APPRISS® HEALTH

PMP Gateway Effectiveness

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INTRODUCTION

Following our analysis in February 2021 on the utilization of PMP Gateway within multiple states, we are examining the effectiveness of PMP Gateway across several metrics to understand its impacts.

Opioid abuse continues to be an important and growing public health concern. Electronic Prescription Drug Monitoring Programs (PDMPs) have been implemented by states across the country to address this issue. These are tools designed to curb prescription misuse and diversion by allowing prescribers to access a patient's controlled-substance prescription history before writing a prescription or dispensing an opioid prescription. **These data repositories are typically accessed through a web portal and this process can take up to 52 clicks and four minutes for a single report. The in-workflow integration of Appriss Health's PMP Gateway is an enormous simplification of this process, requiring only a single click and 1-3 seconds.** Appriss Health works with over 500 electronic health record (EHR) vendors to create an embedded PDMP report. This includes major physician EHR companies like Epic, as well as software for pharmacy workflow.

The ability to view a patient's history of controlled-substance dispensations at critical moments across the continuum of care should result in more optimal prescribing. In this paper, we examine outcomes associated with the use of PMP Gateway in eight states that have rolled out the solution statewide. Overall, the outcomes indicate positive trends associated with a reduction in the prescribing of opioids.

METHODS

Dispensation history from each state's PDMP database, which contains all prescription data for Schedule II, III, IV, and V controlled substances was used for this analysis. Additional data processing was included:

- The different drug types (e.g., opioid, stimulant, etc.) were defined based on the descriptions supplied to the Food and Drug Administration (FDA) by the manufacturer or distributor, or as identified in DailyMed or First Databank.
- Medication Assisted Therapies (MATs or MOUDs) were identified when patients were specifically prescribed buprenorphine for opioid withdrawal therapy, rather than buprenorphine for pain management.
- Overlapping opioid and benzodiazepine prescriptions were identified when patients had both medications in their possession during the same calendar day.

Descriptive statistics (e.g., frequencies, 30-day rolling averages, percent change) and trend analyses (e.g., segmented regression) were used to assess proportional differences and relative changes (i.e., change in slope) over time for each outcome.

The data used for each state encompassed a period of approximately two years prior to PMP Gateway

implementation, and two years following implementation. This length of time was chosen because it is a reasonable belief that enough time passed following PMP Gateway rollout to create measurable outcomes.

In order to derive more clinically meaningful measures of PMP Gateway's impact across all states, a meta-analysis of each outcome pre- and post-implementation was performed. This was done by obtaining the mean and standard deviation for each outcome from each state and combining this data into a single data set. Given that each outcome was defined and calculated identically for all states, we derived the effect size for each outcome by state as follows:

$\bar{X}_1$ = *mean before PMP Gateway*

$\bar{X}_2$ = *mean after PMP Gateway*

The 95% confidence interval was calculated using the following equation:

$$95\% C.I. = \bar{X}_1 - \bar{X}_2 \pm 1.96 * \sigma_{\bar{x}}$$

$\bar{X}$ is the pooled mean. The final, pooled effect size across all states (i.e., weighted mean difference) was obtained by calculating the average difference in means prior to and after PMP Gateway implementation. The 95% C.I. was then determined based on the calculation above.

Meta-analyses of mean differences assume that the data follow a chi-squared distribution [1]. Thus, model fitting and tests of statistical significance proceed under these assumptions. Although outcomes were defined and measured the same across all states, we used a random effects model to account for possible confounding variables, such as the timing of legislation (e.g., mandatory use), population demographics, and temporality of PMP Gateway implementation.

We also used an additional measure of effect (Cohen's d) and converted it to the r-squared statistic in order to quantify the proportion of variation in each outcome accounted for by implementation. Cohen's d was calculated using the following equation:

$$d = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{\bar{\sigma}_1^2 + \bar{\sigma}_2^2}{2}}}$$

This effect size was then converted to r-squared via the following equation:

$$r^2 = \left(\frac{d}{\sqrt{d^2 + 4}} \right)^2$$

Linear regression analysis was used to determine the differences in the rate of change prior to and after implementation of PMP Gateway.

RESULTS

The findings showed generally positive results associated with PMP Gateway implementation across key outcomes.

