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RESEARCH ARTICLE

Robust Prescription Monitoring Programs and Abrupt Discontinuation of Long-term Opioid Use

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Introduction: This study assesses the associations between the recent implementation of robust features of state Prescription Drug Monitoring Programs and the abrupt discontinuation of long-term opioid therapies.

Methods: Data were from a national commercial insurance database and included privately insured adults aged 18–64 years and Medicare Advantage enrollees aged ≥65 years who initiated a long-term opioid therapy episode between Quarter 2 of 2011 and Quarter 2 of 2017. State Prescription Drug Monitoring Programs were characterized as nonrobust, robust, and strongly robust. Abrupt discontinuation was measured on the basis of high daily morphine milligram equivalents over the last 30 days of a long-term opioid therapy episode or no sign of tapering before discontinuation. Difference-in-differences models were estimated in 2019–2020 to assess the association between robust Prescription Drug Monitoring Programs and abrupt discontinuation.

Results: Among nonelderly privately insured adults, robust Prescription Drug Monitoring Programs were associated with an increase from 14.8% to 15.4% (4% relative increase, p=0.02) in the rate of ending long-term opioid therapy with ≥60 daily morphine milligram equivalents. For older Medicare Advantage enrollees, strongly robust Prescription Drug Monitoring Programs were associated with a reduction from 4.8% to 4.3% (10.4%, p=0.01) and from 3.0% to 2.4% (17.3%, p=0.001) in the rate of ending long-term opioid therapy with ≥90 and 120 daily morphine milligram equivalents, respectively. Prescription Drug Monitoring Programs robustness was not associated with clinically meaningful changes in the rate of discontinuing long-term opioid therapy without tapering.

Conclusions: Discontinuation without tapering was the norm for long-term opioid therapies in the samples throughout the study years. Findings do not support the notion that policies aimed at enhancing Prescription Drug Monitoring Program use were associated with substantial increases in abrupt long-term opioid therapy discontinuation.

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INTRODUCTION

Overprescribing and misuse of prescription opioids were considered one of the root causes of the opioid crisis[1] and were responsible for close to 16,000 overdose deaths in 2018.[2] One prominent state policy tool to address unsafe opioid prescribing is Prescription Drug Monitoring Programs (PDMPs). PDMPs are statewide databases of controlled substances dispensed at retail pharmacies. When used by prescribers, PDMPs provide a nearly complete picture of

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prescription opioids and other controlled substances received by a patient and, in turn, support clinical decisions that balance safe prescribing with effective pain management.

The past 2 decades have seen rapid adoption by states of robust features of PDMPs[3] aimed at increasing the utility of the information provided (e.g., by sharing data among states) and lowering barriers to prescriber use at the point of care (e.g., by allowing prescribers to delegate information extraction to office staff). A total of 3 of the features—legislative mandates for prescriber use of PDMPs, laws allowing prescriber delegation (delegate laws), and interstate PDMP data sharing—gained the most momentum in the past decade.[4] In addition, evidence is accumulating that use mandates that apply to prescribers of all specialties and settings, that require regular PDMP use, and that do not rely on prescriber discretion (termed comprehensive use mandates in the remaining part of this paper) were associated with reductions in prescription opioid misuse and overdose.[3,5–8] However, comprehensive use mandates remain one of the least adopted of all features, having taken effect in only 25 states by the end of 2019.

Meanwhile, there is concern that policies intended to boost prescriber use of PDMPs may create chilling effects or, at a minimum, add to the burden and potential liabilities associated with opioid prescribing.[9] This, in turn, may lead to across-the-board reductions in opioid prescribing regardless of the needs or risks of a particular patient.[10]

Policies to increase prescriber use of PDMPs are intended to benefit individuals who use prescription opioids long term because, aided by PDMPs, providers are better able to identify high-risk opioid use before it escalates into extremely high dose (Appendix Figure 1A, available online), misuse, or overdose. By contrast, long-term users may be particularly vulnerable to the unintended effects of these policies. Although evidence is lacking supporting opioid therapies for chronic noncancer pain,[11] people with long-term use almost always develop a physical dependence on opioids.[12] Abrupt discontinuation of long-term use put these individuals at risk for uncontrolled pain, opioid withdrawal, and transition to illicit opioid use.[13] Although clinical guidelines recommend tapering before termination of long-term use,[14,15] providers who are not pain specialists (accounting for about 86% of Schedule II opioids paid by Medicare Part D[16]) may lack the expertise, time, or self-efficacy to conduct tapering[17] (Appendix Figure 1A and B, available online).

