



Formulary Implementations and Initial Impacts on Workers Compensation

Prescription drug payments comprise a substantial portion of medical expenditures for workers compensation (WC) claims, representing approximately 14% of ultimate total medical costs for Accident Year 2016 [1]. Regulation of prescription drug prices and utilization has recently become a focus of legislative activity in WC as states grapple with high prescription drug costs and the opioid crisis.

Closed drug formularies¹ have recently gained increased attention among states as a pharmacy utilization management tool to provide evidence-based guidance to physicians when prescribing drug treatments for injured workers. One such formulary, which has been implemented in several states,² is the Official Disability Guidelines Workers' Compensation Drug Formulary (the ODG Formulary).

This report investigates post-implementation prescription drug experience in two states which have recently adopted mandatory use of the ODG Formulary: Arizona and Tennessee. Various metrics are used to trace prescription drug utilization and cost trends in each state's WC system before and after formulary implementation. Utilization trends among certain types of medical procedures, which may complement or substitute for prescription drugs, are also examined.

KEY FINDINGS

- Prescription drug utilization decreased across all categories of drugs throughout the time period studied, regardless of whether they required prior authorization. Utilization declined in Arizona and Tennessee, and also in states not adopting a closed formulary. N-drug (defined on the next page) utilization after adoption of the ODG Formulary decreased at a rate of approximately 7% to 14% beyond the utilization decreases observed in relative benchmarks.
- Changes in N-drug utilization were driven by a decrease in the share of active claims³ receiving at least one N-drug in Tennessee; whereas Arizona experienced a decrease in N-drug scripts per claim with an N-drug.
- Utilization of topical and compound drugs in Tennessee⁴ decreased dramatically after formulary implementation.
- Approximately 80% of opioid scripts prior to formulary implementation already involved Y-drugs.
- The ODG Formulary had a limited observed impact on opioid utilization in the early period after implementation.

¹ A "closed" formulary indicates that reimbursement for nonpreferred drugs is not permitted without prior payor authorization. An "open" formulary permits reimbursement for drugs regardless of formulary status.

² As of year-end 2018, 15 states had adopted mandatory use of a closed-drug formulary. NCCI provides advisory services in eight of these states (AR, AZ, IN, KY, MT, OK, TN, and TX); all except Arkansas have adopted the ODG Formulary.

³ An active claim refers to a claim for which at least one medical service was paid during the time period analyzed.

⁴ As will be discussed later in this paper, the formulary was applied more narrowly in Arizona than in Tennessee; the Tennessee implementation specifically treats topical and compound drugs as N-drugs in all cases.

- Decreasing prescription drug utilization offset rising prices for N-drugs, resulting in a decrease in N-drug costs per claim and a decreased share of prescription drug costs attributable to N-drugs.
- There is little evidence that physician services, such as physical medicine⁵ or psychological services, were substituted for prescription drugs due to the ODG Formulary.

BACKGROUND

The ODG Formulary is a detailed list of prescription drugs that are frequently used in the treatment of injured workers. Within this list, there is a status indicator that identifies whether each drug requires prior authorization. Drugs with a status indicator of “N” (N-drugs) require prior authorization by the employer or workers compensation insurer, while drugs with a status indicator of “Y” (Y-drugs⁶) do not require prior authorization. The ODG Formulary is accompanied by evidence-based treatment guidelines (the ODG Guidelines) to be used by the physician in treating injured workers. The use of the ODG Guidelines is intended to serve as a complement to the formulary in guiding physicians when prescribing.

In Tennessee, the ODG Formulary became effective for newly written WC prescriptions dispensed on or after August 28, 2016, and applied to all prescriptions as of February 28, 2017. In Arizona, the ODG Formulary is applicable to opioids and drugs used for chronic pain management as of October 1, 2016.⁷

Legislative interest in the ODG Formulary is relatively recent; early formulary adopters such as Ohio, North Dakota, and Washington relied on proprietary state-specific closed formularies. Prior to the implementations in Arizona and Tennessee, only Texas (in 2011) and Oklahoma⁸ (2014) had adopted the ODG Formulary. As more states contemplate adoption of a formulary, stakeholders are interested in estimating the cost and utilization impacts of such implementation on the WC system.

Given the lack of available experience, published estimates of the potential cost impact of the ODG Formulary have either relied on theoretical models of drug substitution, or empirical analysis of experience in Texas. The California Workers’ Compensation Institute (CWCI) has estimated the impact of a potential ODG Formulary implementation in California [2] using the former option. For each N-drug on the formulary, CWCI identifies the Y-drug that most closely matches its intended treatment, then assumes that all N-drug scripts will be replaced by their matching Y-drug script to determine a cost impact. As part of its legislative analysis process, NCCI has adopted the second approach, estimating a 60% to 90% reduction in N-drug costs in a state following adoption of the ODG Formulary. This range of estimates is based on NCCI’s analysis of transactional prescription drug data collected by the Texas Department of Insurance, as well as the Department’s own research [3].

Both of the above approaches have weaknesses. CWCI’s substitution model assumes that all N-drugs will be replaced by Y-drugs, provided a substitute Y-drug exists; whereas insurers may be willing to grant prior authorization for N-drugs in many cases. On the other hand, post-reform experience in Texas may differ from experience in other states for many reasons, including the following:

- Texas law does not permit the settlement of future medical benefits, and the choice of treating physician is constrained for workers whose employer is part of a certified WC network; post-reform experience may differ in states with other medical benefit structures.
- Texas began implementation of the ODG Formulary in 2011, with a two-year transition program for workers injured before the initial formulary implementation. Since that time, increased awareness of the opioid epidemic and sensitivity to rising drug prices have prompted WC insurers to pay greater attention to pharmaceutical experience. Adoption of a closed formulary, subsequent to such implemented cost control measures, may have a less pronounced impact.

⁵ While physical therapy is frequently used to facilitate recovery early in a claim’s lifecycle, some forms of physical medicine, such as acupuncture, chiropractic manipulative therapy, or massage therapy, may also be used for pain management and post-acute care. Additionally, occupational therapy may be used after the injured worker reaches medical stability to manage permanent disabilities.

⁶ In the states examined in this report, drugs not explicitly listed on the ODG Formulary do not require prior authorization. These drugs are treated as “Y-drugs” throughout this article, unless noted otherwise.

⁷ The application of the ODG Formulary in Arizona was expanded to all claims and treatments as of October 1, 2018.

⁸ In Oklahoma, the implementation of the ODG Formulary formed one part of Senate Bill (SB) 1062, which comprehensively and fundamentally reformed the Oklahoma WC system; any effects of the formulary would be impossible to isolate from the effects of other provisions of SB 1062. As such, post-reform experience in Oklahoma is not considered in this report.

- The usage of drug utilization guidelines can vary between insurance carriers and across jurisdictions.
- Texas simultaneously implemented the ODG Guidelines, which work in conjunction with the ODG Formulary to guide WC treatment protocols.
- Availability and abundance of alternatives to pharmaceutical treatments, particularly as related to the treatment of chronic pain.

This report examines the impact of ODG Formulary implementations in Arizona and Tennessee as well as pharmacy utilization trends in each state before and after the formulary implementation. Utilization of N-drugs is investigated in detail for each state using Fisher quantity indexes. Changes in prices and total cost of N-drugs are also examined.

Two caveats need to be considered regarding the results contained in this analysis:

- Data used for this report is only available through Calendar Year 2017. Thus, due to the recency of the Tennessee and Arizona formulary implementations, post-reform data does not fully reflect the longer-term impacts of the ODG Formulary on prescribing patterns. Because the effectiveness of a formulary is behavior dependent, longer-term effects on prescribing patterns will become apparent as additional post-reform data becomes available.
- The findings in this report are largely observational, rather than inferential. To the extent possible, post-reform experience in each state is compared against a corresponding control group of states to isolate any effects specific to the ODG Formulary. However, there are a large number of confounding factors that could not be controlled for, preventing statistically rigorous inferences. Such factors include:
 - Impacts of other legislative changes affecting the WC system, such as Senate Bill 200 in Tennessee
 - The degree to which settlement of future medical benefits⁹ occurs in each state
 - The presence and effectiveness of nonformulary prescription cost control measures, such as fee schedules, required use of generic drugs, pharmacy benefit managers, and medical provider networks
 - Restrictions on repackaging and physician dispensing of prescription drugs

DATA

The data source used in this report is NCCI's Medical Data Call (MDC). The MDC is a database of paid medical transactions reported by all WC carriers that write at least 1% of the market share in any one state for which NCCI provides ratemaking services. Medical transactions are reported for each WC claim until the claim is closed or until 30 years from the accident date. However, lump-sum payments are not required to be reported, and self-insured data is not included.

MDC data used in this report is subject to the following limitations, including:

- Services provided in Calendar Years 2014 to 2017
- NCCI states except Texas and Oklahoma¹⁰
- Drug transactions reported with a valid National Drug Code (NDC) or with a code indicating a compound drug¹¹

The appropriate status indicator (Y or N) for each prescription drug is identified based on the ODG Formulary, Appendix A, in effect as of June 2017.¹²

⁹ Lump-sum payments are not reported in NCCI's Medical Data Call. In states where a significant portion of medical benefits are paid as lump-sum settlements, the data available for this report is censored. Tennessee permits settlement of future medical benefits with some exceptions. Arizona historically did not permit medical settlements, but recent legislation has eased this restriction.

¹⁰ AK, AL, AR, CO, CT, DC, FL, GA, HI, IA, ID, IL, IN, KS, KY, LA, MD, ME, MO, MS, MT, NC, NE, NH, NM, NV, OR, RI, SC, SD, UT, VA, VT, and WV. TX and OK are excluded due to implementation of mandatory closed formularies prior to the period studied.

¹¹ Compound drugs not otherwise classified are reported in the MDC using Healthcare Common Procedure Coding System code J7999. However, some compound drugs are reported to NCCI using the NDC of the component drugs and are not identifiable as compounded.

¹² The ODG Formulary is regularly updated. However, only a minimal proportion of drug scripts were affected by a change in status indicator during the period studied by this report.

METHODOLOGY

Throughout this analysis, prescription drug experience in Arizona and Tennessee is compared against two control groups:

- NCCI states with similar prescribing patterns prior to formulary implementation
- All NCCI states without a mandatory closed formulary during the period studied (previously enumerated)

To identify states with similar prescribing patterns to Arizona and Tennessee, five metrics are used as a high-level representation of prescribing patterns within each state:

- Number of prescriptions filled per active claim
- Average amount paid for prescription drugs per active claim
- Average morphine milligram equivalents (MME) prescribed per active claim
- Share of prescription drug payments attributable to N-drugs
- Share of prescriptions (i.e., scripts) filled attributable to N-drugs

States are deemed to have matching values for each metric if their values in the year prior to formulary implementation were within one half of a standard deviation of each other. States are classified as “similar” if they match on at least four of the above five metrics. Coincidentally, the one-year period prior to Tennessee’s implementation (9/1/15–8/31/16¹³) overlaps closely with the year prior to Arizona’s implementation (10/1/15–9/30/16). During this pre-implementation time period, the two states themselves matched on all metrics, and each state also had similar metrics to the following states: HI, MD, NM, NV, and VA. Thus, throughout this report, Arizona and Tennessee will be compared to the same set of five states, referred to as “similar states” or “similar nonformulary states” in this report.

ARIZONA AND TENNESSEE BEGAN AT SIMILAR STARTING POINTS

Metric	Arizona	Tennessee	Similar States
Scripts per active claim	2.8	3.2	2.7
Prescription payments per active claim	\$510	\$522	\$461
MME consumption per active claim	1,168	1,161	1,140
N-drug share of prescription drug payments	34%	31%	34%
N-drug share of total scripts	19%	18%	19%

Based on MDC data for prescriptions paid between 10/1/15 and 9/30/16¹⁴

Exhibit 1

During the time period studied in this report, several factors other than the ODG Formulary were likely to have affected trends in prescribing patterns. Factors that could alter prescribing patterns over time include:

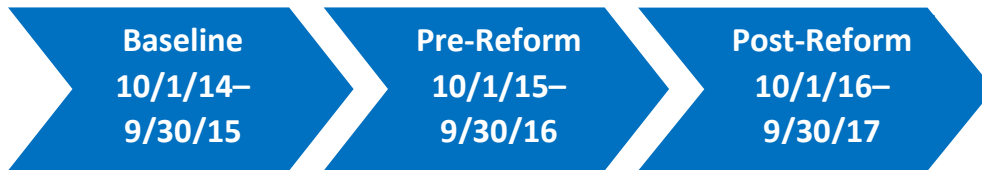
- Increased awareness of the opioid crisis and corresponding attempts to lessen opioid utilization in the WC system
- More rigorous use of pharmacy benefit management tools by insurers and pharmacy benefit managers
- Restrictions on physician dispensing of prescription drugs

To analyze changes in prescribing patterns over time resulting from the formulary implementation, post-implementation changes should also be compared to preexisting trends within the state. To establish a baseline for comparison, all statistics contained in this report are calculated for a base period as well as the pre-implementation and post-implementation periods. To avoid any seasonal effects in the nature of injuries or prescribing patterns, it is vital that all of these time periods correspond to the same calendar months.

¹³ The formulary was implemented in Tennessee as of 8/28/16; throughout this report, we treat the implementation date as 9/1/16 for convenience.

¹⁴ As noted, the year prior to formulary implementation in Tennessee and Arizona differs by only one month. For convenience, the relevant statistics are shown for the year prior to the Arizona implementation; they are nearly identical for the year prior to the Tennessee implementation.

The timeline for Arizona is straightforward; the formulary applies to all claims on or after 10/1/2016, so the subsequent calendar year of data is used as the post-reform period; the year prior to 10/1/2016 represents the pre-reform period, and the year before that forms the baseline period.



