Care Programs.

Table 11. Select unit cost statistics for two segment NDC 60505-2580 by payer type, 2016.

Year	Product NDC	Payer	Number scripts	Cost per user	Cost per script	Cost per days' supply	Cost per unit dispensed
2016	60505-2580	Commercial	57,537	\$52.74	\$17.62	\$0.27	\$0.27
2016	60505-2580	Medicare	119,741	\$66.28	\$18.61	\$0.27	\$0.28
2016	60505-2580	MHCP	28,059	\$40.31	\$7.99	\$0.26	\$0.27

Summary PUF

Tables 12 and 13 show selected cost statistics from the *Summary* PUF for atorvastatin calcium prescriptions. These *Summary* PUF data include the two segment NDC used to populate Tables 8 through 11. Aggregating claims by nonproprietary name combines brand and generic formulations of the drug as well as all dosage forms and active strengths. In 2012, commercial payers accounted for the most atorvastatin calcium prescriptions at 323,440, followed by Medicare at 266,771. Minnesota Health Care Programs accounted for a small fraction of all prescriptions with 23,641. Prescriptions paid by commercial payers or Medicare included more than a 60 day supply, on average, while prescriptions paid by Minnesota Health Care Programs covered just 33.99 days on average. The insurer paid, member paid, and total paid amounts were higher for commercial payers than for Medicare, while these amounts were substantially lower for prescriptions paid by Minnesota Health Care Programs. The cost per days' supply was similar for commercial payers and Medicare (\$2.10 versus \$2.05) while lower for Minnesota Health Care Programs (\$1.77).

Table 12. Select mean cost statistics for atorvastatin calcium by payer type, 2012.

Year	Payer	Number scripts	Days' supply mean	Insurer paid mean	Member paid mean	Total paid mean	Cost per days supply
2012	Commercial	323,440	67.73	\$113.04	\$29.13	\$142.24	\$2.10
2012	Medicare	266,771	61.37	\$102.28	\$22.62	\$125.52	\$2.05
2012	MHCP	23,641	33.99	\$57.22	\$1.72	\$60.05	\$1.77

MN APCD PRESCRIPTION DRUG PUF5

Approximately twice as many prescriptions for atorvastatin calcium were filled in 2016 compared to 2012, with Medicare prescriptions increasing from 266,771 to 644,296. Commercial prescriptions are understated in 2016 relative to 2012 (see “Other Important Data Considerations” section), and the total volume of commercial prescriptions between the two years should not be compared. The mean days’ supply rose modestly between the two years for commercial payers and Medicare while declining for Minnesota Health Care Programs. Medicare prescriptions covered approximately 30 days, on average, compared to 70 days for the other payers. Mean costs for all measures declined sharply between 2012 and 2016. While members with commercial coverage paid a larger share of the costs than their insurers in 2016, members with coverage under Medicare or the Minnesota Health Care Programs continued to pay a smaller share than their insurers. The total cost per days’ supply was similar across payers at \$0.29 for commercial payers, \$0.30 for Medicare, and \$0.31 for Minnesota Health Care Programs.

Table 13. Select mean cost statistics for atorvastatin calcium by payer type, 2016.

Year	Payer	Number scripts	Days' supply mean	Insurer paid mean	Member paid mean	Total paid mean	Cost per days supply
2016	Commercial	452,806	69.00	\$9.18	\$11.14	\$20.35	\$0.29
2016	Medicare	644,296	70.08	\$12.58	\$8.23	\$20.87	\$0.30
2016	MHCP	202,589	30.53	\$8.03	\$1.46	\$9.51	\$0.31

Appendix C: User Calculations

Means for Alternative Units

Means reported in each PUF are calculated over the number of prescriptions filled. Users may also wish to calculate means over different units – for example, per prescription, 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 they can also be computed for member paid or insurer paid amount. For example, the average member cost per prescription can be calculated by dividing the total member cost by the number of prescriptions in a given PUF record. Similarly, the average member cost per member can be calculated by dividing the total member cost by the number of unique members in a given PUF record. 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.

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 14.

Table 14. 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	5,000	100	500,000	N/A
2	7,000	85	595,000	N/A
3	8,500	75	637,500	N/A
Aggregate	20,500	N/A	1,732,500	84.51 ^a

^a 1,732,500 / 20,500 = 84.51

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 14 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 15. 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 14 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.

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Table 15. Calculation of standard deviation for an aggregate of records.