This study uses a large commercial insurance claims database to assess the net implications of the recent implementation of robust PDMP features for safe discontinuation of long-term prescription opioid use among (1) nonelderly adults with private insurance and (2) older adults enrolled in Medicare Advantage (MA) plans. The investigators hypothesize that such implementation is associated with a higher risk of abrupt discontinuation of long-term opioid use (Appendix Figure 1A and B, available online).

METHODS

Study Sample

Study data were from the 2011–2017 Health Care Cost Institute claims database, containing about one third of privately insured adults and close to one half of MA enrollees nationwide. Populations of interest included adults with at least 1 long-term opioid episode who were either (1) aged 18–64 years and privately insured or (2) aged ≥65 years and enrolled in MA.

Prescription opioid episodes were determined by grouping opioid prescriptions (for pain, excluding opioids to treat opioid use disorder) on the basis of start and end dates and were terminated with a gap ≥30 days in continuous possession. Episodes that lasted for ≥90 days were considered long-term episodes.[18] Policy implications for patients with active cancer or cancer-related pain are likely different. Episodes were excluded if the patient received at least 1 diagnosis of malignancy in a 3-month window surrounding the start of the opioid episode: 1 before, 1 in which the episode started, and 1 after.

Study samples were restricted to individuals residing in 1 of the 29 states that had enabled prescriber online access to PDMPs by January 1, 2011. By doing so, we focused on the implementation of robust PDMP features above and beyond the implementation of a PDMP.

Measures

Robustness of PDMPs was defined to reflect 3 features: a legislative mandate for prescriber use of PDMPs (referred to as use mandate in the remaining part of this paper), legislation allowing prescribers to delegate PDMP use to office staff (delegate law), and state participation in PMP InterConnect[19] to enable interstate PDMP data sharing. Comprehensive use mandates (applying to all prescribers, mandated PDMP use for an initial prescription to a patient and at least annually thereafter, and not allowing prescriber discretion) were further distinguished from other use mandates that fell short of being comprehensive. These features represented major and recent state efforts during study years (2011–2017) to enhance prescriber use of PDMPs. By contrast, all other features considered in a previous study[3] (e.g., at least weekly update of PDMP data) had been adopted by at least half of the states included in the study before 2011. Studies using data before 2014 found limited changes to no changes in opioid use[15] and limited changes in opioid overdose deaths[20] associated with those features.

For PDMP use mandates and delegate laws, effective dates of the laws were initially obtained from the National Alliance for Model State Drug Laws. The research team subsequently conducted extensive original research of state legislations and policy statements to reconcile discrepancies among different sources and

to update policies and dates. The National Association of Boards of Pharmacy provided the go-live dates of interstate data sharing.

A 3-category PDMP policy measure was defined: nonrobust (not all the 3 features), robust (noncomprehensive use mandates and the other 2 features), and strongly robust (comprehensive use mandates and the other 2 features). The staggered implementation of these policies created substantial variation across states (Appendix Figure 2, available online). All the 29 states started off with a nonrobust PDMP; 21 states transitioned from nonrobust to robust or strongly robust PDMPs. A total of 9 states were exposed to strongly robust PDMPs by the end of Quarter 2 (Q2) of 2017 (2017Q2).

Abrupt discontinuation of long-term opioid therapies (LTOTs) was assessed with 2 measures.[21] The first assessed whether the daily morphine milligram equivalents (DMMEs) over the last 30 days of the episode were ≥60. Individuals receiving, for ≥1 week, DMMEs ≥60 are considered opioid tolerant and are thus at high risk of developing withdrawal symptoms when opioid therapy is discontinued.[13] Although guidelines on opioid tapering do not specify a safe dose before LTOTs can be discontinued and typically recommend tapering after the lowest possible dose is reached, 60 DMMEs is likely much higher than the lowest possible dose.[14,15] DMME cut points of 90 and 120 additionally were considered.

