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Brief Report

# Reduction of opioid prescribing through the sharing of individual physician opioid prescribing practices☆

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ABSTRACT

*Background:* Drug overdoses are the most common cause of accidental death in the United States, with the majority being attributed to opioids. High per capita opioid prescribing is correlated with higher rates of opioid abuse and death. We aimed to determine the impact of sharing individual prescribing data on the rates of opioid prescriptions written for patients discharged from the emergency department (ED).

*Methods:* This was a pre-post intervention at a single community ED. We compared opioid prescriptions written on patient discharge before and after an intervention consisting of sharing individual and comparison prescribing data. Clinicians at or over one standard deviation above the mean were notified via standard template electronic communication.

*Results:* For each period, we reported the median number of monthly prescriptions written by each clinician, accounting for the total number of patient discharges. The pre-intervention median was 12.5 prescriptions per 100 patient discharges (IQR 10–19) compared to 9 (IQR 6–11) in the post-intervention period ($p < 0.001$). This represents a 28% reduction in the overall rate of opioid prescriptions written per patient discharged. Using interrupted time series analysis for monthly rates, this was associated with a reduction in opioid prescriptions, showing a decrease of almost 9 prescriptions for every 100 discharges over the 6 months of the study ($p = 0.032$).

*Conclusion:* Our study demonstrates the sharing of individual opioid prescribing data was associated with a reduction in opioid prescribing at a single institution.



## 1. Introduction

Despite significant time, funding and resources dedicated to addressing the opioid epidemic, mortality from opioids still grows in the United States (US). Currently the leading cause of accidental death in the US is drug overdose, the majority of which are attributed to opioids. In 2015, 63.1% of drug overdose deaths involved opioids, nearly one third of which were prescription drug related [1].

One area of primary prevention with the potential to impact the opioid crisis is the prescription of opioid medications by emergency physicians. While emergency physicians account for an overall low total number of opioid prescriptions written for patients compared to other specialties, they are high frequency providers and substantial variation exists among individual physicians [2]. Decreasing excessive or unnecessary prescribing of opioid medications from the ED may therefore have the potential to reduce subsequent opioid use, misuse, and overdose.

It has been demonstrated that opioid naïve patients who receive a prescription for an opioid medication on discharge from the ED are at increased risk of continuing to receive prescriptions for opioids one year later [3]. Similarly, patients who receive opioid analgesics versus NSAIDs after motor vehicle collision have no difference in risk for moderate to severe musculoskeletal pain at six weeks after discharge from the ED, but patients who were prescribed opioid medications were more likely to report use of prescription opioid medications at six week follow-up [4]. Finally, opioid prescription medications may also play a role in mortality attributed to illicit opioids as heroin users are often introduced to opioids in the form of prescription opioid medication prior to using heroin [5]. Given risks of future opioid prescription use, misuse, and transition to heroin use, limiting physician prescribing of opioid medications may decrease mortality from opioids.

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There is evidence that comparing physician behavior to peers through the sharing of individual performance data can be an effective method to improve practice behavior [6]. A recent study by Michael et al. demonstrated that self-perception of opioid prescribing by emergency physicians was frequently underestimated [7]. In the randomized controlled trial, the group of emergency physicians who underestimated their prescribing of opioids who were shown individual and group opioid prescribing metrics had a larger magnitude decrease in overall opioid prescribing compared with emergency physicians who had an accurate estimate of their prescribing practices and controls [7]. We hypothesized that the sharing of individual provider opioid prescribing patterns – along with group prescribing for comparison – would decrease prescribing of opioids from a community ED.

## 2. Methods

### 2.1. Study design

The study was a pre-post intervention. It was approved by the institutional review board at Beth Israel Deaconess Hospital-Plymouth.

### 2.2. Study setting and population

The study took place at a single community hospital ED (47,000 patients/year) in suburban Massachusetts. The intervention group consisted of all physician and advanced practice (nurse practitioner and physician assistant) clinicians who staffed the ED of the community hospital where the intervention was deployed.

### 2.3. Study protocol

The pre-intervention period was from March 1, 2015 to August 31, 2015. The intervention was deployed on September 9, 2015 and quarterly thereafter. September 1, 2015, through September 30, 2015 was considered a washout period. The post-intervention period was October 1, 2015 through March 30, 2016. Our study was planned and implemented prior to an October 2016 Massachusetts law mandating the use of the prescription drug-monitoring database prior to prescribing opioid medications. While prior legislation did also require the use of the prescription drug-monitoring database, a regulatory exception was worked out between emergency physicians in Massachusetts and the Department of Public Health. This exception was made for providers in an ED who did not anticipate writing a prescription for more than a five-day supply of a controlled substance or in situations when emergency care is required and utilization of the prescription monitoring program would be likely to result in patient harm in the professional opinion of the provider. Because of this exception, it was encouraged but not standard practice for emergency physicians to utilize the database before writing prescriptions.

For each period, the number of prescriptions written by each clinician per 100 patients discharged and the number of pills per prescription were documented. The following isolated and combination product opioids in pill form were recorded: hydrocodone, oxycodone, hydromorphone, morphine, tramadol, and codeine. Group data was reviewed at staff meeting on a quarterly basis. Individual metrics showing each clinician's data with a comparison to the group mean was distributed to clinicians, highlighting those at or over one standard deviation above the mean. For all clinicians identified as outliers, data were reviewed individually via standard template electronic communication. Basic education about the association of prescribing practices with mortality from opioids was provided at staff meetings. Additionally, prescribing guidelines were provided to support clinicians in their decision not to prescribe opioids to patients with high-risk features.

