

Does Enforcement of Drug Regimen Reviews Improve Medication Safety and Management in Nursing Homes? An Analysis of the CMS Drug Regimen Review Policy

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Abstract

In 2019, the Centers for Medicare & Medicaid Services (CMS) implemented a mandatory comprehensive drug regimen review (DRR) policy in nursing homes (NHs) to address medication-related issues that significantly contribute to morbidity, mortality, hospital readmissions, and escalating healthcare costs among residents. Prior to the policy's implementation, nursing homes frequently faced deficiency citations for medication errors and inadequate drug management practices. This study assesses the policy's impact by comparing trends in deficiency citations before and after the policy enactment, with a particular focus on overall citation prevalence and those specifically related to medication management. Findings from this research offer valuable evidence regarding the effectiveness of the CMS DRR policy in improving medication safety and the quality of care in nursing homes.¹

Keywords: Drug Regimen Review (DRR), Medication Management, Deficiency Citations, Nursing Home Quality, Healthcare.

1. Introduction

Effective medication management remains a persistent challenge in nursing homes, where residents are often at risk of polypharmacy, commonly defined as the concurrent use of five or more drugs (Dovjak, 2022). While polypharmacy may be necessary to manage multiple chronic conditions, it is associated with a heightened risk of drug-related problems and an increased likelihood of potentially inappropriate medication use (Dilles et al., 2011). Therefore, a

comprehensive medication management approach that includes carefully reducing or discontinuing unnecessary medications under the guidance of healthcare professionals, is essential for minimizing polypharmacy and improving the quality of care in nursing homes.

On October 6, 2014, the Improving Medicare Post-Acute Care Transformation (IMPACT) Act was signed into law, mandating that all Skilled Nursing Facilities (SNFs) report standardized patient assessment data, including the Drug Regimen Review (DRR) (Centers for Medicare & Medicaid Services, 2021). The DRR requires a monthly comprehensive evaluation of a resident's medication regimen to promote positive outcomes, reduce risks, and identify and resolve medication-related issues through collaboration with an interdisciplinary care team. This requirement for monthly pharmacist reviews was formalized as part of the Centers for Medicare & Medicaid Services (CMS) initiative to enhance medication safety in nursing homes (Centers for Medicare & Medicaid Services, 2015).

Since the law's enactment, the Centers for Medicare & Medicaid Services (CMS) have worked to develop reporting mechanisms and integrate the Drug Regimen Review (DRR) measure into the Minimum Data Set (MDS) used for nursing home assessments. Implementation began with the incorporation of the DRR into MDS Section N (Medications), with data collection starting in October 2016 for SNFs (Centers for Medicare & Medicaid Services, 2016). This marked the practical start of DRR compliance reporting, although full enforcement was phased in gradually. The CMS State Operations Manual reinforced the monthly review requirement under F-

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Tag, emphasizing that facilities must maintain policies for timely reviews and for acting on pharmacist recommendations (Centers for Medicare & Medicaid Services, 2017). By October 2018, the DRR measure was fully integrated into the MDS, and CMS began implementing stricter oversight to ensure compliance (Centers for Medicare & Medicaid Services, 2019).

Table 1. Definitions of pharmacy services–related deficiency citations.

F-tag	Topic
F-425	Provide routine and emergency drugs through a licensed pharmacist and only under the general supervision of a licensed nurse.
F-428	At least once a month, have a licensed pharmacist review each resident's medication(s) and report any irregularities to the attending doctor.
F-431	Maintain drug records and properly mark/label drugs and other similar products according to accepted professional standards.
F-755	Provide pharmaceutical services to meet the needs of each resident and employ or obtain the services of a licensed pharmacist.
F-756	Ensure a licensed pharmacist performs a monthly drug regimen review, including the medical chart, following irregularity reporting guidelines in developed policies and procedures.
F-757	Ensure each resident's drug regimen must be free from unnecessary drugs.
F-758	Implement gradual dose reductions (GDR) and non-pharmacological interventions, unless contraindicated, prior to initiating or instead of continuing psychotropic medication; and PRN orders for psychotropic medications are only used when the medication is necessary and PRN use is limited.
F-759	Ensure medication error rates are not 5 percent or greater.
F-760	Ensure that residents are free from significant medication errors.
F-761	Ensure drugs and biologicals used in the facility are labeled in accordance with currently accepted professional principles; and all drugs and biologicals must be stored in locked compartments, separately locked, compartments for controlled drugs.