Opioid dispensations decreased on average by 15.6% and did so at a rate that was 113% faster during the two-year period following implementation (Figure 1). This equated to 1,586 fewer opioid dispensations per day, on average, for each state during this period ($p < 0.0001$, r-squared = 0.56), as shown in Figure 2.

Figure 1 **Opioid Dispensation Trends**

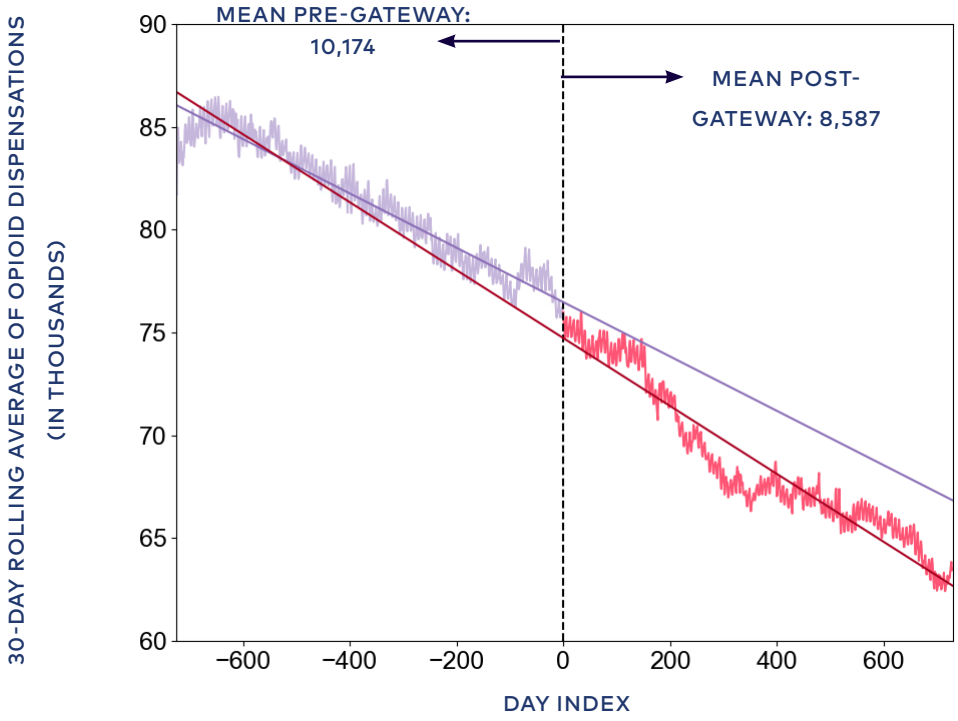

***Figure 1**: 30-day rolling average of opioid dispensations across 8 states and associated linear regressions.*

With PMP Gateway, opioid dispensations decreased on average ***15.6%*** *over two years.*