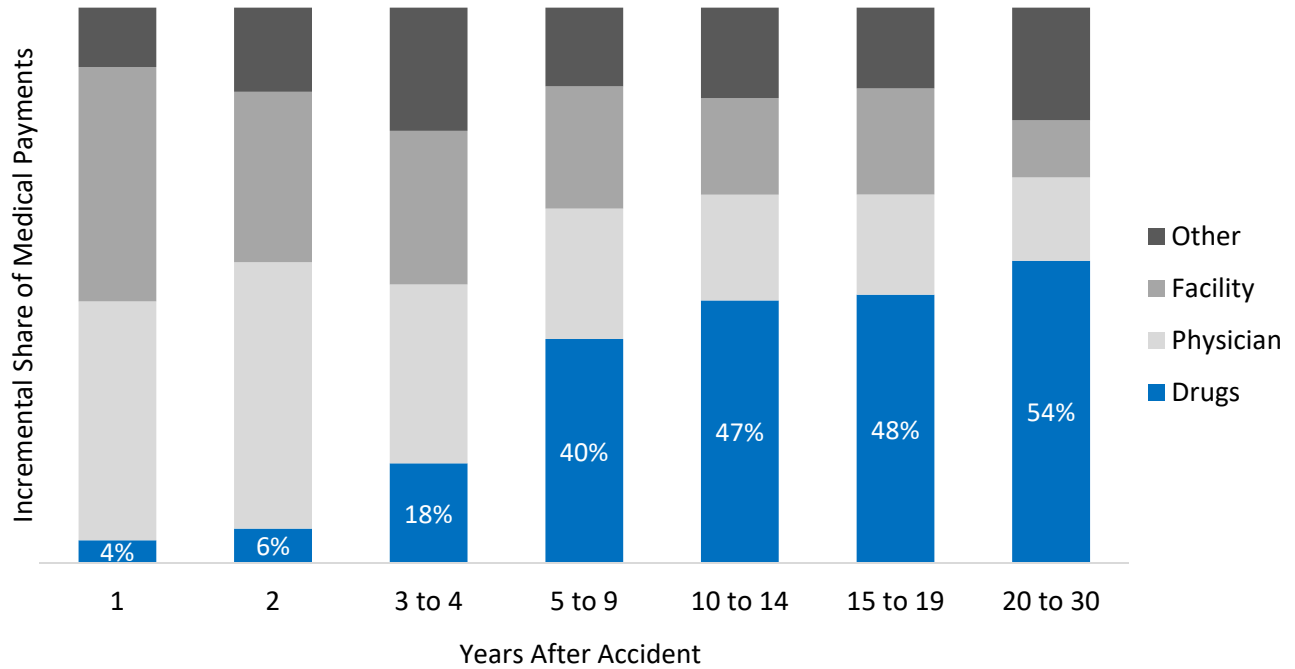
In determining the timeline of the Tennessee implementation, three factors were considered:

- There was a phase-in period from September 2016 to March 2017 in which the formulary applied to new prescriptions but not to refills of existing prescriptions.
- Only transactions with dates of service in Calendar Year 2017 and prior were available for this report, thus limiting the number of months for the post-reform period. Instead, the six-month period prior to September 2016 is used as the pre-reform period, while the six months after March 2017 are used as the post-reform period. Interim data for Tennessee from the phase-in period may be distorted due to seasonal variation; data from this period is omitted from most exhibits in this report.
- Potential distortions exist due to the enactment of Tennessee SB 200, which implemented significant changes¹⁵ to WC benefits applicable to accidents occurring after 7/1/2014. As workers compensation is a long-tailed line of insurance, and drug costs are disproportionately concentrated in the later years of a claim’s lifecycle (see Exhibit 2), nearly three-quarters of Tennessee drug transactions studied in this report are associated with pre-SB 200 claims, and no significant distortions due to SB 200 are observed. Nevertheless, whenever data is analyzed at a specific maturity level (for example, when examining prescribing patterns within one year of the accident date), all claims under comparison are subject to the newer governing statutes.



¹⁵ Among other changes, SB 200 created a distinct Court of Workers Compensation Claims and a medical billing dispute resolution system, altered the criteria for a compensable claim, modified the intended interpretation of the WC statutes, and changed the determination of the treating physician.

THE INCREMENTAL DRUG SHARE OF MEDICAL COSTS RISES WITH CLAIM MATURITY IN TENNESSEE



Based on MDC data for medical payments in Calendar Year 2017¹⁶

Exhibit 2

Once the timeline and control groups are established, prescription drug data is aggregated by period, state grouping, and status on the ODG Formulary. The analysis, which was conducted separately for Arizona and Tennessee, begins with an exploration of price and utilization trends over time among prescription drugs. Price and utilization are measured by Fisher indexes (see Appendix for further explanation of the Fisher price and utilization indexes). Changes in prescribing patterns are compared before and after formulary implementation and are also compared to the baseline period. Note that the ODG Formulary is expected to have relatively little impact on drug prices, as it is designed as a tool for controlling drug utilization and does not carry any explicit mandate regarding prices.

NCCI research on prescription drugs in the WC system [1][4] has indicated a marked countrywide decrease in prescription drug utilization in recent years. This general decrease in drug utilization across all categories will be readily observable in many of the exhibits in this report. Thus, to assess the impacts of the ODG Formulary implementations, it is necessary to examine not only the absolute decrease in N-drug utilization, but also the degree to which the post-implementation decrease in N-drug utilization accelerated.

The analysis described above is likely to be of interest to stakeholders for examining the effects of the ODG Formulary on overall WC prescription drug costs. However, when analyzing changes over time across the entire population of active WC claims, it is difficult to control for changes in several factors which may affect drug utilization patterns, including:

¹⁶ Facility costs represent hospital inpatient, hospital outpatient, and ambulatory surgical center payments. “Other” includes durable medical equipment, prosthetics, orthotics, medical supplies, transportation, and all other uncategorizable medical costs. Note that this graph shows the incremental share of drug payments; the exhibit indicates that 54% of the payments made between 20 and 30 years after injury were for drugs, rather than the cumulative drug share of medical payments.

- The average maturity of claims¹⁷
- Nature and severity of injuries
- Legislative changes to benefit levels or compensability standards
- Changes in future medical benefit settlement patterns

To address these factors, the report also examines changes in utilization patterns for a fixed cohort of claims in each state. In both Arizona and Tennessee, the cohort studied consists of all claims with accident dates between 1/1/2005 and 12/31/2009 for which at least one N-drug was provided during the pre-reform period and which received at least one medical service during the post-reform period. This cohort will hereafter be referred to as the 2005/09 cohort. By examining a cohort of claims which remained open during the post-reform period, it is possible to observe a single fixed group of claims on both a pre-reform and post-reform basis. As defined, the 2005/09 cohort has the same mix of injuries and benefit levels before and after formulary implementation, without distortions due to settlements. Additionally, the selected cohort of claims in each state is sufficiently mature that there is little expected change in the composition of medical services during the relatively narrow time frame between the pre-reform and post-reform periods, and a larger proportion of medical services are expected to be for prescription drugs.

For the selected cohorts, utilization patterns for N-drugs and Y-drugs are examined, along with utilization of physical medicine and psychological services. The focus of this section of the analysis will be to determine the degree to which either Y-drugs or alternative physician services are being substituted for N-drugs after formulary implementation.¹⁸ A disadvantage of selecting a cohort of relatively more mature claims is that prescribing patterns may have become well-established; it may be difficult for a physician to find an appropriate substitute for an N-drug that the injured worker has been receiving for several years. Drug utilization for each cohort is measured using a Fisher index, as described in the Appendix. Utilization of physician services is measured by WC Relative Prices (WCRPs).¹⁹

¹⁷ Claim maturity is important because, as observed in Exhibit 2, a WC claim receives a changing mix of medical services over the claim's lifecycle. Medical care immediately following an accident is more likely to focus on return to work; the focus shifts to post-acute or ancillary care later after the worker reaches medical stability. Drugs constitute over 40% of WC medical payments 10 or more years after injury.

¹⁸ Note that the Texas Department of Insurance [3] uses a similar cohort analysis to examine substitution effects following the Texas formulary implementation. However, its selected cohort of claims is much more recent than the cohorts examined in this report.

¹⁹ WCRPs are determined by multiplying the number of units (typically 15 minutes for physical medicine and psychological services) of a physician service associated with a transaction by a relative value factor. This factor adjusts each unit to reflect the relative amount of effort and complexity associated with each service in a WC setting. These adjustment factors are developed by NCCI by year of service, service category, and place of service (facility or nonfacility).

DATA ANALYSIS—TENNESSEE

The analysis of Tennessee experience begins with a summary of several prescription drug price and utilization metrics in Tennessee in Exhibit 3. There are several noteworthy observations from Exhibit 3:

- All prescription drug utilization metrics decreased between the pre-reform and post-reform periods. Both the share of claims receiving any drugs and the number of scripts per claim with a script decreased.
- The share of claims with any N-drug²⁰ script decreased by 20% after formulary implementation.
- Although average prices for both Y-drugs and N-drugs increased slightly, the average price per script for all drugs combined decreased due to a change in mix of drugs toward less-costly Y-drugs. As noted in the Appendix, correcting for such “substitution effects” is a primary benefit of measuring price and utilization trends with Fisher indices.

	Pre-Reform	Post-Reform	% Change
Share of Claims With at Least One Prescription Drug	41%	38%	-6%
Share of Claims With at Least One N-Drug Script	12%	10%	-20%
Share of Claims With at Least One Y-Drug Script	39%	37%	-5%
Scripts per Claim With at Least One Prescription Drug	6.3	6.1	-4%
N-Drug Scripts per Claim With at Least One N-Drug Script	4.1	4.0	-3%
Y-Drug Scripts per Claim With at Least One Y-Drug Script	5.3	5.2	-1%
Price per Script	\$162	\$160	-2%
Price per N-Drug Script	\$282	\$284	+1%
Price per Y-Drug Script	\$135	\$136	+1%
Drug Cost per Claim With at Least One Prescription Drug	\$1,030	\$975	-5%

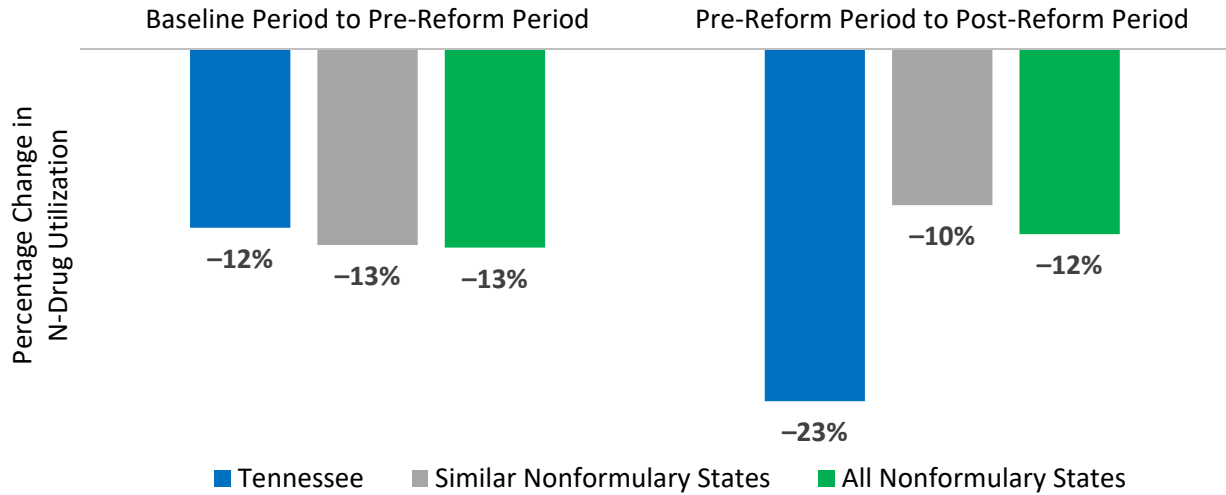
Based on MDC data for prescriptions paid between 3/1/16 and 8/31/17

Exhibit 3

During the pre-reform period, N-drugs constituted 19% of all prescription drug scripts and 34% of prescription drug payments in the Tennessee WC system. Exhibit 4 shows the percentage change in overall utilization between time periods, as measured by a utilization index for N-drugs. This chart shows that N-drug utilization has decreased across all time periods and states included in the report. The decrease in N-drug utilization in Tennessee represented a slightly lower rate of decrease than in similar states from the baseline period to the pre-reform period. However, the rate of decrease for N-drug utilization accelerated from the pre-reform to post-reform period, with N-drug utilization in Tennessee changing by an additional -14% [= (1 - .23) / (1 - .10) - 1] compared to the decrease observed in similar nonformulary states.

²⁰ Throughout the Tennessee portion of this report, all drugs requiring topical application and all drugs identifiable as compounds are treated as N-drugs regardless of the status on the ODG Formulary, consistent with Tennessee rules. This treatment is also applied to data for nonformulary states whenever they are compared to Tennessee.

THE DECREASE IN N-DRUG UTILIZATION IN TENNESSEE ACCELERATED AFTER IMPLEMENTATION

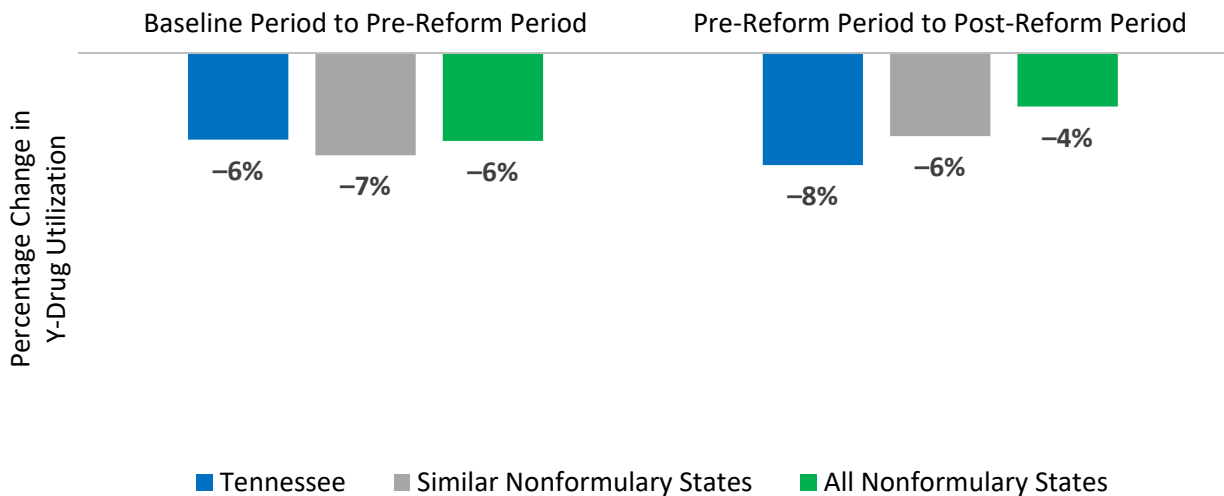


Based on MDC data for prescriptions paid between 3/1/15 and 8/31/17

Exhibit 4

Exhibit 4 suggests that the ODG Formulary implementation intensified the pre-reform downward trend in N-drug utilization in Tennessee. As N-drugs are not recommended by the ODG Formulary and require prior authorization, this result is expected. However, it is also possible that there was an overall shift in utilization patterns for all drugs independent of the formulary implementation. To evaluate this possibility, trends in Y-drug utilization must also be investigated. In Exhibit 5 below, changes in overall Y-drug utilization are shown. As with N-drugs, Y-drug utilization shows a clear downward trend, though the rate of decrease is lower than for N-drugs. In Tennessee, there was a slight acceleration in the rate of decrease in Y-drug utilization, but the effect is far less pronounced than for N-drugs.