These efforts to implement the DRR in nursing homes were intended to improve the quality of medication management and to support the prevention and early detection of adverse drug events in the growing nursing home population. Under federal regulations, deficiency citations are issued to nursing homes that fail to meet the DRR-related participation requirements (US Government Printing Office, 2025).

Each citation is classified by scope and severity into one of twelve categories, labeled “A” through “L”(Centers for Medicare & Medicaid Services, 2018). These citations reflect areas of non-compliance, including issues related to medication errors and inadequate drug management practices. A nursing home facility is considered to have lower quality of care if it receives one or more deficiencies rated at scope and severity levels F, H, I, J, K, or L on any of the 49 specified F-tags (Centers for Medicare & Medicaid Services, 2017). As such, they serve as important indicators of care quality and highlight the need for systematic improvement in nursing home settings.

Recognizing the importance of evaluating quality in medication management, our study aims to examine the impact of the 2019 CMS DRR policy on the prevalence of deficiency citations in nursing homes. Specifically, it assesses whether there has been a reduction in the overall number of deficiency citations and the number of citations related to medication management since the policy's implementation. By analyzing trends in deficiency citations before and after the policy, this research offers valuable insights into the effectiveness of the CMS initiative in improving medication safety and quality of care in nursing homes.

2. Method

2.1 Data Sources

To examine the impact of the Drug Regimen Review (DRR) policy on the quality of care in nursing homes, we use Nursing Home Compare (NHC) as our primary dataset (Centers for Medicare & Medicaid Services, 2025). The NHC dataset provides comprehensive information on deficiency citations, facility characteristics, nurse staffing levels, and 5-star quality ratings. Although the DRR policy was formally introduced earlier, 2019 likely marks the point when CMS began enforcing the policy more rigorously through audits and deficiency citations, particularly focusing on whether facilities acted on pharmacist recommendations (Centers for Medicare & Medicaid Services, 2019). Our study period spans from 2017 to 2024, comprising a pre-implementation period (2017-2019) and a post-implementation period (2020-2024). Following established practices for this dataset (Castle & Myers, 2006), missing values for continuous variables were imputed using mean substitution. No imputation was required for categorical independent variables due to the absence of missing data.

2.2 Dependent Variables

Variables	Definition
<i>Facility</i>	
Beds	Total number of beds
Occupancy	Percentage of occupied beds (%)
Profit	Indicates whether a facility is for-profit (1/0)
Hospital	Indicates whether a facility is hospital-based (1/0)
Chain	Indicates whether a facility is part of a chain (1/0)
Medicaid	Percentage of Medicaid residents (%)
Medicare	Percentage of Medicare residents (%)
<i>Patient</i>	
Average RUGS NCMI	The average RUGS NCMI for all residents admitted during the calendar year.
Nursing home days SNF	Percentage of all nursing home days during the calendar year that were SNF Medicare-covered days (%)
<i>Staffing</i>	
RN hours	RN hours per resident day
LPN hours	LRN hours per resident day
CNA hours	CNA hours per resident day
<i>Market</i>	
HHI	Herfindahl-Hirschman Index that measures the market concentration
U.S. census region	U.S. census region: West, Midwest, South, or Northeast

We use deficiency citations as indicators of the quality of care in nursing homes. Facilities that fail to meet federal participation requirements are subject to deficiency citations. Because our study focuses on the quality of medication management, we restrict our analysis to deficiency citations related to pharmacy services. Specifically, we analyze ten F-tags categorized under “Pharmacy Services Deficiencies.” F425, F428, and F431 were the original tag numbers used to cite pharmacy-related deficiencies. A new set of F-tags was introduced in November 2017 as part of updated federal regulations for nursing home facilities (Centers for Medicare & Medicaid Services, 2020; Simonson, 2018). The updated F-tags include seven that specifically address pharmacy services: drug regimen review (F755 and F756), unnecessary medications (F757 and F758), medication errors (F759 and F760), and medication labeling and storage (F761). Detailed definitions of these F-tags are provided in Table 1.

Table 2. Definitions of Nursing Home Characteristics.

In this study, F757 and F758 were grouped together due to their shared focus on unnecessary medication use. Likewise, F759 and F760, both related to medication errors, were analyzed as a combined category. Our dependent variable includes (1) the number of nursing homes receiving each of the relevant F-tags and (2) the number of nursing homes with a total count of pharmacy-related F-tags above the sample average.