Figure 2 **Opioid Dispensations: Meta-Analysis**

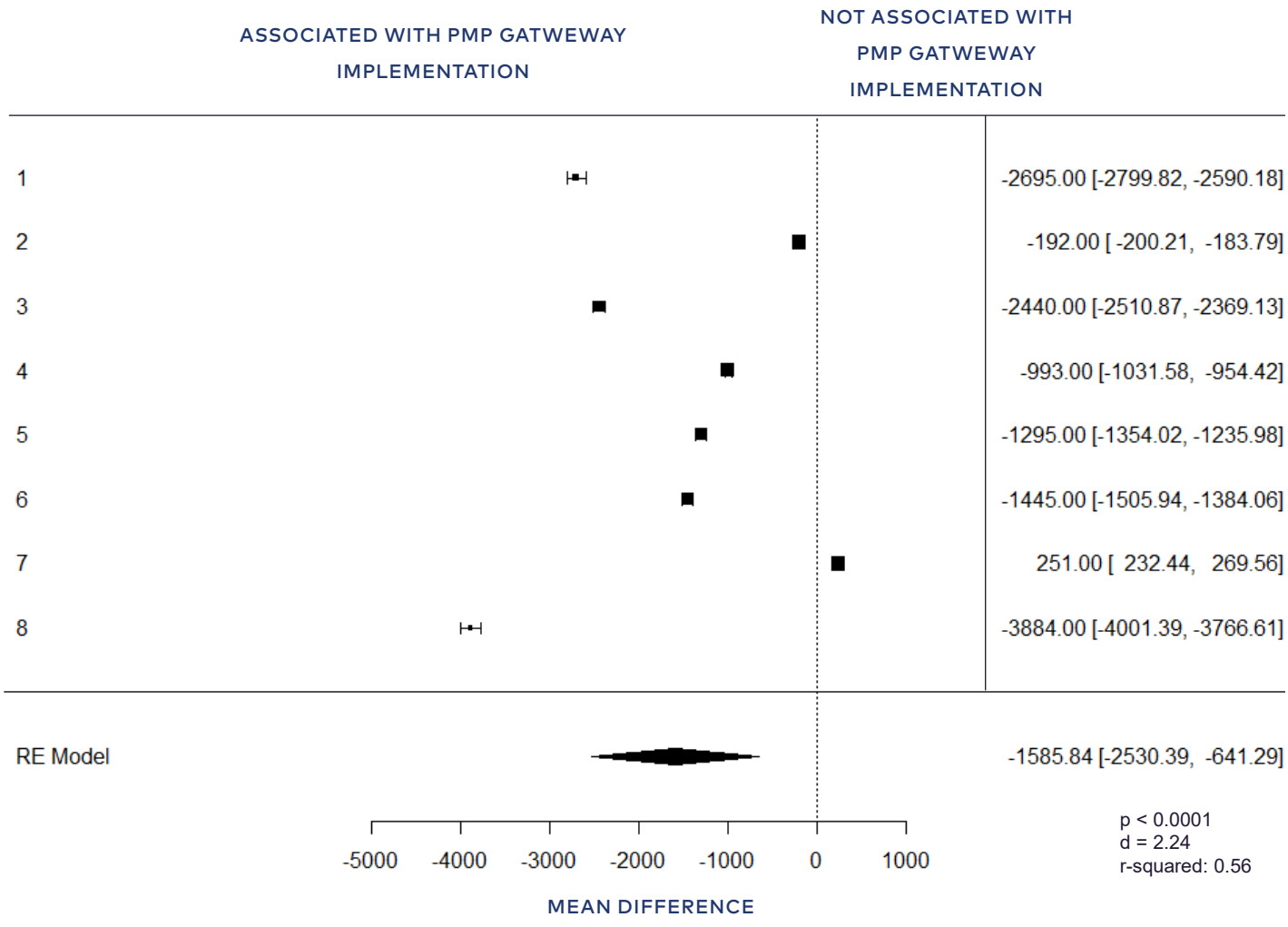

Figure 2: *Meta-analysis of opioid dispensations across 8 states.*

To examine if the greater proportion of the decrease in opioid dispensations was concentrated in opioids with higher-risk profiles, we next analyzed Schedule II opioid dispensation patterns. This subgroup analysis revealed that Schedule II opioid dispensations decreased by 20.1% during the two years following implementation and did so at a 182% faster rate (Figure 3). This translated into 1,533 fewer dispensations per day for each state ($p = 0.0006$, r-squared = 0.65).