The second measure directly assessed the evidence for tapering before discontinuation, where tapering was determined to have occurred if the DMME over the last 30 days of the LTOT was at least 10% lower than the DMME in the previous 30 days. Guidelines recommend slower tapers for patients who have been on opioids for a long time—as slow as 10% every month.[14] Lack of dose reduction by ≥10% over the last 2 months of the LTOT thus strongly suggests lack of tapering before discontinuation.

Statistical Analysis

Study samples included episodes that started from Q2 of 2011 to 2017Q2 to allow for observation of ≥180 days of an LTOT episode, should it last that long. The main analyses adopted a difference-in-differences framework and estimated a linear probability model of abrupt discontinuation of LTOTs associated with robust PDMP policies. A given episode's exposure to a robust PDMP was determined to be 1 (0 otherwise) if the episode started on or after the effective date of the state's robust PDMP status. The analysis controlled for 2 additional policies: state legislation limiting the duration or dosage of the initial opioid prescriptions or opioids prescribed for acute pain (opioid limits) and medical marijuana legalization (MML). Shorter duration or lower dose of the initial opioids might have led to a lower rate of long-term use[22] and thus have implications for LTOT-related outcomes. Opioid limits may also have been inadvertently applied to LTOTs, increasing the likelihood of abrupt discontinuation. MML may contribute to the discontinuation of LTOTs because marijuana may be perceived as a potential substitute for prescription opioids for chronic pain.[23]

Other covariates included dichotomous indicators of calendar quarters (Q2 of 2011–2017Q2) to control for secular trends in the outcome (time-fixed effects), dichotomous indicators of states to control for between-state differences that did not change over time (state-fixed effects), patient demographics, and chronic pain and behavioral health conditions. A more detailed description of the model and variables is in Appendix Text 1 (available online). Robust SEs were adjusted by considering clustering of episodes of the same patient.

Investigators conducted 3 sensitivity analyses. First, exposure to robust PDMP policies was determined at the 90th (versus the 1st) day of a given episode. Second, episodes were excluded if they ended during or after December 2017 (accounting for 11.3% of all LTOT episodes) because in the absence of data from 2018 and beyond, the observed end of these episodes might not be the true end. Third, patient episodes with an alcohol or drug use disorder were excluded because of potential nonmedical use of opioids.

Robust PDMP and other opioid-related policies may reduce the likelihood that an opioid episode, once initiated, ultimately develops into long-term use. Because the first measure of abrupt discontinuation was directly based on DMMEs over the last 30 days of the episode, estimates might be biased if the average doses of LTOT episodes increased over time (e.g., because of increasing severity of chronic pain among those who developed long-term use). To assess potential biases, additional analysis estimated the associations between robust PDMPs and (1) the probability of long-term use (using all episodes) and (2) the natural logarithm of DMMEs over the entire LTOT episode.

Data analyses were performed in 2019–2020 using Stata, version 16. The study protocol was approved by the Weill Cornell Medicine IRB.

RESULTS

The study samples included 272,169 LTOT episodes from 205,755 privately insured adults aged 18–64 years and 296,954 episodes from 195,438 MA enrollees aged ≥65 years. For 0.04% of all LTOT episodes, patients had enrollment records for both a private and an MA plan when the episode started. These episodes were included in the MA sample. Table 1 shows that 15% of LTOT episodes by nonelderly privately insured adults and 11% by the elderly MA enrollees had a DMME ≥60 before discontinuation. The percentages for ≥90 or 120 DMMEs were much lower. A very high proportion (≥80% in both samples) of the participants discontinued without tapering.