2.3 Independent Variables

Four categories of nursing home characteristics were selected as independent variables based on their conceptual relevance to pharmacy care quality and prior research on factors associated with deficiency citations (Wesson et al., 2021). The definitions of the selected variables are summarized in Table 2.

Facility characteristics include total number of beds, occupancy rate, hospital-based (binary), for-profit status (binary), multifacility (binary), and the proportions of residents covered by Medicaid and Medicare. Previous studies have linked these characteristics to various types of deficiencies. For example, bed size, occupancy rate, and ownership have been associated with F-tags related to medication storage and errors (Castle et al., 2010), while other attributes—such as chain affiliation and payer mix—have been linked to higher rates of mental health-related deficiencies (Harrington et al., 2000), lower quality of care (Akinci & Krolikowski, 2005), and a reduced use of medication technicians in such settings (Hughes et al., 2006).

Patient acuity is captured using the average Resource Utilization Group (RUGs) Nursing Case Mix Index (NCMI) and the percentage of SNF Medicare-covered days. These indicators have been widely used to adjust for variations in patient needs and have been associated with nursing home quality (Rantz et al., 2004).

Staffing levels, measured in hours per resident day for registered nurses (RNs), licensed practical nurses (LPNs), and certified nursing assistants (CNAs), have been shown to influence the likelihood of pharmacy-related deficiencies (Bowblis, 2011; Walsh et al., 2014).

To reflect external market conditions, the Herfindahl-Hirschman Index (HHI) and U.S. Census region were included as proxies for regional market competition. These factors have previously been associated with staffing-related, mental health-

related, and abuse-related deficiencies (Castle & Myers, 2006; Castle et al., 2010; McDonald et al., 2013).

Together, these independent variables represent a comprehensive set of factors that influence nursing home quality—capturing dynamic internal operations (e.g., staffing), stable organizational structures (e.g., bed count), and external contextual conditions (e.g., market competition) (Castle et al., 2010).

Table 3. Number of nursing homes receiving each relevant deficiency citation during the study period.

Deficiency Citation No.	2017	2018	2019	2020	2021	2022	2023	2024	Grand Total
F-755	27	2268	2295	1063	1457	1741	2040	1829	12720
F-756	10	1260	1265	439	741	972	952	802	6441
F-757	11	1382	1234	474	604	725	796	654	5880
F-758	15	2695	2821	892	1236	1642	1653	1454	12408
F-759	14	1371	1484	561	828	1098	1142	1039	7537
F-760	19	977	1166	606	937	1074	1228	1015	7022
F-761	22	3313	3849	1552	2556	2660	3014	2850	19816
F-425	1923	68	5	5					2001
F-428	1056	34	2	2					1094
F-431	3712	98	7	1					3818
Grand Total	6809	13466	14128	5595	8359	9912	10825	9643	78737

2.4 Model

We summarized the frequency of pharmacy-related deficiencies in Table 3, showing the number of nursing homes receiving each citation and illustrating the statistical trend in citations over the study period.

To examine the impact of the DRR implementation, we employed an interrupted time series (ITS) approach to analyze trends in pharmacy-related deficiency citations. ITS is a widely used quasi-experimental design for evaluating the effects of interventions or policy changes over time (Grimshaw et al., 2000; Harris et al., 2006; Penfold & Zhang, 2013). It provides a rigorous framework for estimating the temporal effects of an intervention while accounting for pre-existing trends. This method is particularly appropriate in contexts where randomized controlled trials are infeasible, such as large-scale policy interventions in healthcare (Bernal et al., 2017)—making it well suited to our study.

We firstly estimate the following model:

$$y_{it} = \beta_0 + \beta_1 T_{it} + \beta_2 X_{it} + \beta_3 X_{it} T_{it} + \epsilon \quad (1)$$

where the dependent variable represents the number of facilities that received at least one deficiency citation

for F-tag i in year t . T denotes time, X indicates the study phase (0 for the pre-implementation period, 2017–2019; 1 for the post-implementation period, 2020–2024), XT is the interaction term representing time after implementation, and ϵ denotes the residual error.

3. Results and Discussion

We first present a descriptive summary of the number of nursing homes receiving pharmacy-related deficiency citations over time, as shown in Figure 1.

This figure illustrates trends across seven F-tags categorized under “Pharmacy Services Deficiencies.”