Figure 3 **Schedule II Dispensation Trends (Opioids Only)**

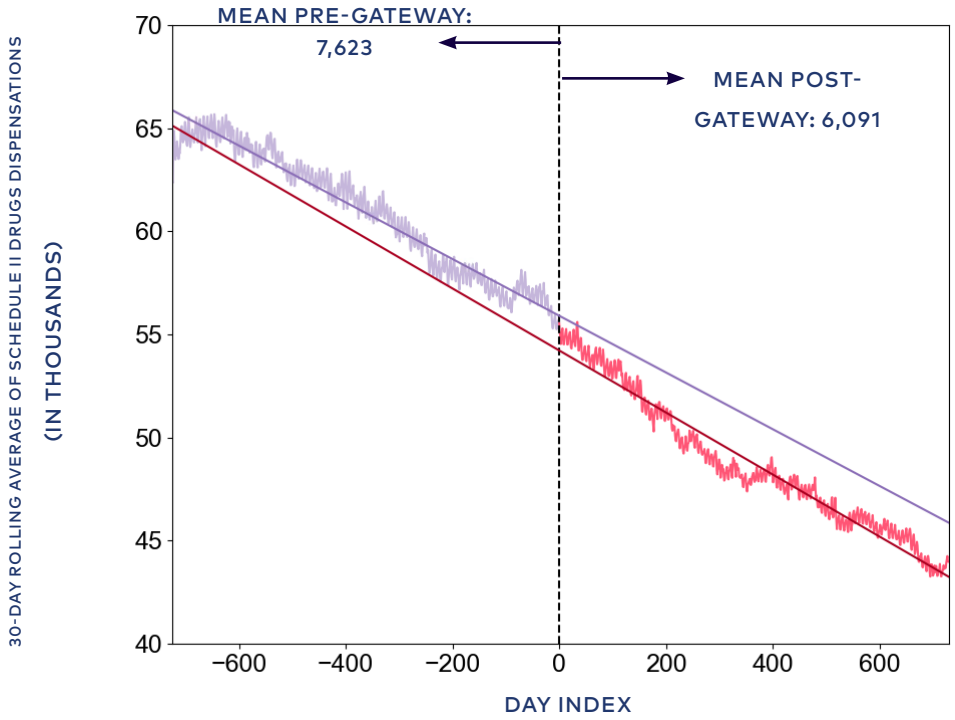

***Figure 3**: 30-day rolling average of Schedule II dispensations across 8 states, and associated linear regressions.*

Figure 4 **Schedule II Drug Dispensations: Meta-Analysis**

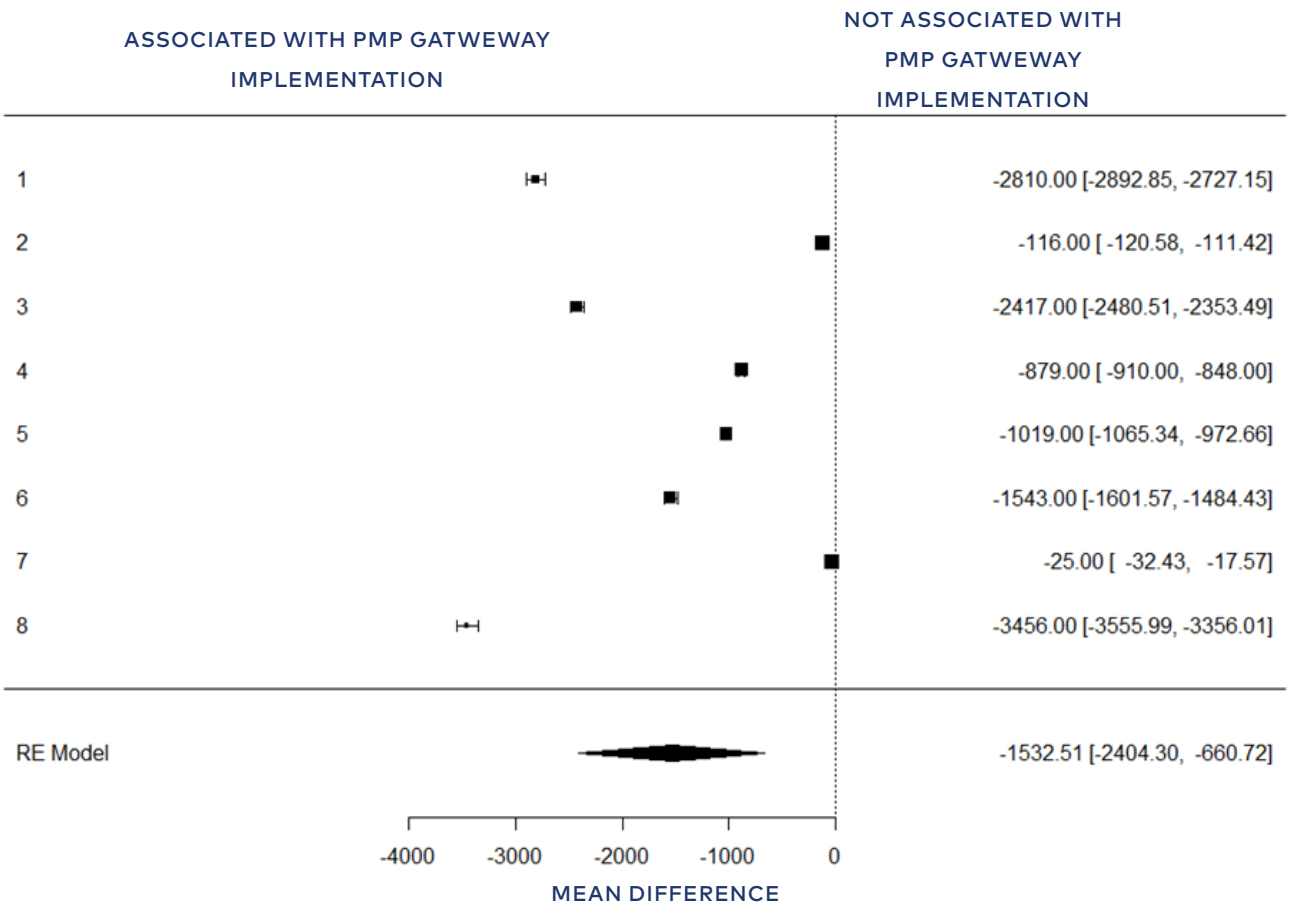

***Figure 4**: Meta-analysis of Schedule II dispensations across 8 states.*

Similarly, changes in buprenorphine MAT (or MOUD) dispensations showed a 39.5% increase during the two years following PMP