Analysis assessing the relative trends in study outcomes between states that implemented robust PDMP policies and those that did not lent support to the parallel trend assumption of the difference-in-differences models (Appendix Figure 3, available online). For privately insured adults aged 18–64 years, robust PDMPs, compared with nonrobust PDMPs, were associated with an increase from 14.8% to 15.4% (a 4% relative increase, 95% CI=1.4, 6.7, p=0.019) in the rate of LTOT discontinuation with a DMME ≥60 (Figure 1). For MA enrollees aged ≥65 years, strongly robust PDMPs, compared with nonrobust PDMPs, were associated with a reduction from 4.8% to 4.3% (a 10.4% reduction, 95% CI=4.0, 16.8, p=0.010) and from 3.0% to 2.4% (a 17.3% reduction, 95% CI=9.2, 25.3, p=0.001) in the rate of LTOT discontinuation with DMMEs ≥90 and ≥120,

Table 1. Sample Statistics

Variables	Privately insured, aged 18–64 years, *n* (%)	Medicare Advantage, aged ≥65 years, *n* (%)
Number of long-term episodes	272,169	296,954
Number of unique patients	205,755	195,438
Sex		
Male	123,202 (45.3)	102,144 (34.4)
Female	148,967 (54.7)	194,810 (65.6)
Age, years		
18–24	6,921 (2.5)	NA
25–34	31,475 (11.6)	NA
35–44	57,973 (21.3)	NA
45–54	90,194 (33.1)	NA
55–64	85,606 (31.5)	NA
65–74	NA	172,899 (58.2)
75–84	NA	92,320 (31.1)
≥85	NA	31,735 (10.7)
Behavioral health indicators		
Mental health disorder	60,979 (22.4)	61,238 (20.6)
Alcohol use disorder	3,119 (1.2)	1,779 (0.6)
Drug use disorder	6,730 (2.5)	4,749 (1.6)
Tobacco use	12,133 (4.5)	6,999 (2.4)
Chronic pain indicators		
Back pain	105,902 (38.9)	101,798 (34.3)
Neck pain	44,134 (16.2)	27,104 (9.1)
Arthritis pain	116,946 (43.0)	150,944 (50.8)
Other pain	64,553 (23.7)	57,034 (19.2)
Features of long-term opioid episode		
DMME ≥60 in the last 30 days	40,732 (15.0)	32,364 (10.9)
DMME ≥90 in the last 30 days	21,214 (7.8)	13,919 (4.7)
DMME ≥120 in the last 30 days	13,759 (5.1)	8,397 (2.8)
No tapering	216,497 (79.6)	259,962 (87.5)
Average DMME, mean (SD)	36.33 (76.5)	26.24 (30.9)

Note: Samples include long-term episodes of opioid therapies of privately insured adults aged 18–64 years and Medicare Advantage patients aged ≥65 years residing in 1 of the 29 states that had an operating Prescription Drug Monitoring Program (on the basis of user access date) by January 1, 2011.
DMME, daily morphine milligram equivalent; NA, not applicable.

respectively (Figure 2). For both populations, robust and strongly robust PDMPs were associated with a statistically significant but clinically insignificant (~1%) increase in the rate that LTOTs ended with no tapering (Figure 3).

For either population, opioid limits were not associated with statistically or clinically significant differences in study outcomes. For privately insured adults aged 18–64 years, MML was associated with a 5.3%, 12.7%, and 20.6% increase in the rate of LTOT discontinuation with ≥60, ≥90, or ≥120 DMMEs, respectively (Appendix Table 1, available online). This association was not observed among older MA enrollees.

For both populations, male sex; younger age; and having a diagnosis of a mental health disorder, a drug use disorder, back pain, neck pain, and other chronic pain (other than back, neck, arthritis pain) were associated with a higher rate of ending LTOTs with a high dose (Appendix Tables 1 and 2, available online). Conversely, male sex, younger age, having a diagnosis of a mental health disorder, and having a diagnosis of a drug use disorder were associated with a lower rate of ending the LTOT without tapering (Appendix Tables 1–2, available online).

Sensitivity analyses that (1) determined policy exposure at the 90th day of the LTOT, (2) that excluded episodes that ended in or after December 2017, and (3) that excluded LTOT episodes with an alcohol or drug use disorder generated very similar results to those of the main analysis (Appendix Figures 4.1–4.3, 5.1–5.3, and 6.1–6.3, available online).