DRR is a structured evaluation of a resident’s medications to identify adverse effects, interactions, duplicate therapies, or noncompliance (Code of Federal Regulations, 2025). As part of medication reconciliation, DRR helps improve safety, reduce inappropriate drug use, and support safer transitions in post-acute and long-term care. This expectation is consistent with the trends illustrated in Figure 1. Across all the F-tags in the study, there is a noticeable decline in the number of facilities cited around the year 2020. This timing aligns with the implementation of the DRR policy. The reductions are particularly evident in F-tags directly related to drug reviews and medication errors, suggesting that the policy may have contributed to improved compliance and safer medication management practices. While the number of citations fluctuates slightly in subsequent years, the overall downward trend supports the conclusion that DRR implementation is associated with fewer

pharmacy-related deficiencies. These descriptive results provide preliminary evidence of the policy's effectiveness in improving medication safety in nursing homes.

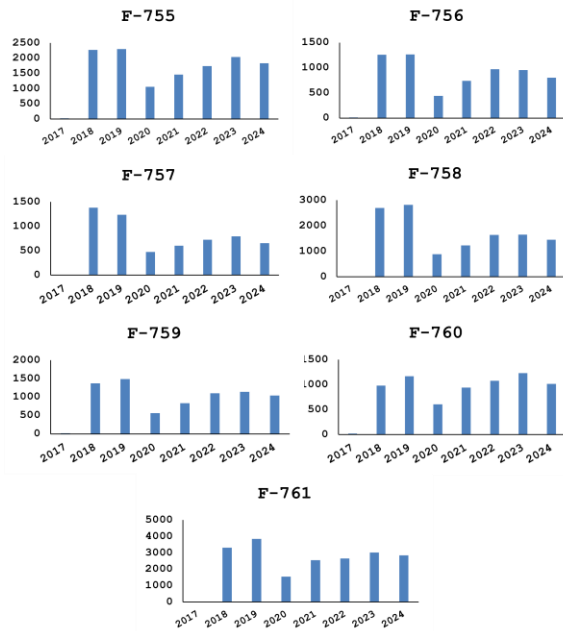


Figure 1. Number of nursing home facilities receiving pharmacy-related deficiency citations over the study period.

To further examine the impact of DRR implementation, Figure 2 illustrates the trend and level changes in the total number of nursing homes receiving pharmacy-related deficiency citations before and after the introduction of DRR. Following the policy change in 2019, there is a clear and immediate drop in the number of cited facilities, indicating a significant level change. Although the number of citations gradually increased in the following years, it remained below the pre-implementation peak.

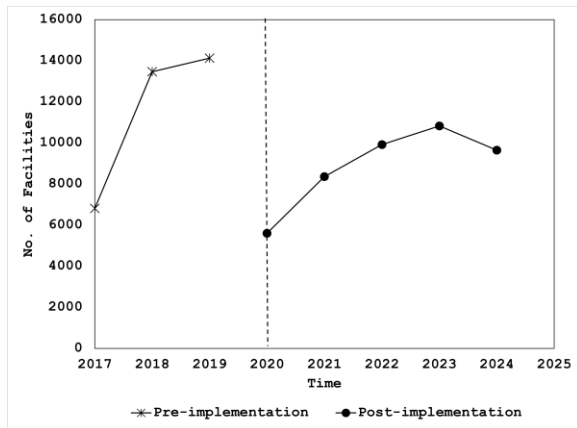


Figure 2. Trend and level changes in the number of nursing homes receiving deficiency citations before and after policy implementation.

To assess whether this observed pattern is statistically significant, we applied an ITS analysis, and the results are shown in Table 4. Data analysis was conducted using SAS (version 9.4), with statistical significance defined as $p < 0.05$. From the results, the pre-intervention trend, represented by the coefficient β_1 , was positive but not statistically significant, suggesting that the number of citations was relatively stable prior to the policy implementation. Following the introduction of the DRR policy, there was a significant immediate drop in the number of cited facilities, as indicated by the negative and statistically significant level change (β_2). This result points to a sharp decline in pharmacy-related deficiency citations immediately after the policy was enacted. The post-intervention trend change (β_3) was not statistically significant, indicating limited evidence of a gradual increase in citations following the policy implementation. However, the combined post-policy trend ($\beta_1 + \beta_3$) was statistically significant, suggesting that the overall trajectory of citations shifted meaningfully in the post-implementation period compared to the pre-intervention trend.