Gateway implementation, which was 797% more accelerated during this time compared to the two years prior to implementation (Figure 4).

This increase translated to approximately 150 more buprenorphine MAT (or MOUD) dispensations per day for each state ($p = 0.02$, r-squared = 0.98, Figure 6).

Figure 5 **Buprenorphine MAT Dispensation Trends**

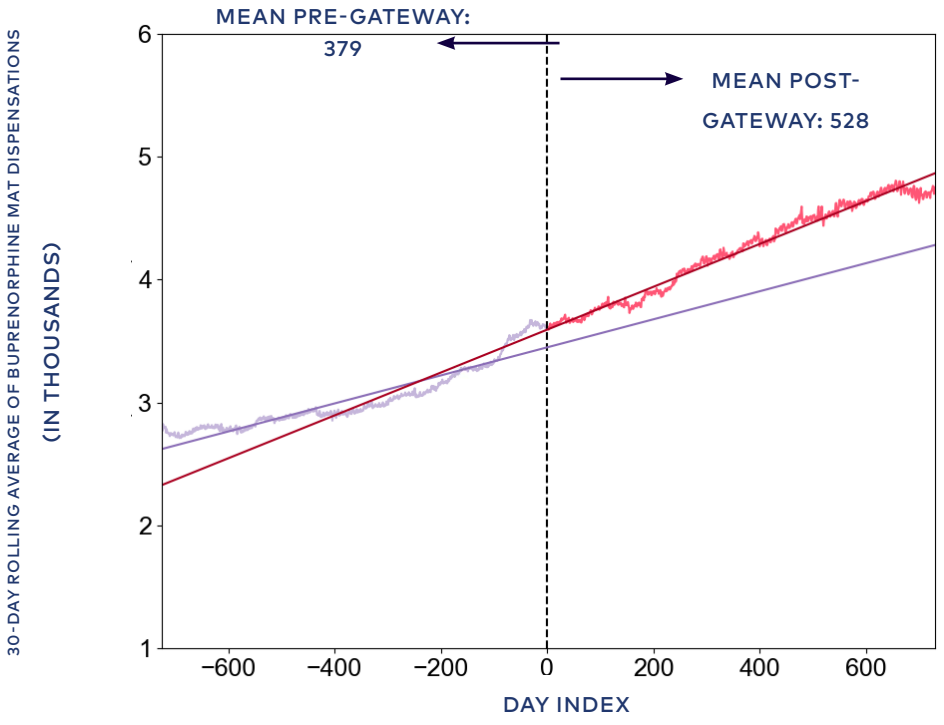

***Figure 5**: 30-day rolling average of buprenorphine MAT (MOUD) dispensations across 8 states, and associated linear regressions.*