Record	Total paid SD	Number of scripts	(1)	Total paid mean	(2)	(3)	(4)
1	10	5,000	500,000	100	239.94	1,199,700	N/A
2	8	7,000	448,000	85	0.24	1,681	N/A
3	7	8,500	416,500	75	90.44	768,741	N/A
Aggregate	N/A	20,500	1,364,500 ^a	N/A	N/A	1,970,122 ^b	12.75

^a within group sum of squares

^b between group sum of squares

Example column calculations in Table 15:

(1) $10^2 * 5,000 = 500,000$

(2) $(100 - 84.51)^2 = 239.94$

(3) $239.94 * 5,000 = 1,199,700$

(4) $\sqrt{\frac{1,364,500 + 1,970,122}{20,500}} = 12.75$ (standard deviation of aggregate record)

Appendix D: Example Use Cases

The following use cases, taken from 2016 PUF data, are examples of questions that can be easily answered using the PUFs. Additional use cases are available in the data short take that accompanied the release of the PUFs.⁶

When reviewing the use cases, note that paid amounts in the PUFs do not reflect rebates. Inferences drawn from cost per prescription comparisons should consider supply measures such as quantity dispensed and days' supply, which are available in the PUFs.

What are the top ten most prescribed drugs in Minnesota?

Rank	Commercial	Medicare	MN Health Care Programs
1	Levothyroxine Sodium	Lisinopril	Albuterol Sulfate
2	Lisinopril	Levothyroxine Sodium	Omeprazole
3	Atorvastatin Calcium	Atorvastatin Calcium	Lisinopril
4	Amoxicillin	Omeprazole	Gabapentin
5	Sertraline HCL	Simvastatin	Levothyroxine Sodium
6	Simvastatin	Amlodipine Besylate	Cholecalciferol
7	Albuterol Sulfate	Furosemide	Sertraline HCL
8	Omeprazole	Warfarin Sodium	Ibuprofen
9	Metformin HCL	Gabapentin	Amoxicillin
10	Hydrocodone Bitartrate, Acetaminophen	Metformin HCL	Metformin HCL

How does the cost of atorvastatin calcium differ by manufacturer among commercially insured individuals?

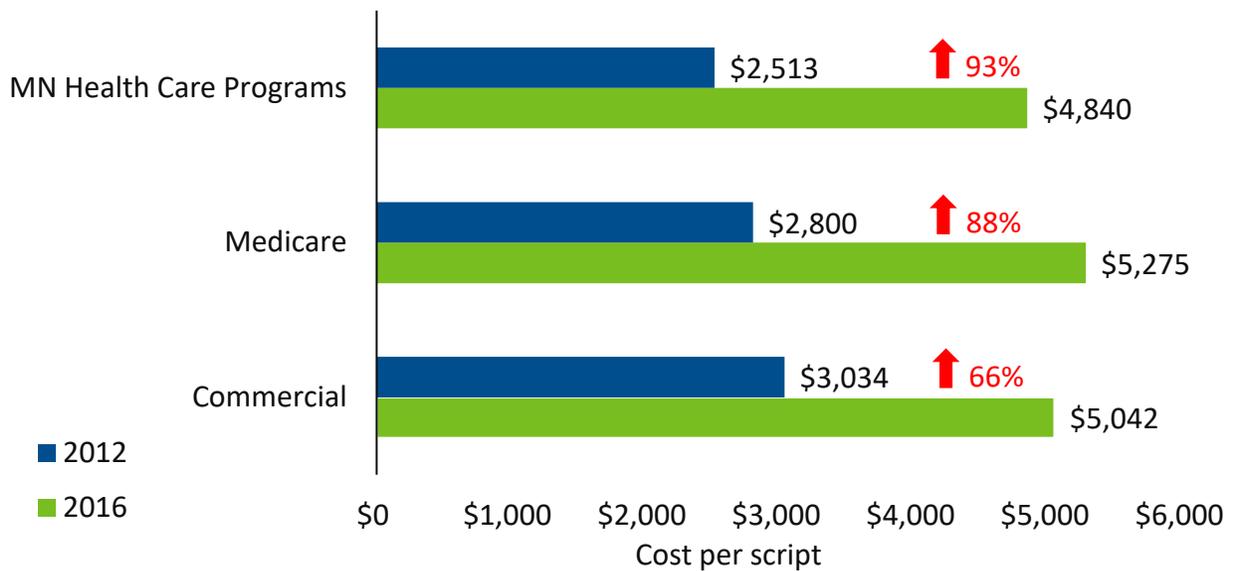
Pfizer → \$446.69 per prescription
(brand)

Apotex → \$13.20 per prescription
(generic)

Note: atorvastatin calcium treats high cholesterol and lipid levels. 10 mg tablets.

What was the 5 year cost per prescription change for Humira?

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Note: Humira treats inflammatory conditions such as rheumatoid arthritis.