Y-DRUG UTILIZATION SHOWS A MUCH SMALLER POST-IMPLEMENTATION SHIFT



Based on MDC data for prescriptions paid between 3/1/15 and 8/31/17

Exhibit 5

Having observed the drop in N-drug utilization in Tennessee, the next step is to break down utilization into components. As described in the Appendix, overall utilization of N-drugs is tracked by a Fisher index adjusted for changes in claim volume. Changes in this utilization index can be further broken down into three components:

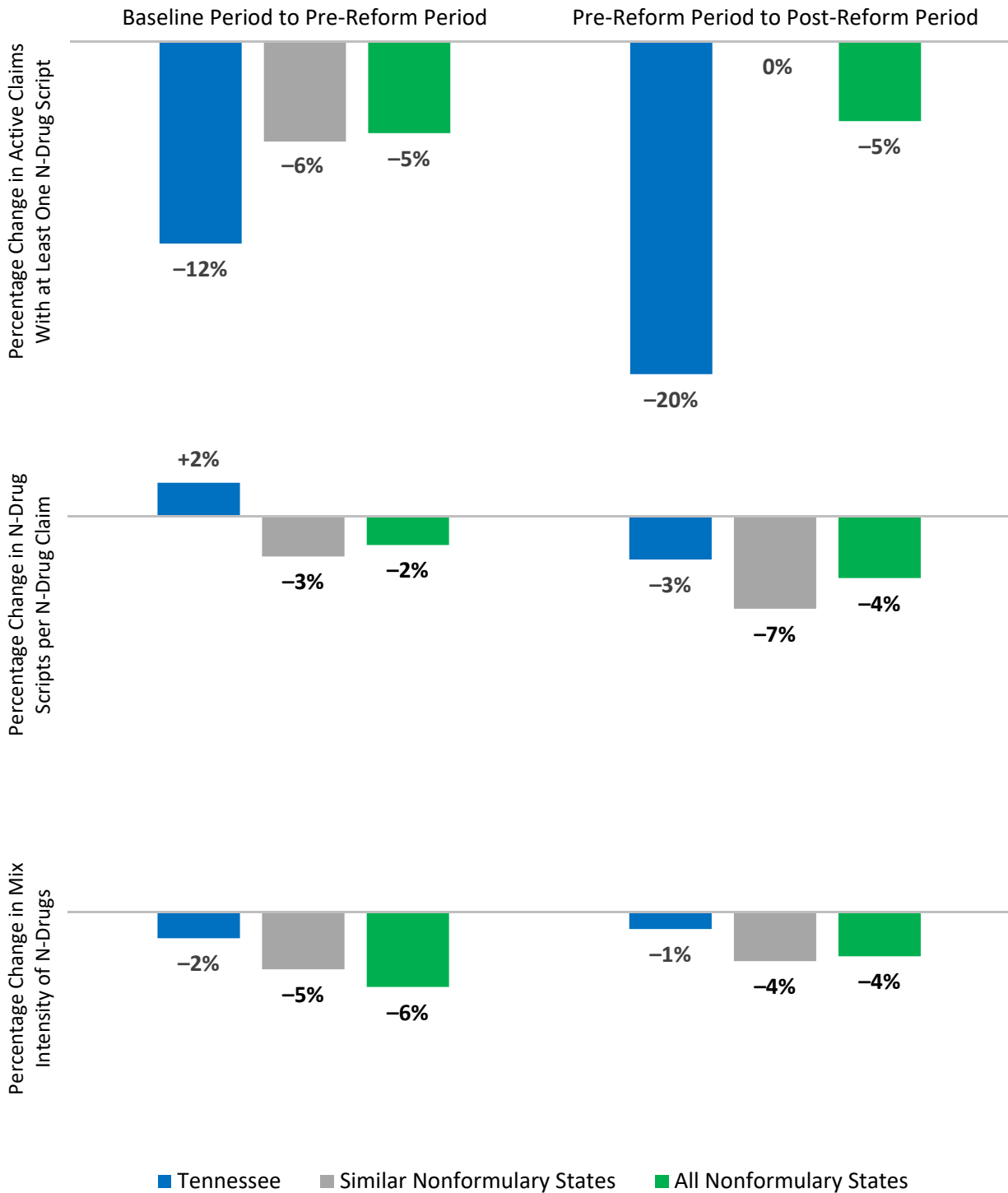
- Change in the number of active claims receiving at least one N-drug script
- Change in the average number of N-drug scripts for claims with at least one N-drug script
- Shifts within the mix of N-drugs prescribed

The combined changes in these three utilization components match the overall change in N-drug utilization shown in Exhibit 4.

Implementation of a closed formulary could potentially impact any of the three utilization components. For example,

- A large decrease in the proportion of active claims receiving at least one N-drug could indicate that the formulary is being used as a “blanket” tool to redirect treatment patterns away from N-drug usage
- A decrease in the average number of N-drug scripts per claim with an N-drug could indicate that the formulary is being used as a tool to gradually wean injured workers away from N-drugs, or could indicate that insurers are granting prior authorization more readily for the first fills of an N-drug but exercising greater restraint in authorizing subsequent refills
- A shift in the mix of N-drugs prescribed could indicate that insurers are providing prior authorization more readily for some N-drugs than for others

N-DRUG UTILIZATION SHIFT WAS DRIVEN BY A DECREASE IN CLAIMS RECEIVING AN N-DRUG



Based on MDC data for prescriptions paid between 3/1/15 and 8/31/17

Exhibit 6

Exhibit 6 shows the breakdown of the three components of utilization. Several observations regarding utilization components may be made:

- Mix intensity of N-drugs declined slightly in Tennessee both before and after formulary implementation, with little apparent difference between periods
- The average number of N-drug scripts per claim with at least one N-drug actually increased in Tennessee from the baseline to pre-reform periods and declined at a slower rate than non-formulary states into the post-reform period
- Mix intensity and average N-drug scripts per claim with an N-drug continued to decline at a slower rate than in nonformulary states during the post-reform period
- There was a marked decrease in the share of active claims receiving any N-drug scripts during the post-reform period; this component is the clear driver of the overall utilization trend noted in Exhibit 4

To illustrate the changing N-drug utilization patterns in Tennessee, Exhibit 7 shows the top 10 N-drugs by number of scripts during the pre-reform period along with utilization statistics. The ranks of these top 10 N-drugs show relatively limited rearrangement post-reform, demonstrating the stability in the mix of N-drugs. The formulary implementation does not appear to have had a disproportionate effect on any of the top N-drugs. Likewise, the number of prescriptions filled for each drug per claim receiving that drug remained relatively steady. However, the proportion of active claims receiving at least one script decreased across the board. Diclofenac sodium is a prime example of the trend—the top N-drug (by number of scripts) pre-reform—as it retains the same rank post-reform with minimal change to the average number of scripts per claim receiving at least one script. However, there was a -19% ($= 17.2 / 21.2 - 1$) change in the number of claims with a diclofenac sodium script.

CHANGES IN N-DRUG UTILIZATION WERE RELATIVELY UNIFORM FOR TOP TENNESSEE DRUGS

Drug Name	Pre-Reform Statistics			Post-Reform Statistics		
	Claims Receiving Drug per 1,000 Active Claims	Average Scripts per Claim Receiving Drug	Rank (By Script Count)	Claims Receiving Drug per 1,000 Active Claims	Average Scripts per Claim Receiving Drug	Rank (By Script Count)
Diclofenac Sodium ²¹	21.2	1.8	1	17.2	1.7	1
Morphine Sulfate	7.5	4.8	2	5.6	4.8	3
Oxycontin®	6.8	4.8	3	6.1	4.6	2
Lidocaine	10.1	3.0	4	8.5	2.9	4
Alprazolam	4.7	3.9	5	3.3	4.2	6
Promethazine HCl	9.9	1.8	6	7.3	1.7	7
Carisoprodol	4.8	3.6	7	2.7	3.4	11
Trazodone HCl	4.5	3.8	8	3.8	3.8	5
Clonazepam	3.7	4.3	9	2.5	4.4	8
Diazepam	6.1	2.6	10	4.1	2.5	10

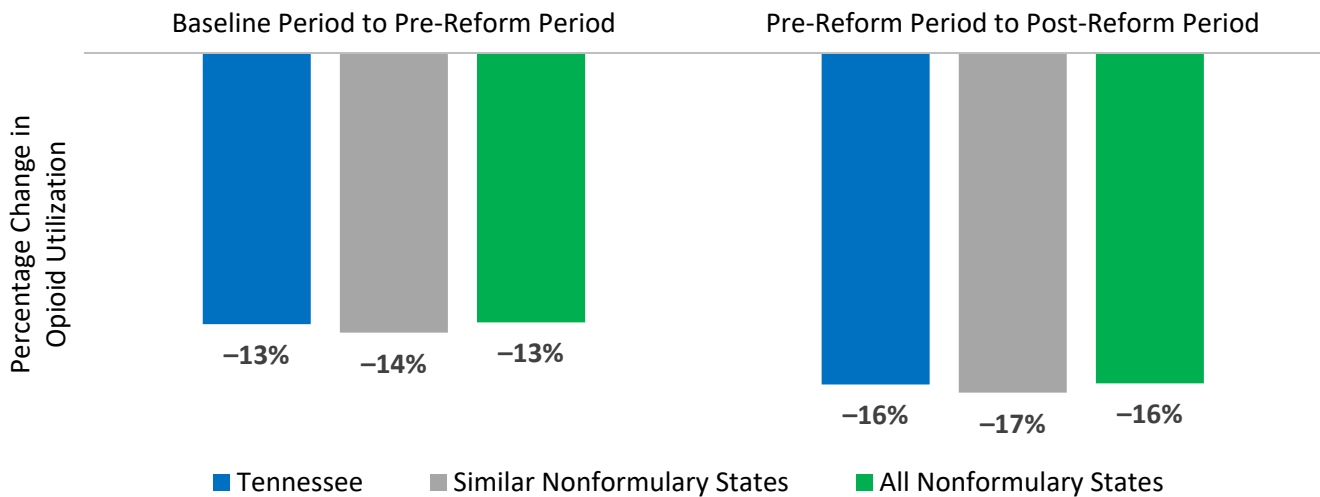
Based on MDC data for prescriptions paid between 3/1/16 and 8/31/17

Exhibit 7

²¹ Includes Voltaren® gel due to a generic equivalent form of diclofenac sodium becoming available during the study period.

In recent years, stakeholders in the WC system have become increasingly cognizant of the nationwide opioid epidemic and have taken steps to limit the utilization of opioids within the WC system. As the ODG Formulary is intended to address dispensing of potentially harmful medications in the WC system, it has been suggested that the ODG Formulary has a role in curbing opioid utilization. However, the composition of opioids prescribed in Tennessee suggests that the ODG Formulary, used in isolation, may have a limited effect on opioid utilization in the Tennessee WC system. Of the top 10 drugs in Tennessee by script count during the pre-reform period, four²² were opioids; all four of these top opioids were Y-drugs. In total, prior to formulary implementation, 81% of opioid scripts in Tennessee were for Y-drugs; Y-drugs constituted 57% of opioid utilization as measured by MME. Exhibit 8 shows the overall utilization of opioids in Tennessee, measured in MME, declining at the same rate as in nonformulary states, both pre-reform and post-reform.

TN OPIOID UTILIZATION CHANGES WERE INDISTINGUISHABLE FROM NONFORMULARY STATES



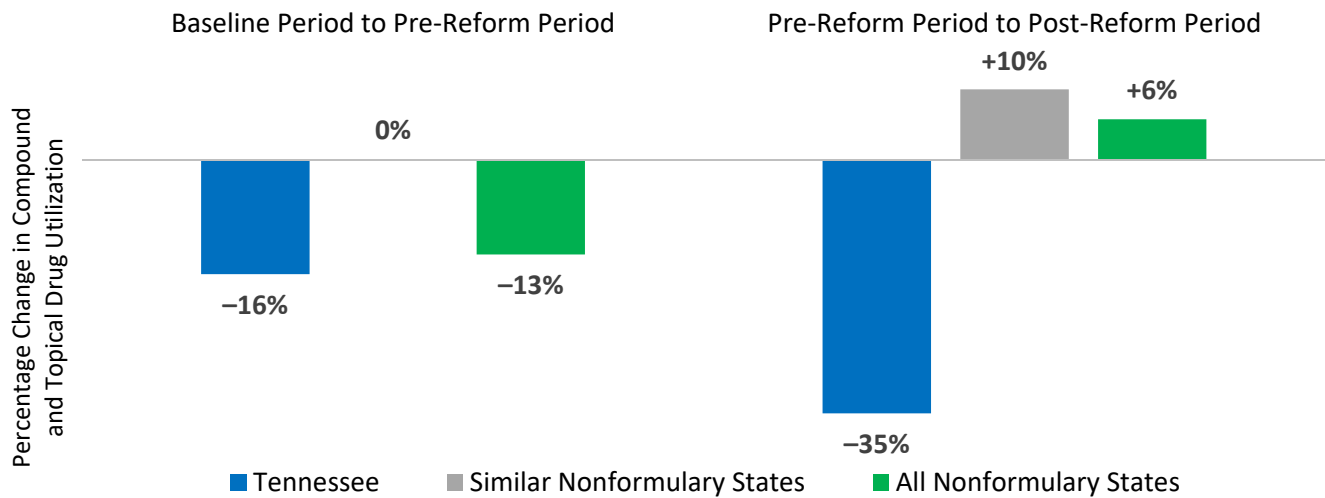
Based on MDC data for prescriptions paid between 3/1/15 and 8/31/17

Exhibit 8

²² Hydrocodone bitartrate-acetaminophen, oxycodone HCl-acetaminophen, tramadol HCl, and oxycodone HCl; these four drugs accounted for 76% of opioid scripts during the pre-reform period.

For Tennessee, this report also investigates a specific sub-category of N-drugs: drugs requiring topical application or compounding. Topical²³ and compound²⁴ drugs were of particular interest because regulators and insurers in the WC system have become increasingly skeptical about the efficacy of many of these drugs relative to their costs [5]. Under the Tennessee regulations governing the formulary, all topical and compound drugs require prior authorization regardless of status indicator on the ODG Formulary. These high-cost drugs were likely to receive particular scrutiny after the formulary implementation to assess medical effectiveness. Exhibit 9 indicates a dramatic decrease in compound and topical utilization in Tennessee, compared to increases in utilization in other states.