Figure 6 **Buprenorphine MAT Dispensations: Meta-Analysis**

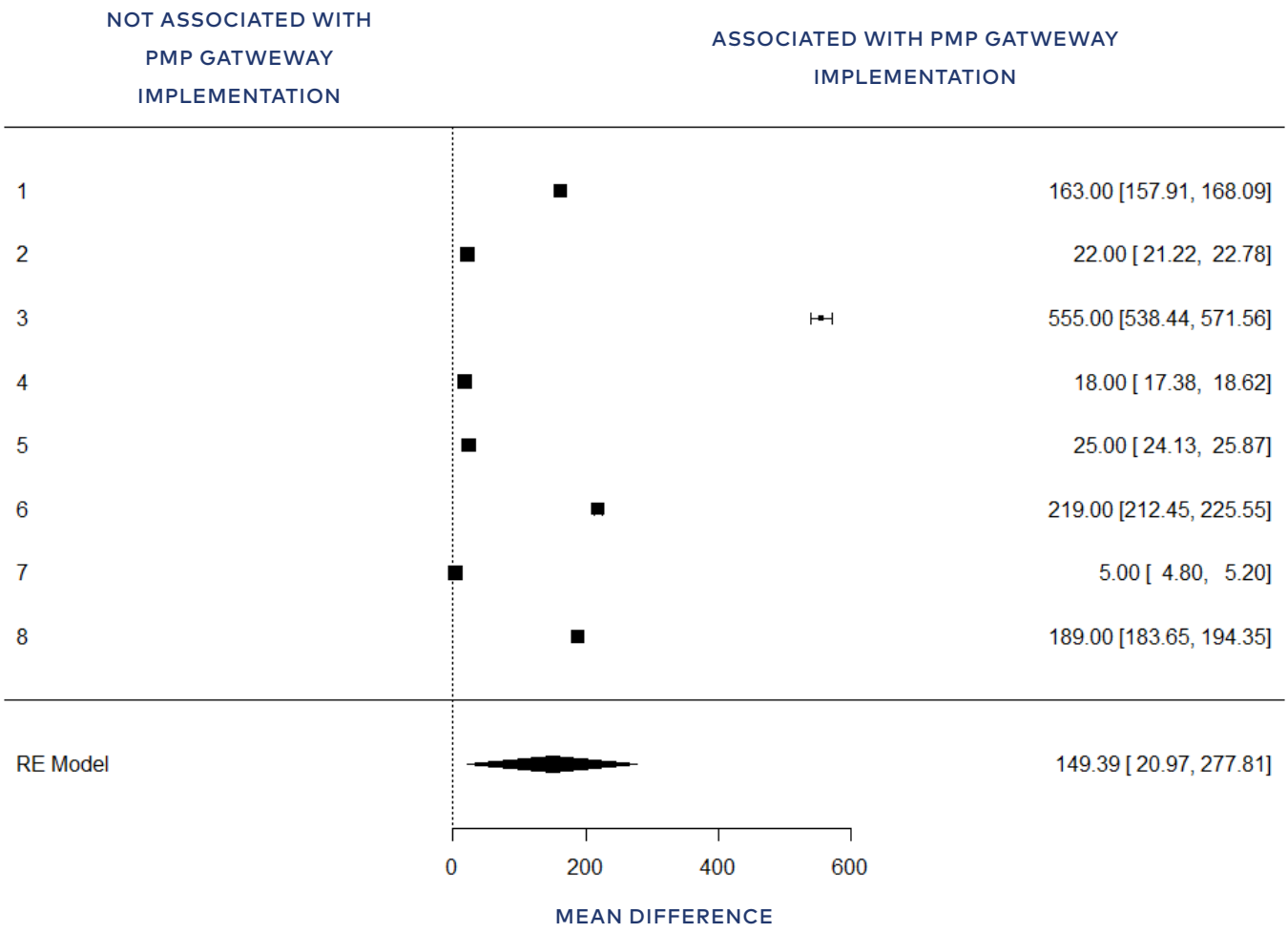

***Figure 6**: Meta-analysis of buprenorphine MAT (MOUD) dispensations across 8 states.*

Finally, we analyzed the average number of overlapping days per month among patients who had been prescribed concurrent opioid and benzodiazepine medications and observed a 4.37% reduction from 16.32 to 15.61 overlapping days per patient per month (Figure 6). It is important to note that the average number of days per patient does not refer to all patients, rather those that have overlapping prescriptions.