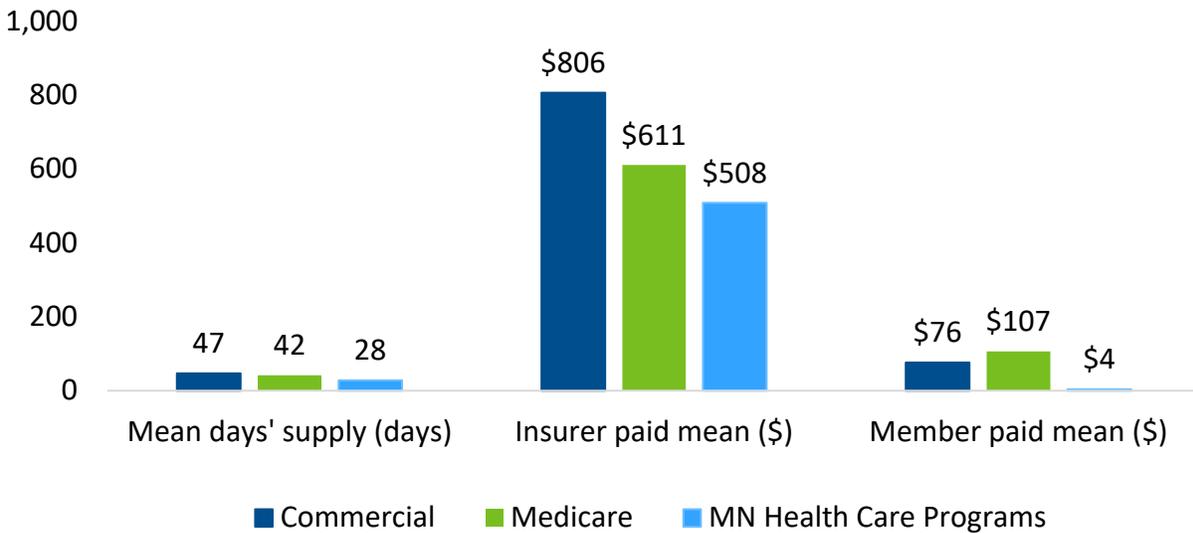
What are the demographics of commercially insured individuals prescribed epinephrine?

Member characteristic	Percentage of prescriptions
Age	
<19 years	49.4%
19 to 44 years	22.1%
45 to 64 years	25.4%
65+ years	3.1%
Sex	
Female	52.8%
Male	47.2%
RUCA class	
Urban core	73.3%
Suburban	12.1%
Micropolitan	6.4%
Rural/small town	8.2%

Note: epinephrine treats asthma attacks and allergic reactions.

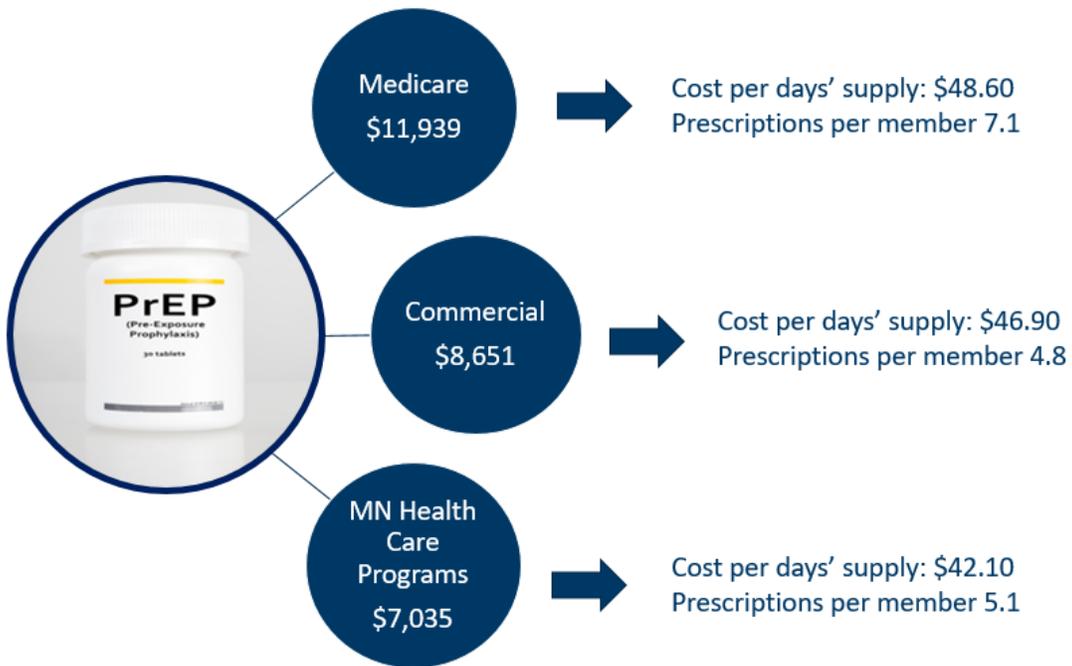
How does cost sharing differ by payer for insulin lispro prescriptions?

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Note: insulin lispro treats diabetes.

What is the annual cost per use of Truvada?



Note: Truvada treats HIV infections and is used as pre-exposure prophylaxis to prevent HIV infection.