UTILIZATION OF TOPICAL AND COMPOUND DRUGS FELL DRAMATICALLY POST-IMPLEMENTATION



Based on MDC data for prescriptions paid between 3/1/15 and 8/31/17

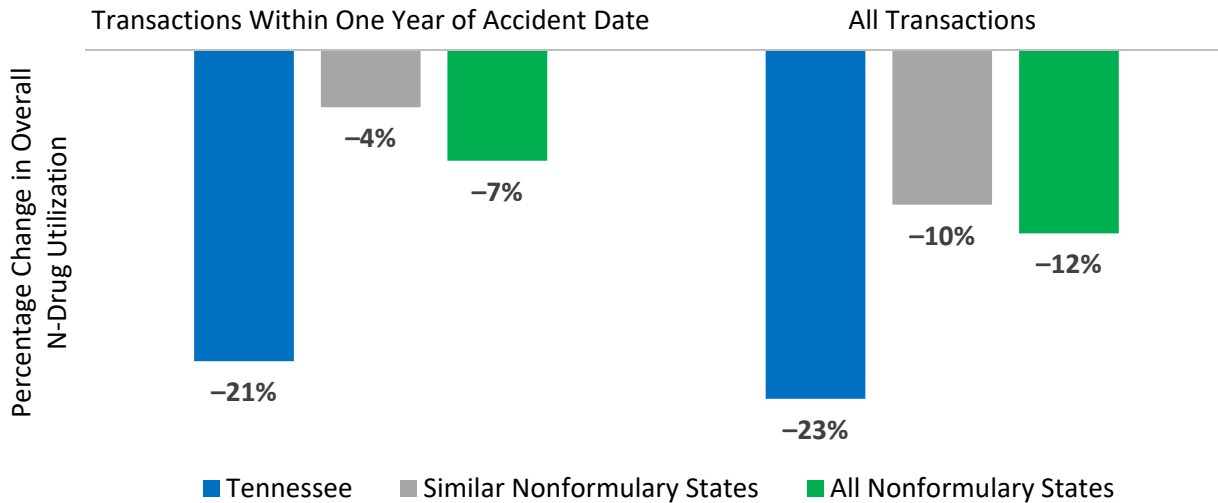
Exhibit 9

²³ Drugs are considered “topicals” in this report if dispensed as a cream, foam, gel, lotion, ointment, shampoo, soap, sponge, or swab.

²⁴ Only compound drugs in the MDC reported with the appropriate code for compound drugs—not otherwise classified can be positively identified as compounds. Other drugs dispensed as a compound but reported using the NDCs of the individual constituents would not be identified. Thus, Exhibit 9 omits some compound drug experience in Tennessee.

So far, this report has examined utilization patterns for the total population of injured workers in the WC system. However, prescribing patterns may become relatively fixed in the later years of a claim’s lifecycle, and thus the formulary might potentially have less effect on older claims than on prescribing patterns shortly after injury. In addition, changes in prescribing patterns early in the life of a claim may have significant effects on total prescription costs to the extent that the adjusted level of consumption of expensive N-drug prescriptions persists over the life of the claim. Exhibit 10 shows that the change in first-year N-drug utilization between pre-reform and post-reform periods is very similar to the experience for all transactions in Tennessee. Therefore, although the characteristics of drug utilization may vary by claim maturity, there is little evidence that the formulary affects first-year drug transactions differently.

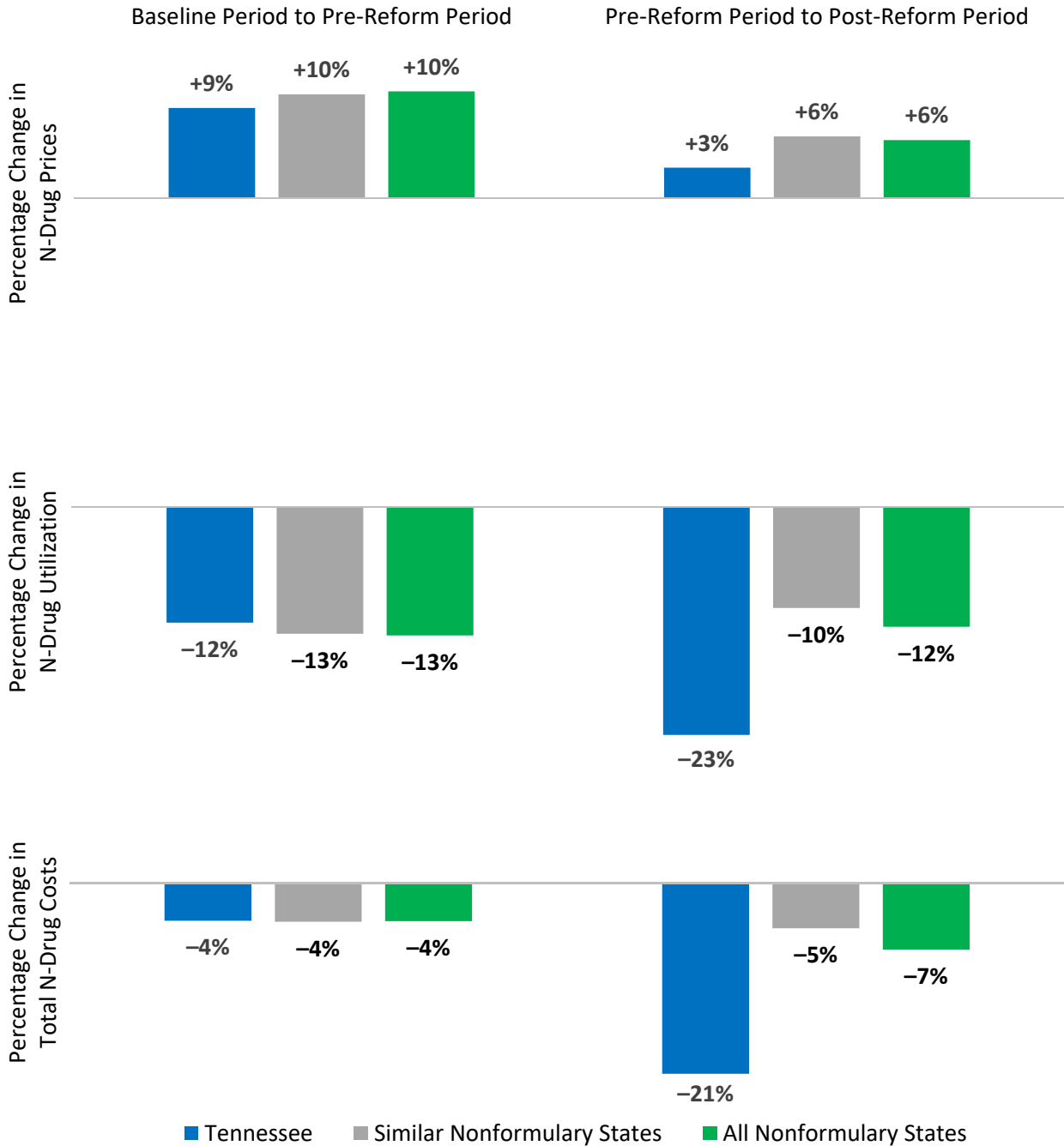
FIRST-YEAR TENNESSEE N-DRUG UTILIZATION PATTERNS MIRRORED OVERALL EXPERIENCE



Based on MDC data for prescriptions paid between 3/1/16 and 8/31/17

Exhibit 10

DECREASING TENNESSEE N-DRUG COSTS WERE DRIVEN BY UTILIZATION; PRICES CONTINUED TO RISE



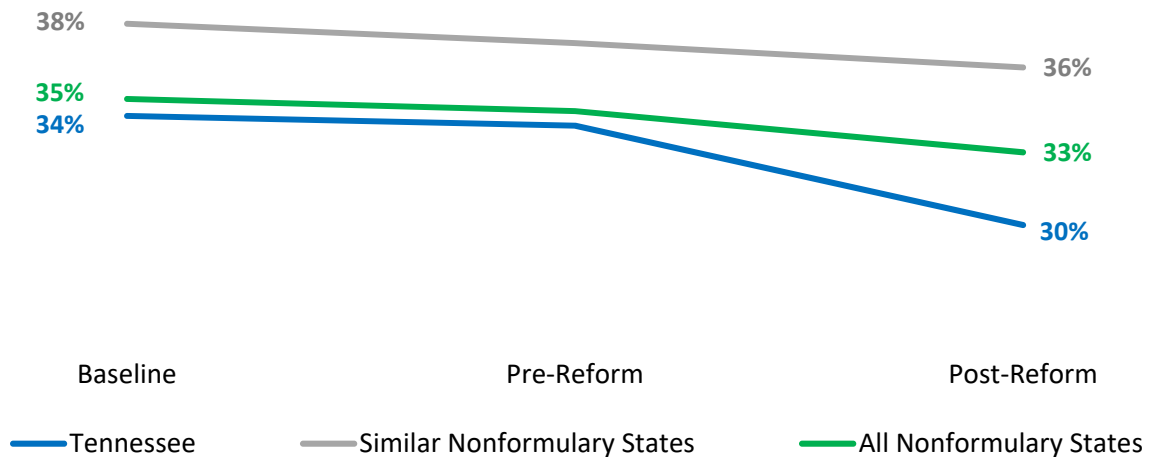
Based on MDC data for prescriptions paid between 3/1/15 and 8/31/17

Exhibit 11

Exhibit 11 breaks down overall N-drug cost changes into price and utilization components. Prices paid in Tennessee per N-drug script, adjusted for the mix of prescriptions, have tracked somewhat closely with nonformulary states. While the 3% increase in average price during the post-reform period trailed nonformulary states slightly, the noticeable drop in total N-drug costs during the post-reform period is principally driven by decreased utilization. Note that in Exhibit 3, a *decrease* in average drug prices was observed, and an increase of only +1% in N-drug prices was observed. This is due to relatively more expensive drugs being replaced by relatively cheaper substitutes; adjusted for substitution, N-drug prices increased.²⁵

Driven by rapid declines in utilization, N-drug costs as a share of total prescription costs have fallen across the country. In Tennessee, this trend tracked closely with the experience of other states from the baseline period to the pre-reform period. The post-reform drop in N-drug utilization identified in Exhibit 4 accelerated the downward trend in Tennessee N-drug cost share. However, N-drugs still constituted 30% of prescription drug costs in Tennessee after the formulary implementation. Note that this report describes only the short-term impact of the ODG Formulary, and in the long-term, there may be a more pronounced decrease in the N-drug share of utilization. It is clear that there has not yet been as large a shift away from N-drugs in the Tennessee WC system as was observed after the formulary implementation in Texas. Thus, comparisons to post-reform experience in Texas [3] should be made with caution.

N-DRUG SHARE OF PRESCRIPTION COSTS DECLINED SLIGHTLY IN TENNESSEE POST-IMPLEMENTATION



Based on MDC data for prescriptions paid between 3/1/15 and 8/31/17

Exhibit 12

²⁵ In Exhibit 11, a +3% increase in N-drug prices (adjusted for substitution) is observed from the pre-reform to post-reform period. In Exhibit 3, an unadjusted price change of +1% was observed. The difference of -2% (= 1% - 3%) between these two observations matches the change in mix intensity observed in Tennessee in Exhibit 6 (although the displayed value differs by 1% due to rounding).

The report now turns to an examination of the cohort of mature claims as described in the methodology section. The next four exhibits show utilization patterns limited to the cohort of mature claims with accident dates between 2005 and 2009.

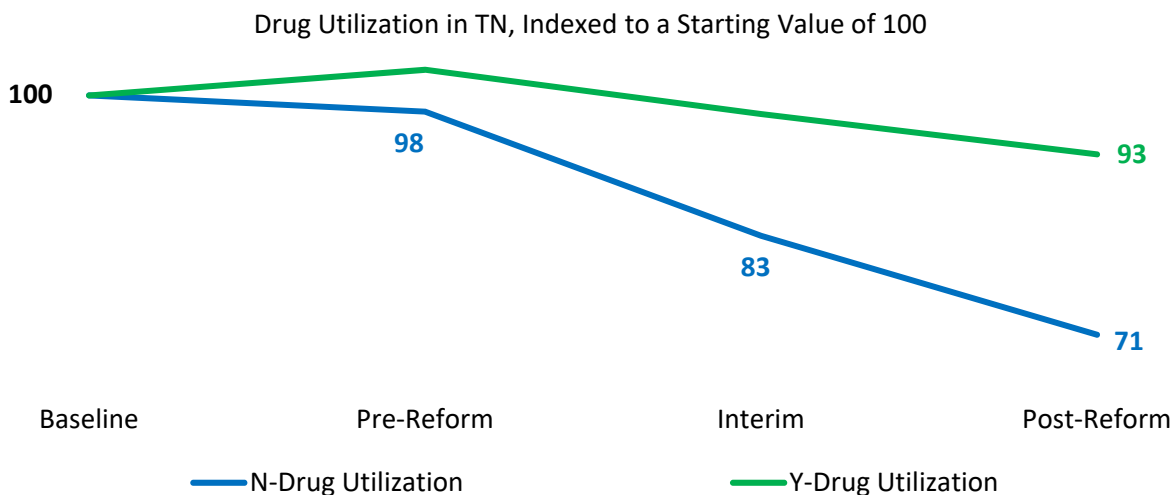
Exhibit 13 traces the utilization of N-drugs and Y-drugs within this cohort from the baseline to post-reform periods, beginning with a starting value of 100. N-drug utilization among the cohort declined 28% from the pre-reform to the post-reform period (from an indexed value of 98 to 71); this exceeds the 23% utilization decrease observed among all claims in Exhibit 4. However, Y-drug utilization also decreased, though at a much slower rate. As the composition of the cohort does not change between the two periods, and as the mix of medical services is expected to remain stable for such mature claims over the relatively short pre-reform to post-reform time frame, the N-drug utilization decrease in Exhibit 12 is not likely to be due to any shift in claimant characteristics. In addition, the concurrent smaller decrease in Y-drug utilization suggests that claimants did not substitute N-drugs with other types of drugs.

Unlike other Tennessee exhibits in this report, Exhibit 13 also includes the “interim” period in which the formulary applies only to new prescriptions. For the selected cohort, the vast majority of scripts during the period studied are refills of existing prescriptions, and seasonal variations in injury and treatment patterns are less likely to affect a cohort of relatively mature claims.

Of particular note, N-drug utilization decreased at nearly the same rate from the pre-reform to interim period as from the interim to post-reform period. This could be due to adjustments to the course of treatment for workers in the 2005/09 cohort in anticipation of the formulary’s application to existing prescriptions. Such an effect was observed in Texas [3]; by the time the formulary became effective in Texas for “legacy claims” (accidents occurring before October 1, 2011), 64% of treating physicians on such claims had *already* adjusted treatment patterns to account for the application of the formulary, either by eliminating N-drug usage (47%) or by reaching an agreement with the insurer permitting continued N-drug usage (17%). Data from the MDC is insufficiently detailed to determine to what degree treating physicians in Tennessee made similar treatment adjustments.

This report is focused on the immediate effects of the formulary implementation, and data is not available to trace more recent N-drug usage; however, the trend observed in Exhibit 13 suggests that there may be longer-term effects as use of the formulary is phased in.