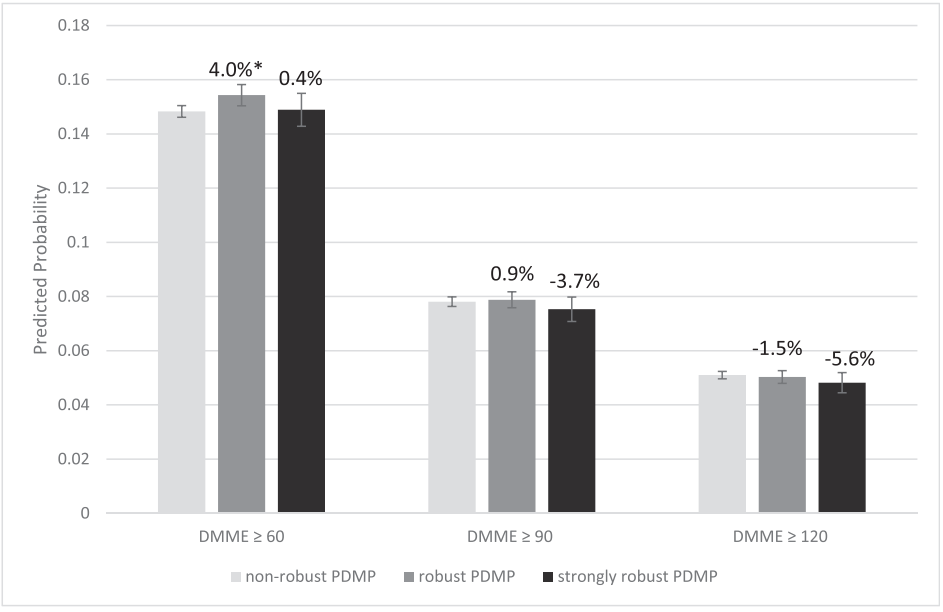

Figure 1. Rate of discontinuing long-term opioid use with a high daily dose associated with robust PDMP: privately insured patients aged 18–64 years.

Note: The number on the top of each bar indicates the relative change in the rate of discontinuing long-term episodes with DMME over 60, 90, or 120 in states with robust/strongly robust PDMPs compared with that in states with nonrobust PDMPs. The whiskers represent 95% CIs of the predicted rates. *p<0.05.

DMME, daily morphine milligram equivalent; PDMP, Prescription Drug Monitoring Program.

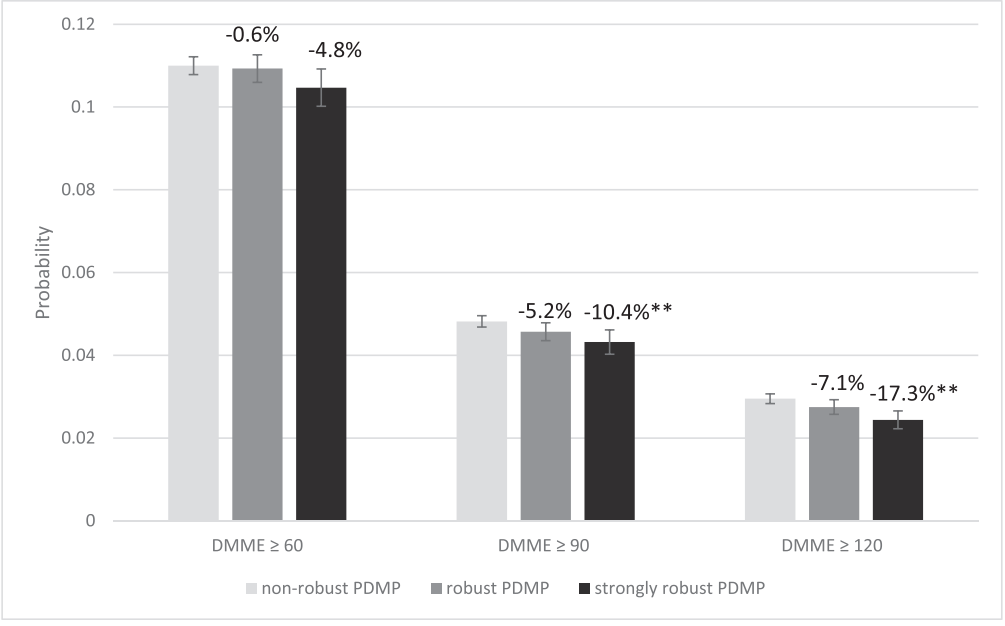

Figure 2. Rate of discontinuing long-term opioid use with a high daily dose associated with robust PDMPs: Medicare Advantage enrollees aged ≥65 years.