Figure 7 **Opioid-Benzo Overlap Days**

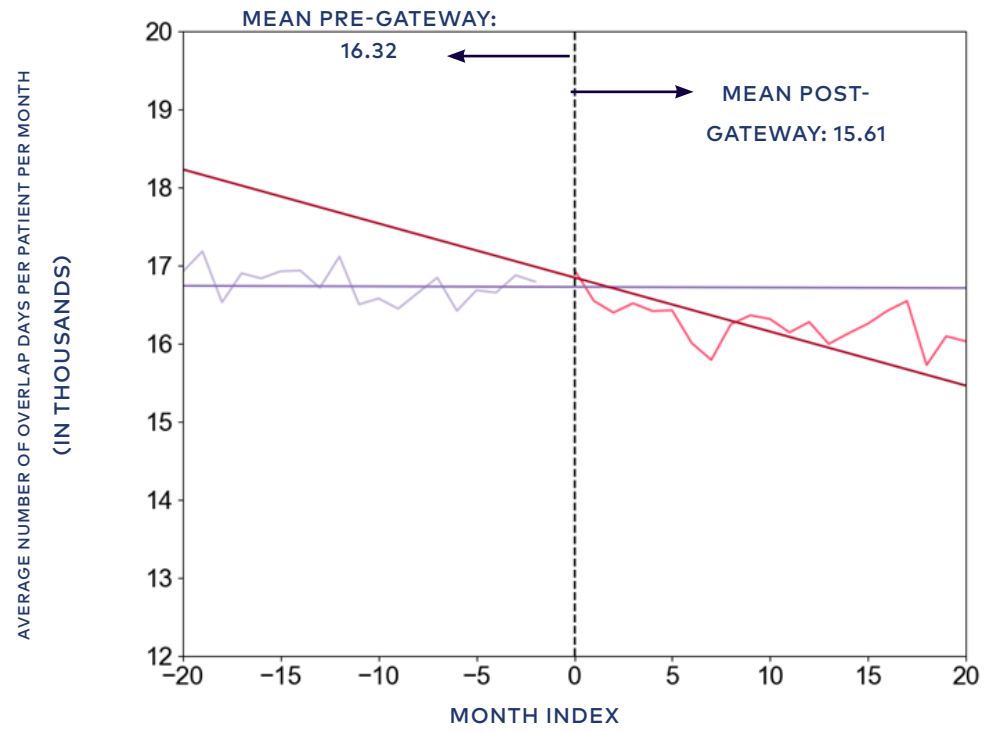

***Figure 7**: Average number of overlap days per patient per month of opioid and benzodiazepine dispensations across 8 states, and associated linear regressions.*

DISCUSSION

The research discussed in this paper was conducted with the intent of confirming what other research has shown [2], but also going beyond that. PDMP implementation, when integrated directly into a provider's or pharmacist's workflow, certainly has an impact on prescribing habits. We evaluated this impact by conducting a meta-analysis of changes in PDMP prescribing patterns in eight states with sufficient data prior to and post PMP Gateway rollout (that is, a period of approximately two years before and after). The choice for this approach was twofold:

1. Measures of effect (e.g., changes in slope) and summary statistics are often difficult to translate into something clinically meaningful, and;
2. The generalizability of the results is very limited with single studies.

In the case of a meta-analysis, it is possible to obtain an effect size that has greater statistical power than single studies alone and is both more tangible and clinically meaningful. Moreover, extrapolating to the general impacted population is possible because each unit of analysis (i.e., prescribing patterns among patients in each state) is derived from different patient populations.

The current study has shown that opioid dispensations decrease significantly with in-workflow PDMP integration using Appriss Health's PMP Gateway, much of that coming from Schedule II drugs.

Buprenorphine MAT (or MOUD) dispensations for opioid use disorder is shown to increase as a result of PMP Gateway implementation in a statistically meaningful way. Finally, there is a downward trend in the average number of days each month that patients who are being prescribed opioids and benzodiazepines had both medications on hand.

CONCLUSION

The research indicates a positive correlation between the use of PMP Gateway and a reduction in prescriptions of certain controlled substances. Specifically, it shows that states with statewide PMP Gateway integration, in which providers and pharmacists can conveniently run queries directly in clinical workflows, have increased the amount of queries related to patients' controlled-substance histories. These queries, in turn, have resulted in a reduction in the amount of prescriptions across Schedule II, III, IV, and V controlled substances, including opioids. Perhaps the most telling stat is the 15.6% average decrease in opioid dispensations over two years

We can now confidently state that PMP Gateway has made an impact across our sample of states and should continue to make an impact in the future, particularly by reducing the number of opioid prescriptions written over time.

REFERENCES

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2850938/
2. https://www.ojp.gov/pdffiles1/bja/247133.pdf