N-DRUG AND Y-DRUG UTILIZATION BOTH DECREASED FOR THE 2005/09 COHORT IN TENNESSEE

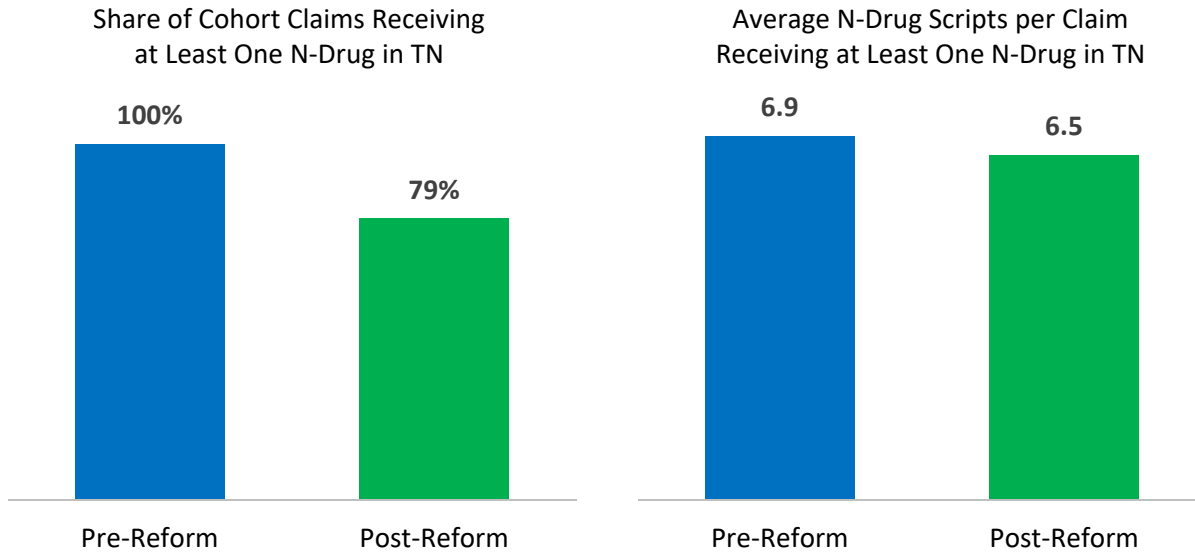


Based on MDC data for prescriptions paid between 3/1/15 and 8/31/17

Exhibit 13

For the 2005/09 cohort, the N-drug utilization decrease between the pre-reform and post-reform period was driven by fewer injured workers receiving an N-drug. For workers who continued receiving N-drugs, the number of N-drugs received remained relatively constant. Note that the 21% decline in share of workers receiving an N-drug closely matches the 20% decrease across the entire population of injured workers observed in Exhibit 6.

THE SHARE OF CLAIMS IN THE 2005/09 COHORT WITH AT LEAST ONE N-DRUG DECREASED



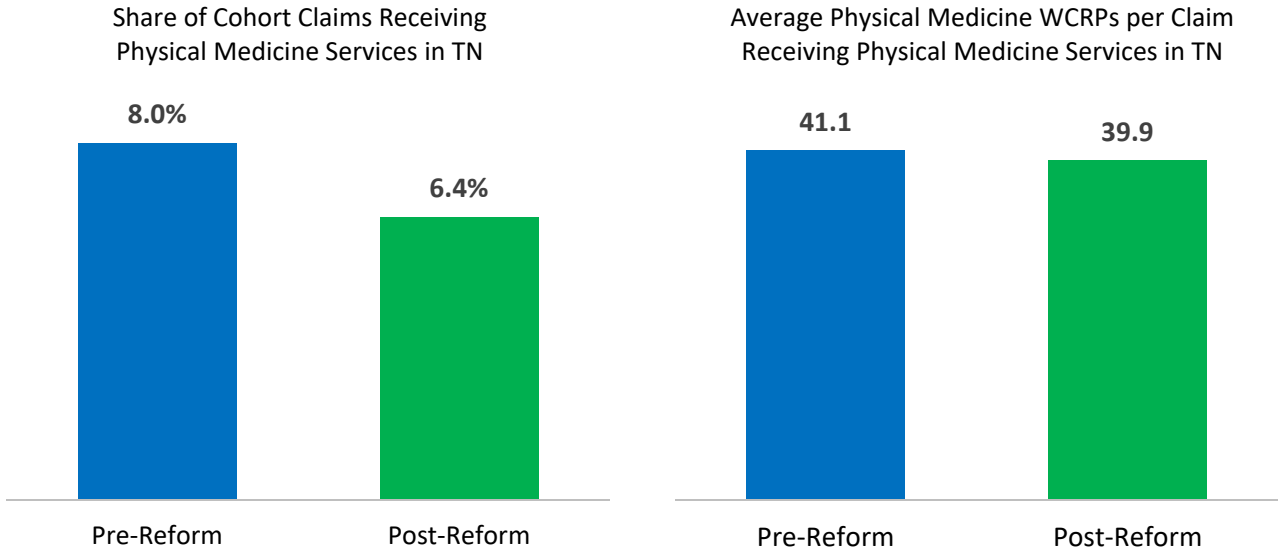
Based on MDC data for prescriptions paid between 3/1/16 and 8/31/17

Exhibit 14

It is possible that injured workers may have increased utilization of physical medicine or psychological services as a replacement for the foregone N-drugs as part of their post-acute care. If so, a spike in utilization of these services should be observable during the post-reform period. Exhibits 15 and 16 below compare the utilization of physical medicine and psychological services, respectively. In Exhibit 14, a large decrease in the share of 2005/09 cohort claims receiving any N-drug was observed. However, all claims in the cohort continued actively receiving medical services during the post-reform period.

For physical medicine, the share of cohort claims receiving any physical medicine service declined in the post-reform period. Among claims receiving any physical medicine services, physical medicine utilization per claim, as measured by WCRPs, also declined slightly. Likewise, both the share of claims receiving psychological services and the average level of psychological services per worker receiving psychological services decreased between the pre-reform and post-reform periods. There is no evidence that these physician services were being substituted in place of N-drugs for pain management or other post-acute care within the cohort.

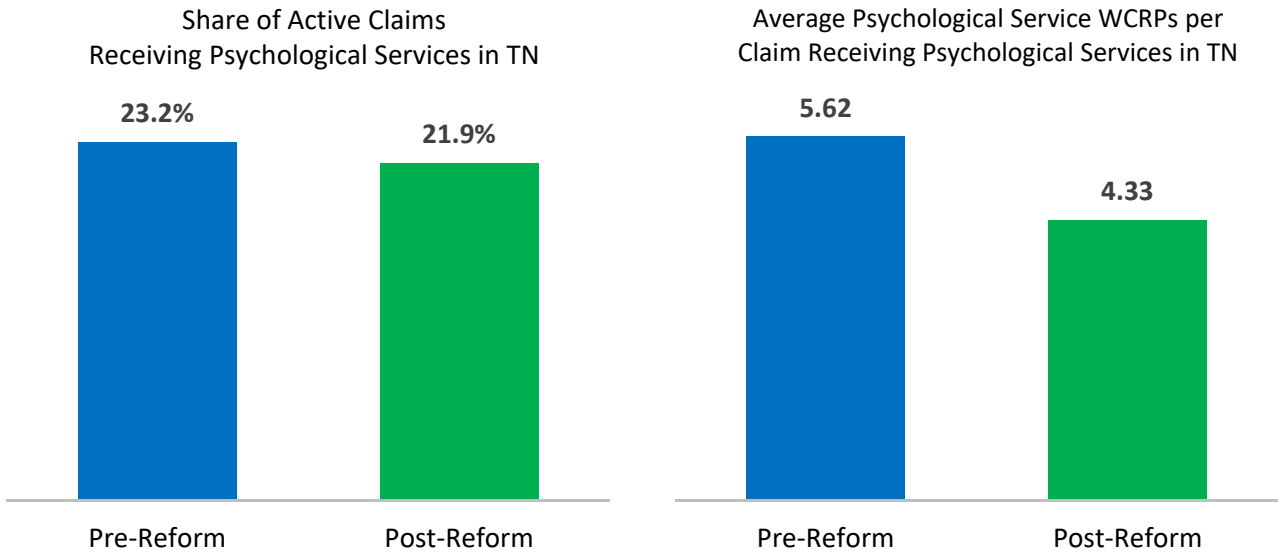
COHORT UTILIZATION OF PHYSICAL MEDICINE SERVICES DECREASED



Based on MDC data for physician services provided between 3/1/16 and 8/31/17; claims occurring between 2005 and 2009

Exhibit 15

COHORT UTILIZATION OF PSYCHOLOGICAL SERVICES DECREASED



Based on MDC data for physician services provided between 3/1/16 and 8/31/17; claims occurring between 2005 and 2009

Exhibit 16

DATA ANALYSIS—ARIZONA

As in the Tennessee section of this report, the analysis of the Arizona ODG Formulary implementation begins with an overview of pre-reform and post-reform prescription drug utilization in Exhibit 17. Some notable observations from Exhibit 17 include the following:

- Prescription drug utilization metrics show a declining trend between the pre-reform and post-reform periods. The share of claims receiving drug scripts remained flat, while the number of scripts per claim with a script decreased.
- The share of claims with any N-drug script decreased by 10% after formulary implementation.
- The average price per script for Y-drugs and all drugs decreased. As will be shown later, this is due to the substitution of relatively less expensive drugs in place of more expensive drugs; adjusted for this substitution effect, prices increased. Drug costs for claims with a prescription drug also decreased 10%.

	Pre-Reform	Post-Reform	% Change
Share of Claims With at Least One Prescription Drug	42%	42%	0%
Share of Claims With at Least One N-Drug Script	9.2%	8.3%	-10%
Share of Claims With at Least One Y-Drug Script	41%	41%	0%
Scripts per Claim With at Least One Prescription Drug	6.6	6.1	-8%
N-Drug Scripts per Claim With at Least One N-Drug Script	6.5	6.0	-8%
Y-Drug Scripts per Claim With at Least One Y-Drug Script	5.5	5.2	-5%
Price per Script	\$183	\$178	-3%
Price per N-Drug Script	\$299	\$302	1%
Price per Y-Drug Script	\$149	\$147	-1%
Drug Cost per Claim With at Least One Prescription Drug	\$1,216	\$1,093	-10%

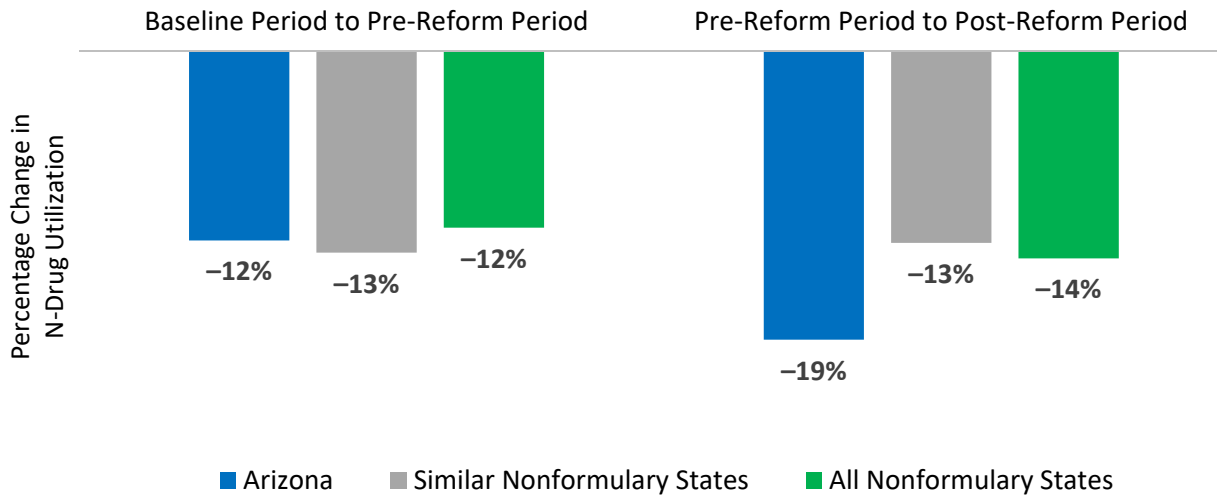
Based on MDC data for prescriptions paid between 10/1/15 and 9/30/17

Exhibit 17

During the pre-reform period, N-drugs constituted 21% of all prescription drug scripts and 35% of prescription drug payments in the Arizona WC system. Exhibit 18 shows the percentage change in overall N-drug utilization between time periods, as measured by a utilization index for N-drugs. As the timeline of the Arizona reform largely overlapped the timeline of the Tennessee reform, similar declines in N-drug utilization across all time periods and states are observed. N-drug utilization in Arizona decreased at a comparable rate to nonformulary states from the baseline period to the pre-reform period. However, the rate of decrease for N-drug utilization did accelerate from the pre-reform to post-reform period, with N-drug utilization in Arizona changing by an additional -7% $[= (1 - .19) / (1 - .13) - 1]$ compared to the decrease observed in similar nonformulary states.

Exhibit 18 suggests that the ODG Formulary implementation accelerated the preexisting downward trend in N-drug utilization in Arizona. As the formulary, using evidence-based medicine, does not recommend the use of N-drugs, this result is expected. The shift in N-drug utilization in Arizona mirrors experience in Tennessee, though with a somewhat smaller magnitude relative to similar nonformulary states.