Note: The number on the top of each bar indicates the relative change in the rate of discontinuing long-term episodes with DMME over 60, 90, or 120 in states with robust/strongly robust PDMPs compared with that in states with nonrobust PDMPs. The whiskers represent 95% CIs of the predicted rates. **p<0.01.

DMME, daily morphine milligram equivalent; PDMP, Prescription Drug Monitoring Program.

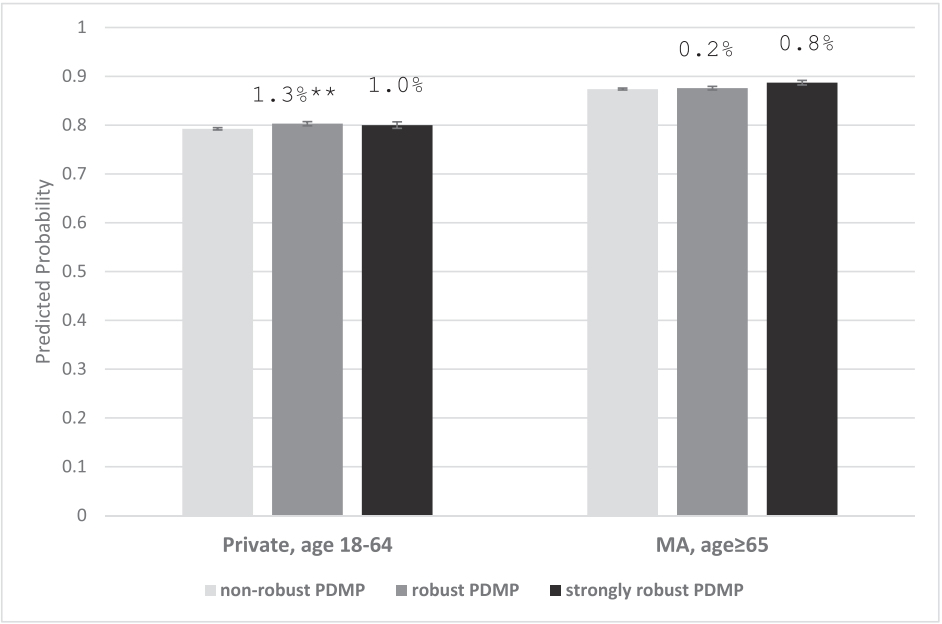

Figure 3. Rate of discontinuing long-term opioid use without tapering associated with robust PDMP.
Notes: The number on the top of each bar indicates the relative change in the rate of discontinuing long-term episodes without tapering in states with robust/strongly robust PDMPs compared with that in states with nonrobust PDMPs. The whiskers represent 95% CIs of the predicted rates. *p<0.05; **p<0.01; ***p<0.001.
MA, Medicare Advantage; PDMP, Prescription Drug Monitoring Program.

Robust PDMPs were associated with a small and negligible change in the rate that an episode developed into LTOT in both populations (Appendix Table 3.1, available online). In addition, robust and strongly robust PDMPs were associated with a 1%–2% reduction in DMMEs of LTOTs (Appendix Table 3.2, available online). These extremely small changes mitigated the concern that the observed associations between robust PDMPs and abrupt discontinuation were driven by changing daily dose of LTOTs over time.

DISCUSSION

This study found that the coimplementation of several state policies aimed at improving the robustness of PDMPs was associated with a modest increase in the rate of LTOT discontinuation, with a high dose among privately insured individuals aged 18–64 years. By contrast, strongly robust PDMPs (with comprehensive use mandates) were associated with reductions in the rate of LTOT discontinuation, with a very high dose (≥90 or 120 DMMEs) among MA enrollees aged ≥65 years, suggesting potentially beneficial outcomes. Robust and strongly robust PDMPs were not associated with clinically meaningful changes in the rate of discontinuing LTOTs without tapering, which was ≥80% in the study samples.