Table 4. Impact of DRR implementation on the number of nursing homes receiving pharmacy-related deficiency citations: results from ITS regression

Parameter	Interpretation	Estimate	Standard Error	Probability
β_1	Pre-Trend	414.5	406.5	0.3655
β_2	Post-Level Change	-66450.8	14518.7	0.0102
β_3	Post-Trend Change	8843.5	4352.7	0.1120
$\beta_1 + \beta_3$	Post-Trend	-	-	0.0372

In addition to analyzing the total number of nursing homes receiving pharmacy-related F-tags, we also use an alternative dependent variable: the number of nursing homes with a total count of pharmacy-related citations exceeding the sample average. This supplementary model allows us to capture facilities with relatively high citation burdens, which may reflect more serious or systemic issues in medication management. By focusing on this subgroup, we aim to

assess whether the DRR policy had a differential impact on nursing homes with higher-than-average deficiency rates, thereby providing a more nuanced understanding of policy effectiveness beyond aggregate trends.

Figure 3 displays the trend in the number of high-burden facilities before and after the policy implementation. Prior to 2019, the number of such facilities remained relatively stable, showing only a slight upward trend. In 2020, coinciding with the start of the DRR policy, there was a notable drop in the number of high-burden facilities. In the subsequent years, the number gradually increased but did not return to pre-implementation levels.

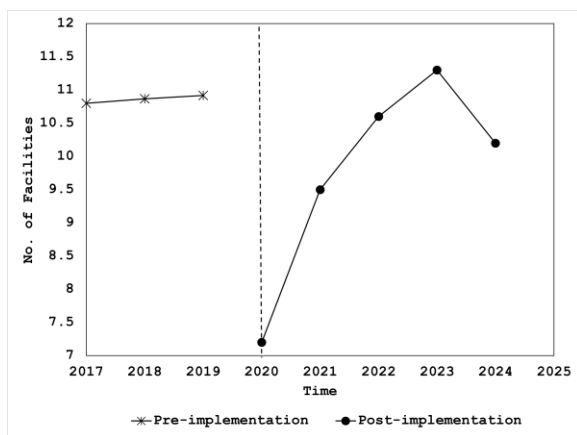


Figure 3. Trend and level changes in the number of nursing homes receiving pharmacy-related deficiency citations above the sample average before and after policy implementation.

The ITS regression results in Table 5 support these visual observations. The pre-intervention trend (β_1) was statistically significant, indicating a gradual increase in the number of high-burden facilities before the policy change. The implementation of DRR was associated with a statistically significant immediate level decrease (β_2), confirming a sharp drop after 2019. The post-intervention trend change (β_3) was also statistically significant, indicating a moderate upward trend after the initial drop. Notably, the combined post-policy trend ($\beta_1 + \beta_3$) remained statistically significant, highlighting a meaningful shift in the trajectory of high-burden citations following the policy.

These results suggest that DRR implementation led to a substantial and immediate reduction in the number of nursing homes with above-average citation counts. Although the number of high-burden facilities began to rise again over time, the overall trend remained significantly altered. This finding reinforces the effectiveness of the DRR policy in curbing

deficiencies, especially in facilities with more severe or frequent violations.

Parameter	Interpretation	Estimate	Standard Error	Probability
β_1	Pre-Trend	0.0138	0.0025	0.0054
β_2	Post-Level Change	-3.3979	0.8520	0.0163
β_3	Post-Trend Change	0.7482	0.2582	0.0442
$\beta_1 + \beta_3$	Post-Trend	-	-	0.0031

Table 5. Impact of DRR implementation on the number of nursing homes receiving pharmacy-related deficiency citations above the sample average: results from ITS regression

4. Conclusion and future research

This study provides empirical evidence on the impact of the DRR policy on pharmacy-related deficiency citations in U.S. nursing homes. Using interrupted time series analysis, we find that the implementation of DRR in 2019 was associated with a significant and immediate decline in the number of facilities receiving pharmacy-related citations. This effect was evident both in the overall number of cited facilities and among those with above-average citation counts, suggesting the policy had a broad and meaningful influence on improving medication management and regulatory compliance across facilities.

In future research, we plan to extend the analysis by employing multivariable models to examine the likelihood of nursing homes receiving individual or multiple pharmacy-related deficiency citations. This approach will allow us to account for facility characteristics such as ownership, staffing levels, resident acuity, and whether the policy had differential effects across geographic regions or facility types. Incorporating resident-level outcomes and longitudinal facility performance indicators may further illuminate the mechanisms through which DRR implementation influences quality of care. Through these efforts, we hope to contribute to the development of more targeted and sustainable quality improvement strategies in nursing home settings.

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