THE DECREASE IN N-DRUG UTILIZATION IN ARIZONA ACCELERATED AFTER IMPLEMENTATION



Based on MDC data for prescriptions paid between 10/1/14 and 9/30/17

Exhibit 18

During the period studied in this report, mandatory application of the ODG Formulary is limited to opioids and drugs used for chronic pain management.²⁶ Hence, prescription drugs in Arizona require prior authorization only if:

- The drug has a status indicator of “N” on the ODG Formulary, *and*
- The drug is an opioid *or* is used for chronic pain management

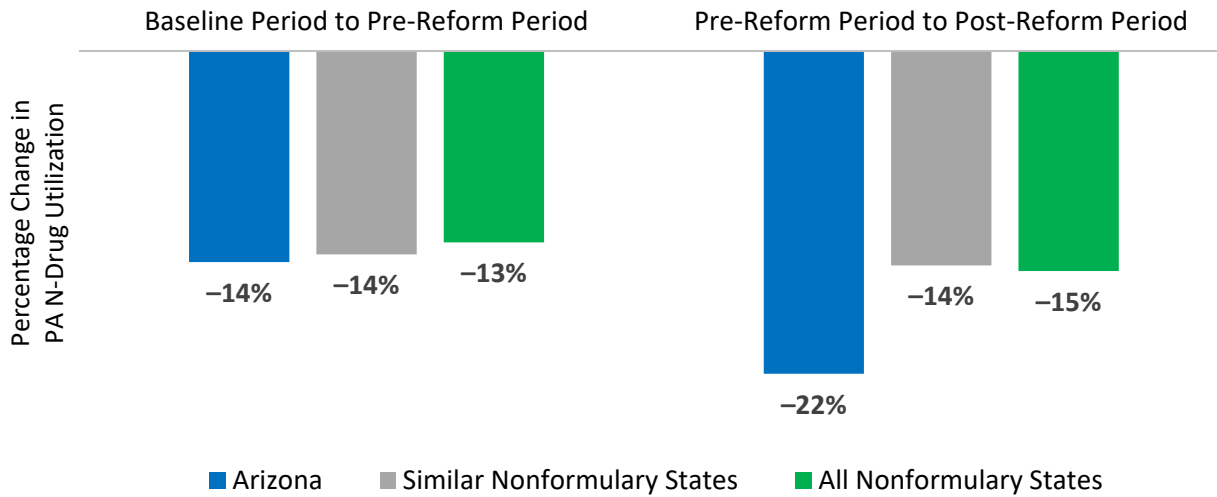
Exhibit 19 examines utilization trends specifically for those N-drugs for which prior authorization is mandatory in Arizona. Such drugs will be referred to as PA N-drugs. All opioids that are N-drugs are considered PA N-drugs. Nonopioid N-drugs are assumed to be PA N-drugs if they are dispensed more than 90 days after the date of the worker’s injury and are part of the following ODG Formulary categories:

- Nonsteroidal anti-inflammatory drugs
- Muscle relaxants
- Cannabinoids
- Topical analgesics

During the pre-reform period, PA N-drugs constituted 69% of N-drug payments in Arizona. As PA N-drugs represent such a large share of N-drugs, it is not surprising that utilization patterns for PA N-drugs in Exhibit 19 closely match the behavior observed for all N-drugs in Exhibit 18. Utilization of PA N-drugs changed in the post-reform period by an additional -9% [= (1 - .22) / (1 - .14) - 1] compared to utilization of the same set of drugs in similar nonformulary states. Note that in Exhibit 19, the same group of PA N-drugs is used in nonformulary states as in Arizona, to maintain comparability.

²⁶ Beginning 10/1/18, the ODG Formulary applies to all prescription drugs in the Arizona WC system.

PA N-DRUG UTILIZATION TRENDS WERE SIMILAR TO ALL N-DRUG UTILIZATION



Based on MDC data for prescriptions paid between 10/1/14 and 9/30/17

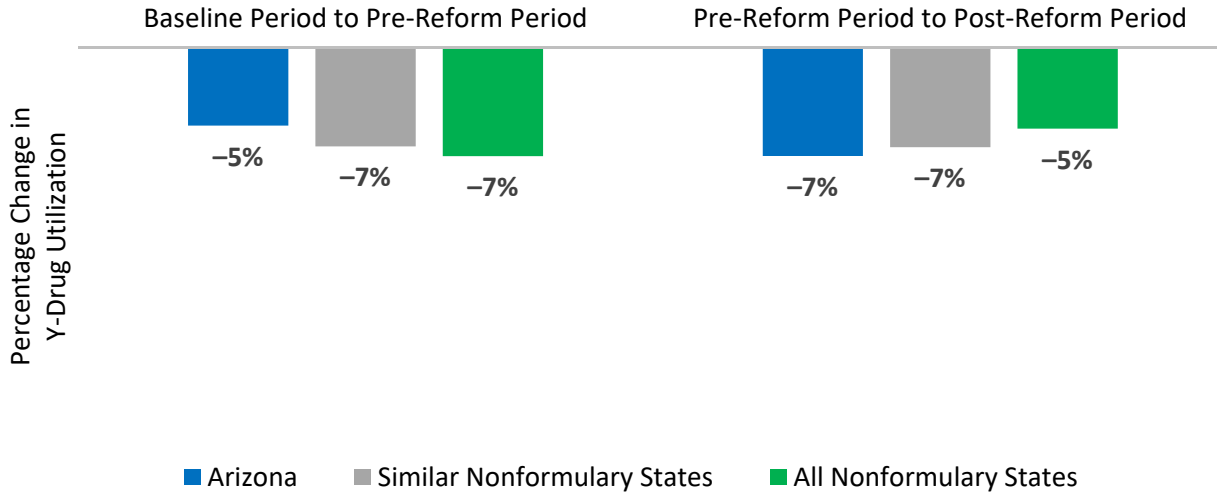
Exhibit 19

The remainder of the Arizona section in this report will examine prescribing patterns for N-drugs without distinguishing PA N-drugs from other N-drugs that do not require mandatory preauthorization in Arizona. This is for two reasons:

- Most N-drugs were assumed to be PA N-drugs, under the assumptions described above. Thus, any observations regarding PA N-drugs are likely to hold for all N-drugs. This can be observed by comparing Exhibits 18 and 19.
- The definition of PA N-drugs used for Exhibit 19 is an imperfect proxy for identifying drugs used for chronic pain management. Whether or not a script is used for chronic pain management, and thus subject to mandatory application of the formulary, is dependent on the specific diagnosis and course of treatment that the injured worker undergoes.

It is possible that an overall shift in utilization patterns for all drugs in Arizona occurred but was independent of the formulary implementation. To evaluate this possibility, trends in Y-drug utilization are investigated in Exhibit 20 below. As with N-drugs, Y-drug utilization in Arizona shows a clear downward trend, though the rate of decrease is lower than for N-drugs. Note that Y-drug utilization trends in Arizona before and after formulary implementation closely resemble trends observed in Tennessee in Exhibit 5, just as post-reform N-drug experience showed similarity.

Y-DRUG UTILIZATION SHOWS A MUCH SMALLER POST-IMPLEMENTATION DECLINE

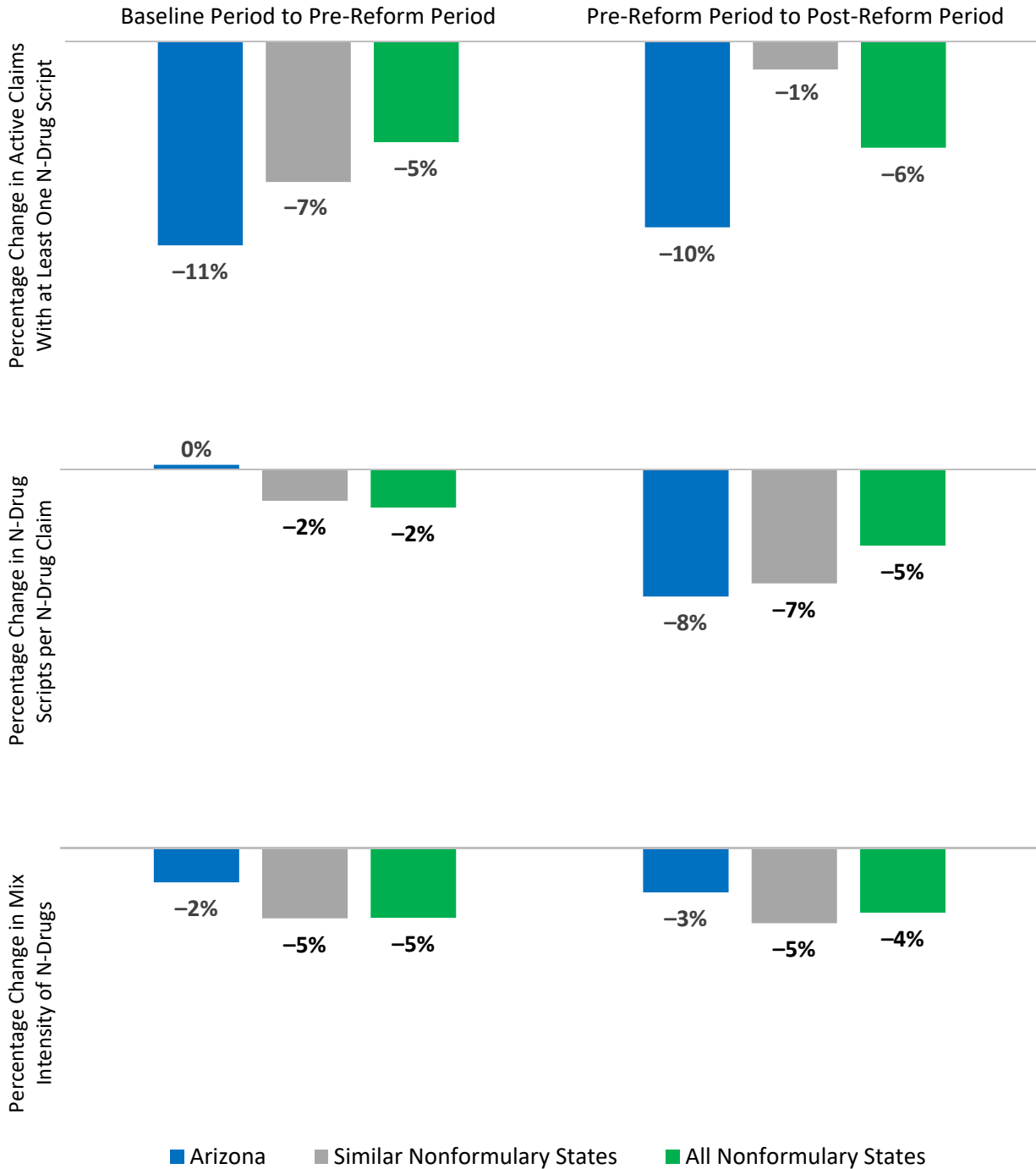


Based on MDC data for prescriptions paid between 10/1/14 and 9/30/17

Exhibit 20

Having observed the drop in N-drug utilization in Arizona, the next step is to break down utilization into components. Exhibit 21 shows the breakdown of the three components of utilization. The number of active claims receiving an N-drug in Arizona decreased faster than in nonformulary states both before and after formulary implementation, with little change in the rate of decrease. Mix intensity of N-drugs also continued to decrease at similar rates before and after implementation. The average number of N-drug scripts per claim with an N-drug remained flat prior to implementation but then dropped by about 8% after formulary implementation. This change in the average number of N-drug scripts per N-drug claim is the primary driver of the utilization decrease observed in Exhibit 18.

ALL COMPONENTS OF N-DRUG UTILIZATION DECLINED IN ARIZONA AFTER IMPLEMENTATION



Based on MDC data for prescriptions paid between 10/1/14 and 9/30/17

Exhibit 21

To illustrate the changing N-drug utilization patterns in Arizona, Exhibit 22 shows the top 10 N-drugs by number of scripts during the pre-reform period along with utilization statistics. The ranks of these top 10 N-drugs show relatively little rearrangement post-reform, demonstrating the stability in the mix of N-drugs. The proportion of active claims receiving at least one script decreased nearly across the board, consistent with observed trends in Exhibit 21. One notable exception is the topical drug lidocaine; while fewer active claims received scripts for other top N-drugs, the share of claims receiving a lidocaine script increased 16% ($= 10.4 / 9.0 - 1$) between the two periods.

FEWER ACTIVE CLAIMS RECEIVED TOP N-DRUGS IN ARIZONA

Drug Name	Pre-Reform Statistics			Post-Reform Statistics		
	Claims Receiving Drug per 1,000 Active Claims	Average Scripts per Claim Receiving Drug	Rank (By Script Count)	Claims Receiving Drug per 1,000 Active Claims	Average Scripts per Claim Receiving Drug	Rank (By Script Count)
Oxycontin®	6.9	8.0	1	5.3	8.3	2
Diclofenac Sodium ²⁷	24.1	2.2	2	22.8	2.1	1
Carisoprodol	9.8	4.4	3	6.0	4.8	4
Lidocaine	9.0	3.5	4	10.4	3.3	3
Morphine Sulfate	4.6	6.7	5	4.0	6.4	5
Diazepam	7.5	3.0	6	5.6	2.8	7
Trazodone HCl	3.6	5.3	7	3.2	5.3	6
Topiramate	3.2	4.7	8	2.8	4.6	8
Tramadol HCl	3.7	3.9	9	2.7	3.3	10
Alprazolam	2.5	5.2	10	1.8	4.7	11

Based on MDC data for prescriptions paid between 10/1/15 and 9/30/17

Exhibit 22

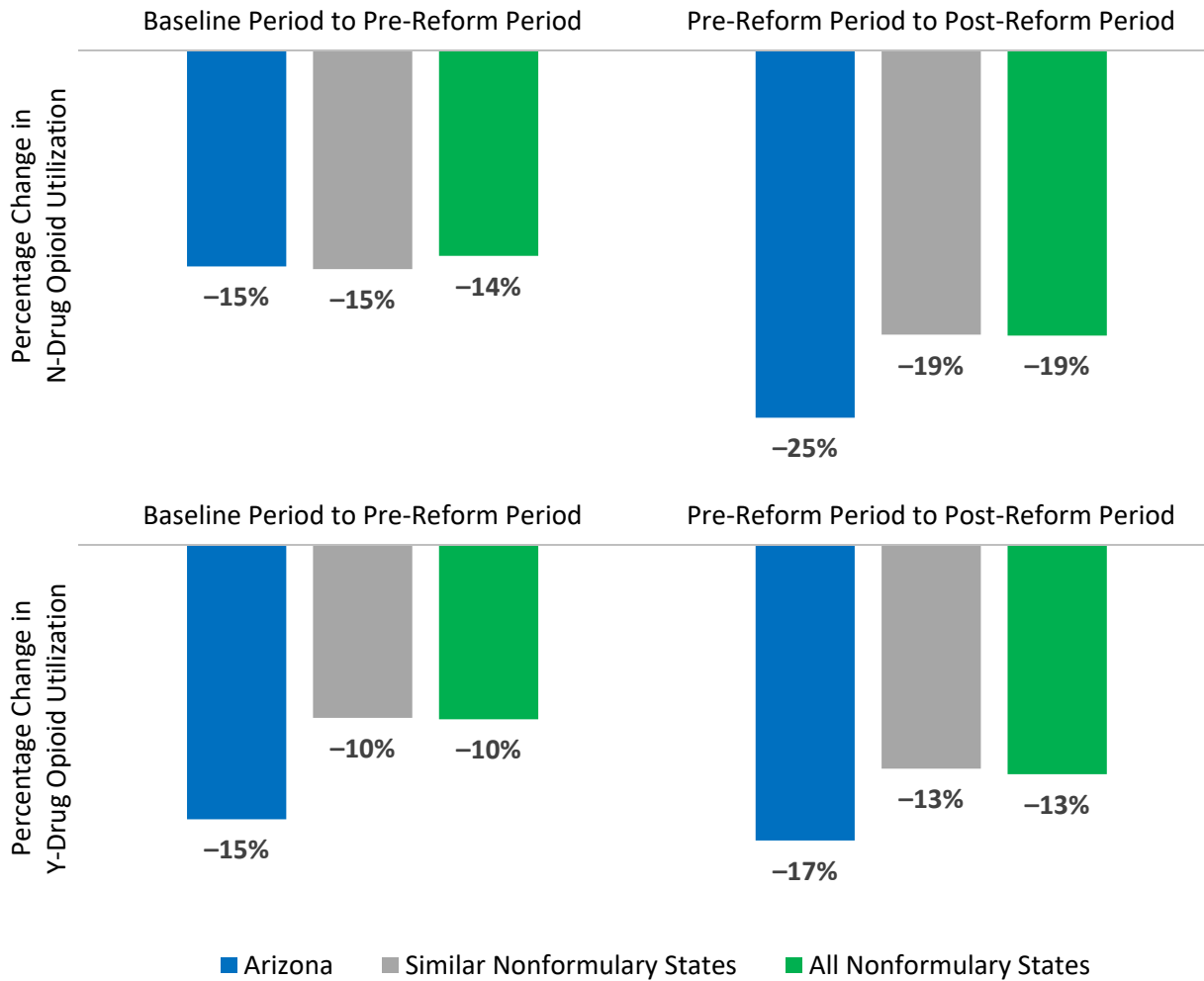
In Arizona, regulations specifically applied the ODG Formulary to all opioid utilization. However, most opioids during the pre-reform period would have had a status indicator of “Y” on the formulary. Prior to formulary implementation, 79% of opioid scripts in Arizona were for Y-drugs, and Y-drugs represented 55% of opioid consumption measured by MME. Of the top 10 drugs in Arizona during the pre-reform period, four²⁸ were opioids; all four of these top opioids were Y-drugs.