Study findings provided little support for the notion that robust PDMPs and, in particular, comprehensive use mandates have led to unintended increases in abrupt discontinuation of long-term opioid use. By contrast, the findings suggest that strongly robust PDMPs might have been protective among older MA enrollees who used opioids long term. These findings likely reflect increased use of PDMPs by prescribers and their clinical teams, in response to the robust features of PDMPs, to identify (and therefore contain) high-risk opioid use before it escalates into dangerously high doses. Such protective effects were of a much smaller magnitude and did not achieve statistical significance among the younger privately insured population. A much higher proportion of younger patients had very high doses during their LTOTs than the proportion of older patients and were probably less susceptible to the protective effects of the PDMP policies.

State MML was associated with an elevated risk of discontinuing LTOT with a high dose among younger privately insured adults but not among older MA enrollees, suggesting that younger adults receiving LTOTs at a high dose may be perceived as not needing to taper before LTOT discontinuation if they are substituting marijuana for opioids for chronic pain. There is emerging evidence that MML is associated with modest

reductions in the opioid prescriptions received by Medicare[24] or Medicaid[23] patients as well as reductions in opioid overdose–related mortalities.[25] This study's finding highlights the potential risks associated with marijuana substitution if it is associated with discontinuing prescription opioids at high doses, an area for future investigation.

This study draws attention to the very high rate (≥80%) of LTOT discontinuation without tapering, suggesting that clinical management and discontinuation practices for patients receiving LTOTs in community settings were largely inconsistent with current guidelines.[15] The substantial proportion who were receiving a high dose (≥60 DMMEs) before discontinuation (10%–15% in the study samples) and the high proportion who discontinued without tapering suggest a serious burden of uncontrolled pain and potential adverse outcomes related to abrupt discontinuation.

Primary care providers accounted for approximately 66% of all Schedule II opioids paid for by Medicare Part D.[16] A recent survey estimated that less than half (46%) of primary care providers believed that they were sufficiently trained to prescribe and manage opioids and that the vast majority (84%) felt it was stressful to manage patients with chronic pain.[17] These providers expressed willingness to prescribe opioids with specialty support but considered communication with pain specialists inadequate, suggesting the promise of primary care–based pain management models that incorporate continued medical training, specialty consultation, and care management support.

Limitations

In this study, a relatively low threshold (a gap in opioid supply ≥30 days) was adopted to define LTOT discontinuation. Some of the observed discontinuations might reflect laps in prescription fills rather than reflect the true discontinuation. This should not be an issue for almost half of the LTOT episodes in the samples because they represented the only opioid episode observed for an individual. In addition, the rates of abrupt discontinuation were similar for LTOT episodes with or without a follow-up episode, suggesting that misclassification of discontinuation, if any, would not be consequential to the outcomes of interest.

The measures of abrupt discontinuation of LTOTs were constrained by the limited clinical details in claims data. In particular, for an unknown proportion of LTOT episodes, clinicians may have discontinued prescribing on the basis of evidence of diversion or nonmedical use by the patient, which could not be distinguished from LTOTs for medical use. In addition, robust PDMPs were defined on the basis of 3 policies that were rare before 2011 but saw rapid implementation during study years. The results may reflect an overestimation of the associations with the 3 specific policies to the extent that states implementing all 3 PDMP policies were also more likely to have implemented other features. A previous study using latent transition analysis found that features of PDMPs characterizing empirically identified classes of PDMPs changed substantially over time.[26] The study definition of robust PDMPs may not be entirely comparable with definitions in other studies but was adopted to reflect the prominent developments in PDMP policies during 2011–2017.

CONCLUSIONS

The findings of this study do not support the notion that recent policies aimed at enhancing PDMP use increased the abrupt discontinuation of LTOTs. By contrast, findings suggest that strongly robust PDMPs might be protective to older MA patients by preventing their long-term opioid use from escalating into very high dose. At the population level, the very high rate of discontinuing LTOTs without tapering is of particular concern and calls for additional investigation and pain management models to address barriers to tapering.

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All authors have made substantive contributions to the study. YB conceived the study and drafted the manuscript. YB and HZ analyzed and interpreted the data. KW and PJJ managed the claims data files and prepared the analytical data sets. All authors contributed to the critical review of the manuscript.

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SUPPLEMENTAL MATERIAL

Supplemental materials associated with this article can be found in the online version at https://doi.org/10.1016/j.amepre.2021.04.019.

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