The large share of opioids with a “Y” status indicator suggests that the ODG Formulary may have a muted effect on opioid utilization. However, it is possible that the formulary implementation would have a noticeable effect on those opioids which are N-drugs. As opioid usage was an explicit target of the formulary regulations in Arizona, Exhibit 23 divides Arizona’s opioid utilization experience, measured in MME, by formulary status to investigate. For N-drug opioids, the rate of decrease in utilization accelerated relative to nonformulary states in the post-reform period. The utilization trend for Y-drug opioids shows a smaller shift.

²⁷ Includes Voltaren® gel due to a generic equivalent form of diclofenac sodium becoming available during the study period.

²⁸ Hydrocodone bitartrate-acetaminophen, oxycodone HCl-acetaminophen, tramadol HCl, and oxycodone HCl; recall that these were also the four opioids in the top 10 prescription drugs in the Tennessee WC system during the pre-reform period. As noted in the methodology section, Tennessee and Arizona have quite similar prescribing patterns during their respective pre-reform periods.

TRENDS IN OPIOID UTILIZATION VARIED SLIGHTLY BY FORMULARY STATUS IN ARIZONA



Based on MDC data for prescriptions paid between 10/1/14 and 9/30/17

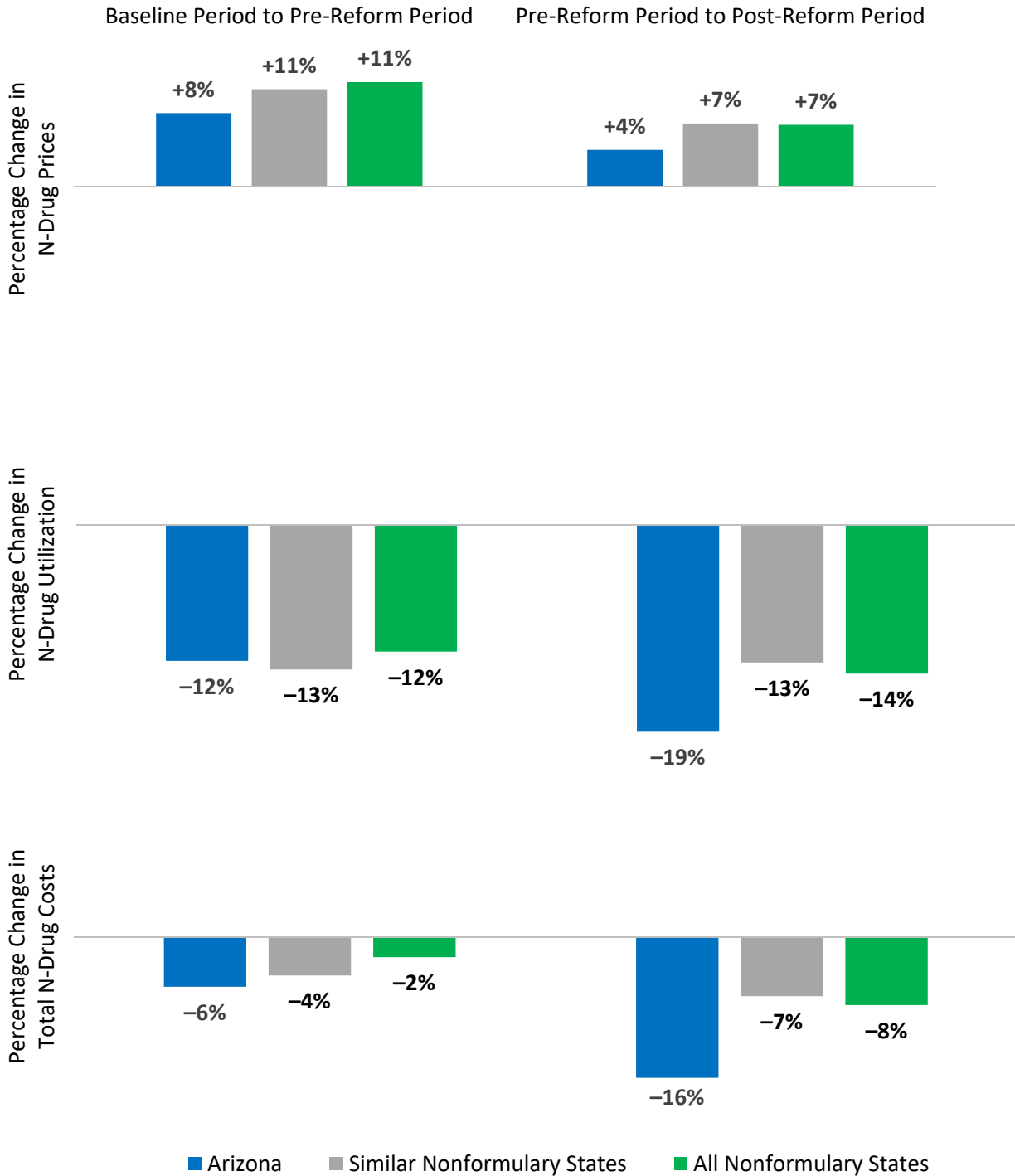
Exhibit 23

Exhibit 24 breaks down overall N-drug cost changes in Arizona into price and utilization components. Prices paid per N-drug script, adjusted for the mix of prescriptions, continued to rise during the post-reform period. N-drug prices in Arizona did increase somewhat more slowly than in nonformulary states, possibly due to other prescription cost control measures.²⁹ The 18% drop in total N-drug costs during the post-reform period is principally driven by decreased utilization. Note that in Exhibit 17, an average change in N-drug prices of only +1% was observed as relatively more expensive N-drugs were replaced by relatively cheaper substitutes; the +4% price change in Exhibit 24 is adjusted for substitution.³⁰

²⁹ For example, a marked increase in the use of mail-order pharmacies was observed for WC prescriptions in Arizona in recent years. However, this is just one possibility, and an examination of prescription drug price trends is outside the scope of this report.

³⁰ In Exhibit 24, a +4% increase in N-drug prices (adjusted for substitution) is observed from the pre-reform to post-reform period. In Exhibit 17, an unadjusted price change of +1% was observed. The difference of -3% (= +1% - 4%) between these two observations matches the change in mix intensity observed in Arizona in Exhibit 21.

DECREASING ARIZONA N-DRUG COSTS WERE DRIVEN BY UTILIZATION; PRICES CONTINUED TO RISE

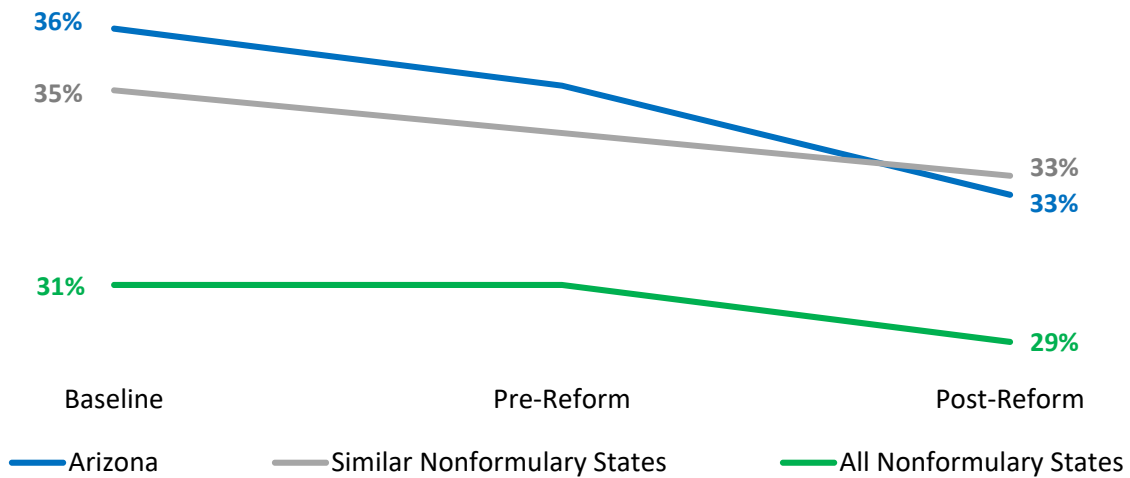


Based on MDC data for prescriptions paid between 10/1/14 and 9/30/17

Exhibit 24

Driven by rapid declines in utilization, N-drug costs, as a share of total prescription costs, have fallen across the country. In Arizona, the N-drug share of prescription payments declined more quickly than in nonformulary states from the baseline period to the pre-reform period, and this rate of decrease accelerated after formulary implementation. Nevertheless, the decrease in N-drug share of drug costs compared to experience in nonformulary states is relatively modest, and any decline in N-drug costs due to the formulary immediately after implementation must be relatively slight. However, it is important to note that the results presented in Exhibit 25 describe trends extending only one year after formulary implementation and may not represent a complete picture of the *ultimate* efficacy of the formulary. In particular, beginning in October 2018, the ODG Formulary will apply to all drugs rather than specific categories. Universal application of the formulary may streamline its use in determining prescription drug treatments and may help standardize treatment patterns and insurer authorization processes. Other regulations regarding the formulary and prescription drug use are also likely to continue evolving over time.

N-DRUG SHARE OF PRESCRIPTION COSTS DECLINED SLIGHTLY IN ARIZONA POST-IMPLEMENTATION



Based on MDC data for prescriptions paid between 10/1/14 and 9/30/17

Exhibit 25³¹

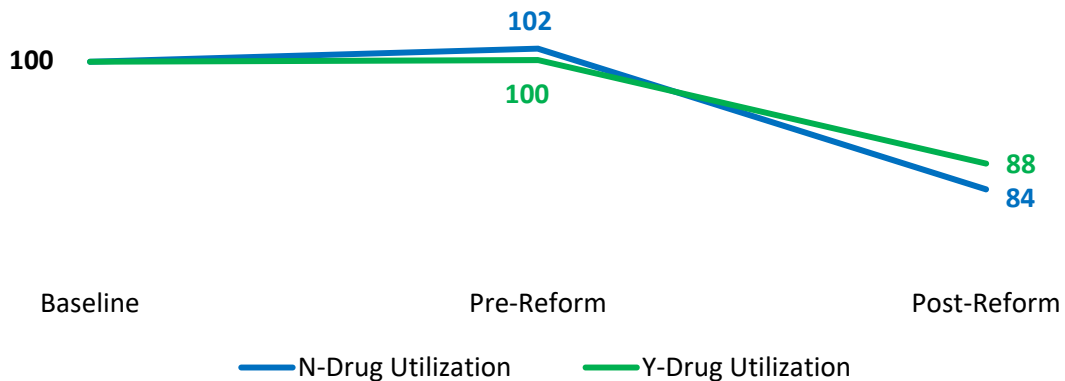
³¹ Note that the N-drug shares for nonformulary states in this exhibit are not directly comparable to Exhibit 12 for two reasons. First, the Tennessee data is drawn from six-month time intervals, while yearlong time periods are examined for Arizona. Second, consistent with Tennessee rules, all topical drugs are treated as N-drugs regardless of the status indicator in the Tennessee analysis; this treatment is not applied in Exhibit 25 because Arizona rules do not contain this restriction.

The report now turns to an examination of the cohort of mature Arizona claims. The next four exhibits show utilization patterns limited to the cohort of mature claims with accident dates between 2005 and 2009 (the 2005/09 cohort).

Exhibit 26 traces the utilization of N-drugs and Y-drugs within this cohort from the baseline to post-reform periods, beginning with a starting value of 100. N-drug utilization among the 2005/09 cohort declined 18% from the pre-reform to the post-reform period (from an indexed value of 102 to 84); this nearly matches the 19% utilization decrease observed among all claims in Exhibit 18. Y-drug utilization also decreased in the post-reform period at a slightly slower rate. Because the composition of the cohort does not change between the two periods, and because the mix of medical services is expected to remain stable for such mature claims over the relatively short pre-reform to post-reform time frame, the N-drug utilization decrease in Exhibit 26 is not likely to be due to any shift in claimant characteristics. In addition, the concurrent decrease in Y-drug utilization suggests that claimants were not substituting N-drugs with other types of drugs.

N-DRUG AND Y-DRUG UTILIZATION BOTH DECREASED POST-REFORM FOR THE 2005/09 COHORT

Drug Utilization in AZ, Indexed to a Starting Value of 100

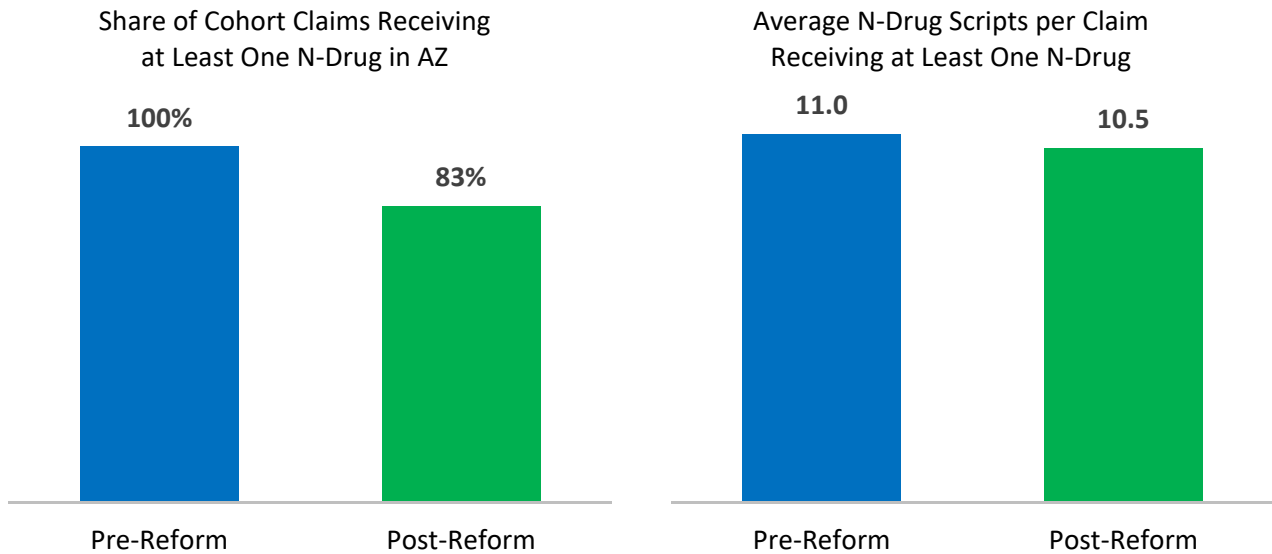


Based on MDC data for prescriptions paid between 10/1/15 and 9/30/17

Exhibit 26

For the 2005/09 cohort, the N-drug utilization decrease between the pre-reform and post-reform period is primarily driven by a 17% reduction in the number of injured workers receiving an N-drug. For workers who continued receiving N-drugs, the average number of N-drugs received also declined. This experience also closely parallels results for the Tennessee 2005/09 cohort shown in Exhibit 14.

COHORT UTILIZATION DECREASE WAS DRIVEN BY SHARE OF CLAIMS WITH AT LEAST ONE N-DRUG



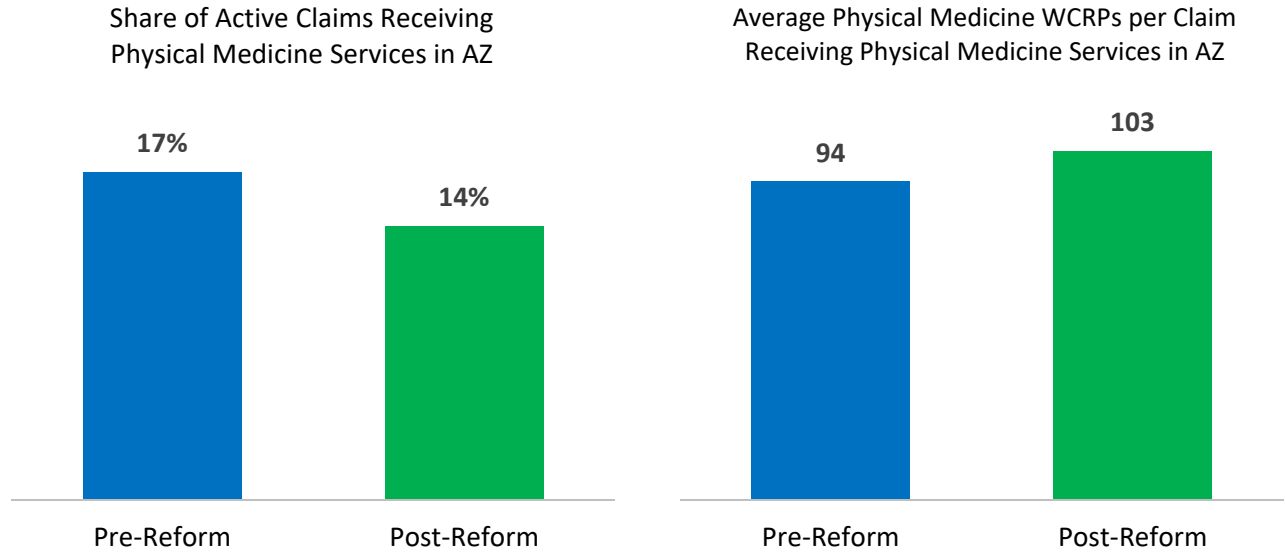
Based on MDC data for prescriptions paid between 10/1/15 and 9/30/17

Exhibit 27

Exhibits 28 and 29 below compare the utilization of physical medicine and psychological services, respectively. In Exhibit 27, a large decrease in the share of 2005/09 cohort claims receiving any N-drug was observed. However, all claims in the cohort continued actively receiving medical services during the post-reform period. In Arizona, this is particularly noteworthy, as the formulary implementation was specifically targeted at opioids and other chronic pain management drugs; due to the post-acute nature of medical care for mature claims, pain management drugs would be expected to make up most prescriptions in the cohort. Approximately 17% of the cohort ceased using N-drugs as part of their post-acute care, while still actively receiving other medical services. It is possible that injured workers may have increased utilization of physical medicine or psychological services as a replacement for the foregone N-drugs as part of their treatment. If so, a spike in utilization of these services should be observable during the post-reform period.

For physical medicine, the share of cohort claims receiving any physical medicine service declined from 17% to 14% in the post-reform period. Among claims receiving any physical medicine services, physical medicine utilization per claim, as measured by WCRPs, did increase, with the net result that utilization of physical medicine remained approximately flat between periods. Likewise, between the pre-reform and post-reform periods, the share of claims receiving psychological services decreased by one-third, approximately offsetting an increase in the average level of psychological services for workers receiving psychological services. This observation suggests that these physician services were not being substituted in place of N-drugs for pain management or other post-acute care within the 2005/09 cohort.

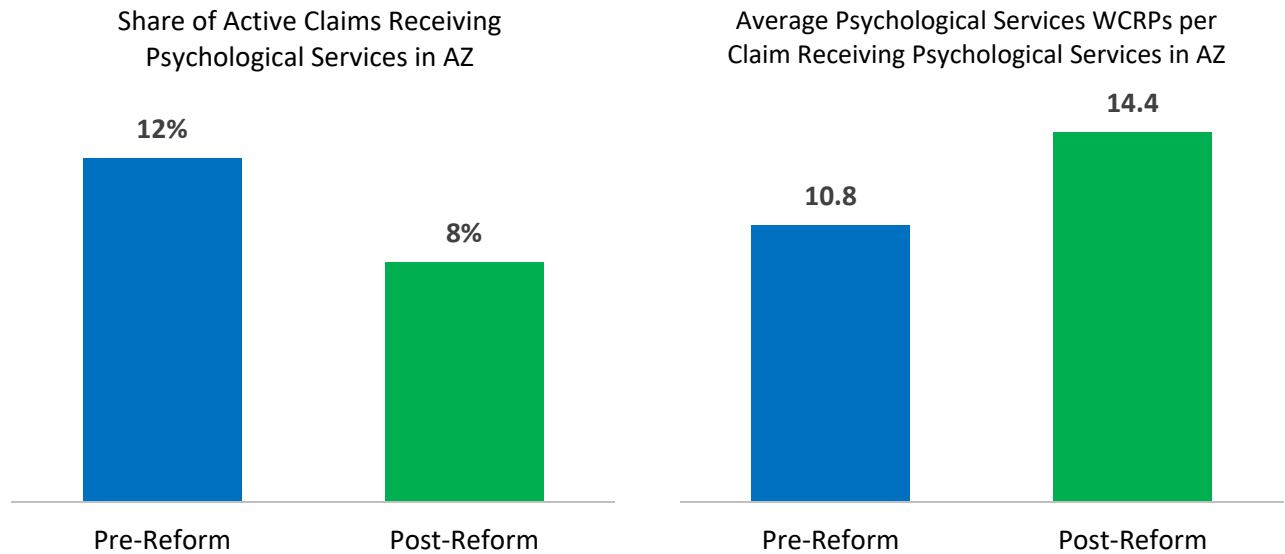
COHORT UTILIZATION OF PHYSICAL MEDICINE REMAINED FLAT POST-IMPLEMENTATION



Based on MDC data for services provided between 10/1/15 and 9/30/17; claims occurring between 2005 and 2009

Exhibit 28

COHORT UTILIZATION OF PSYCHOLOGICAL SERVICES REMAINED FLAT POST-IMPLEMENTATION



Based on MDC data for services provided between 10/1/15 and 9/30/17; claims occurring between 2005 and 2009

Exhibit 29

CONCLUDING REMARKS

This report examined changes in price and utilization trends in WC prescription drug experience following mandatory implementation of the ODG Formulary. The small number of states available for study and the presence of nonformulary effects on drug utilization prevent us from making conclusive inferences from the data examined. Nevertheless, this report does observe some overall decrease in N-drug utilization, and hence costs, immediately following implementation of the formulary. As summarized in Exhibit 30 below, N-drug utilization did decline at a perceptibly faster rate after formulary implementation in both Arizona and Tennessee, compared to utilization declines in other comparable observed categories. In the two states studied, post-reform N-drug utilization decreased at a rate of approximately 7% to 14% beyond the N-drug utilization decreases observed in nonformulary states; N-drug utilization also decreased more rapidly than other benchmarks. In addition, examination of a fixed cohort of claims in each state found little evidence of an increased utilization in Y-drugs or physician services that might be substituted for the eliminated N-drugs.

POST-REFORM N-DRUG UTILIZATION DECREASED MORE QUICKLY THAN RELEVANT BENCHMARKS

Tennessee Observations	
Rate of Change in TN N-Drug Utilization, Pre-Reform	-11.8%
Rate of Change in TN Y-Drug Utilization, Post-Reform	-7.6%
Rate of Change in Similar State N-Drug Utilization, Post-Reform	-10.3%
Rate of Change in TN N-Drug Utilization, Post-Reform	-23.2%

Arizona Observations	
Rate of Change in AZ N-Drug Utilization, Pre-Reform	-12.5%
Rate of Change in AZ Y-Drug Utilization, Post-Reform	-7.1%
Rate of Change in Similar State N-Drug Utilization, Post-Reform	-12.6%
Rate of Change in AZ N-Drug Utilization, Post-Reform	-19.0%

Based on MDC data for prescriptions paid between 10/1/14 and 9/30/17

Exhibit 30

The results summarized in Exhibit 30 describe only the immediate post-reform period. Post-reform experience in Texas has shown significantly different results. Some potential causes of the differences between results observed in this report and results found in Texas in [3] have already been mentioned in the Background section of this report. As more data becomes available in states that have adopted the ODG Formulary, further research will be needed to better understand both the longer-term impacts of the formulary and differences in effects between states.

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APPENDIX

Measurement of price and utilization over time requires special care. In particular, it is necessary to account for any “substitution effect” when prices change. For example, suppose Drug A and B both cost \$1 and are pharmacologically identical. If the price of Drug A increases to \$5, but all Drug A scripts are replaced with Drug B scripts by consumers, there is no actual change in the prices paid for drugs—all scripts actually being purchased still cost \$1. To account for the changing mix of goods purchased, price and utilization should be tracked by indexes that account for this substitution effect. The index used to measure prices and utilization changes between periods in this analysis is the Fisher index, which is constructed from Paasche and Laspeyres indexes.

The Laspeyres price index measures changes in price assuming that quantities are fixed at the prior period’s levels. Since this index relies on last period’s quantities prior to any substitution effect taking place, under normal economic circumstances (substitution of relatively more expensive products with less expensive products) the Laspeyres index will overestimate price inflation. The Paasche price index is the reverse of the Laspeyres price index, using the current period’s quantities in place of last period’s. This index measures the change in price-holding quantities fixed at their most recent value. Since the Paasche price index relies on quantities after substitution has occurred, the Paasche price index underestimates price inflation under normal circumstances. The Fisher price index is the geometric mean of the Paasche and Laspeyres price index. As the Fisher index balances the results of the Paasche and Laspeyres indexes, it represents the most appropriate index for measuring price changes over time.

In addition to price indexes, Paasche, Laspeyres, and Fisher indexes may also be constructed to measure quantities of goods over time. This requires only switching the terms for price and quantity in the index formulas. Thus, both the Paasche and Laspeyres quantity indexes are calculated by measuring the change in quantity while holding prices fixed, and, again, the Fisher quantity index is the geometric mean of these two indexes. The product of the Fisher price and Fisher quantity indexes represents the total change in expenditure during a period.

One potential distortion in the index calculation involves goods that enter or exit the market entirely. This is of particular concern when measuring drug price and utilization, as new drugs periodically enter the WC system after receiving approval from the US Food and Drug Administration. Since different sets of products are held constant when calculating the Paasche and Laspeyres indexes, the two indexes will be calculated using a different set of drugs. A potential solution to this issue would be to limit the calculation to drugs that have transactions present during both periods in the index calculation. However, in this report, we found that the indexes calculated with this limitation turn out to be extremely similar to the unmodified index values. Hence, no limitation on goods was used in calculating the results shown in this report.

The other potential distortion in these index values arises from changes in the number of active claims over time. The frequency of WC claims has been decreasing for some time [6], and this is reflected in a marked decrease in the total number of active claims in the MDC over the time period studied by this report. Without adjustment, this drop in active claim count would artificially decrease the quantity index values, conflating a decrease in utilization with a decrease in claims in the database over time. Hence, a claim adjustment factor is applied to the value of the Fisher quantity index equal to the active claim count in the current period divided by the active claim count in the baseline period. This adjusted quantity index is referred to as the utilization index in this report.

Index Formulas			
Incremental Paasche Price Index:	$IPPI_t = \frac{\sum_i P_t Q_t}{\sum_i P_{t-1} Q_t}$	Incremental Paasche Quantity Index:	$IPQI_t = \frac{\sum_i P_t Q_t}{\sum_i P_t Q_{t-1}}$
Incremental Laspeyres Price Index:	$ILPI_t = \frac{\sum_i P_t Q_{t-1}}{\sum_i P_{t-1} Q_{t-1}}$	Incremental Laspeyres Quantity Index:	$ILQI_t = \frac{\sum_i P_{t-1} Q_t}{\sum_i P_{t-1} Q_{t-1}}$
Incremental Fisher Price Index:	$IFPI_t = \sqrt{IPPI_t \times ILPI_t}$	Incremental Fisher Quantity Index:	$IFQI_t = \sqrt{IPQI_t \times ILQI_t}$
Cumulative Fisher Price Index:	$FPI_t = \prod_{k=1}^t IFPI_k$	Cumulative Fisher Quantity Index:	$FQI_t = \prod_{k=1}^t IFQI_k$
Claim Adjustment Factor:	$CAF_t = \frac{C_t}{C_{Baseline}}$		
Utilization Index:	$UI_t = FQI_t \times CAF_t$		

Where:

$IFPI_t$ = Incremental Fisher price index from period t-1 to period t

FPI_t = Cumulative Fisher price index from the initial period to period t

$P_{i,t}$ = Price of product i at period t

$Q_{i,t}$ = Quantity of product i at period t

C_t = Count of active claims in the MDC during period t