### 2.4. Key outcome measures

Descriptive statistics of median opioid prescriptions (monthly rates per 100 discharges) with inter-quartile range (IQR) and median pills per prescription were compared using Wilcoxon signed rank test.

Our primary outcome was the change in prescribing at the provider level after the intervention using an Interrupted Time Series (ITS) analysis, which is a quasi-experimental approach for evaluating longitudinal effects of interventions. We divided the trial period into two time segments - before and after implementation of the intervention. In ITS approach, two parameters define each segment: level and trend. The level is the value of the series at the beginning of a given time interval (intercept). The trend is the rate of change of a measure (in other words, the slope) during a segment. In segmented regression analysis, each segment of the series can exhibit both a level and a trend. A change in level indicates an abrupt intervention effect. A change in trend, defined by the change in the slope of the segment after the introduction of the pathway, indicates a more gradual change. Using an ITS approach, we employed Autoregressive Integrated Moving Average (ARIMA) models to estimate the changes in level and trend following the intervention. For the graphical analysis of the ARIMA model, we employed a linear depiction of the slope.

As a secondary analysis, we evaluated both the mean total number of opioid prescriptions per 100 patients discharged and mean number of pills per opioid prescription per month pre- and post-intervention by each individual provider.

### 2.5. Data analysis

Analyses were performed using SPSS software (version 21, SPSS Inc. Chicago, Illinois). The level of significance was 0.05.

## 3. Results

The pre-intervention median was 12.5 opioid prescriptions per 100 patient ED discharges (IQR 10–19) compared to 9 (IQR 6–11) in the post-intervention period ($p < 0.001$). This represents a 28% reduction in the overall rate of opioid prescriptions written per patient discharged. The median number of patients discharged each month per physician before the intervention was 119 (IQR 49–155) compared to 107 (IQR 53–151) post intervention ($p = 0.75$). Table 1 summarizes the per capita opioid prescribing and demonstrates a statistically significant decrease in the overall number of pills written per prescription in the intervention group.

When stratified by type of clinician, the median number of opioid prescriptions for mid-level providers (physician assistants and nurse-practitioners) was 22 per 100 discharges pre-intervention and 9 per 100 discharges post intervention ($p = 0.109$); for physicians the median was 12 opioid prescriptions per 100 discharges pre-intervention and 8 opioid prescriptions per 100 discharges post intervention ($p = 0.001$).

Using ITS analysis for monthly prescription rates, the post-intervention slope plotting prescription rates over time showed a non-statistically significant increase of about 0.4 opioid prescriptions per 100 patients discharged each month in the time period before the intervention ($p = 0.324$) and a statistically significant decrease of 0.5 prescriptions per 100 patients discharged per month after the intervention ($p = 0.009$), for a total decrease of almost 9 prescriptions per 100 discharges over the six months of the study. The intercept revealed a significant immediate decrease in opioid prescriptions from pre- to post-intervention ($-0.96$, $p = 0.47$). The monthly trend in opioid prescriptions is demonstrated in Fig. 1, and depicts a steady decrease in prescription rates in the post-intervention period.

We observed that the decreased in the rate of opioid prescriptions was also seen at the individual provider level. Fig. 2 demonstrates the change in mean opioid prescribing from pre- to post-intervention at

**Table 1**
Descriptive statistics of opioid prescriptions before versus after the intervention.

| | Before intervention Median [IQR] | After intervention Median [IQR] | p-value |
|---|---|---|---|
| Opioid prescriptions per 100 patients discharged per physician | 12.5 [10–19] | 9 [6–11] | <0.001 |
| Opioid pills per prescription | 17 [14–18] | 15 [12–16] | 0.145 |
| Oxycodone prescriptions per 100 patients discharged per physician | 8 [5–11.5] | 4 [3–7] | <0.001 |
| Oxycodone pills per prescription | 16 [14–18] | 13 [11–16] | 0.006 |
| Hydrocodone prescriptions per 100 patients discharged per physician | 2 [1–5] | 2 [1–4] | 0.313 |
| Hydrocodone pills per prescription | 18 [15–22] | 16 [12−23] | 0.658 |

the individual provider level, along with the overall number of discharges for each provider during each time period. The majority of individual providers also prescribed fewer pills in the opioid prescription post-intervention compared with the pre-intervention period. Fig. 3 shows the average total number of opioid pills per prescription by each provider pre- and post-intervention.

## 4. Discussion

This study adds further support to the idea that an intervention based on sharing individual and group opioid prescribing data in the ED setting is associated with a decrease in the per-capita rate of prescriptions written for patients on ED discharge. The ITS approach allowed for the accounting of temporal trends, such as legislative pressure and the media exerting influence on physician opioid prescribing. It is important to note that the study predates the Massachusetts legislation from October 2016 mandating the use of the prescription drug-monitoring database prior to prescribing opioid medications.

Emergency physicians are in a unique position to promote change in the availability of opioid prescriptions and the expectations of patients towards receiving opioid medications on discharge from the ED. While emergency physicians generally prescribe small pill counts, they are high frequency providers and have the opportunity to impact a large number of patients. Recent work using a national sample of Medicare beneficiaries highlighted that higher emergency physician prescribing of opioids had a positive association with increased long-term opioid use [8]. Additionally, more than half of people reporting non-medical prescription painkiller use state that they were given the medication by a friend or relative [9]. Therefore, reducing potentially unnecessary opioid prescriptions will likely benefit the safety of our community as a whole.

Our attempt to modify provider behavior focused on interventions with active feedback and peer comparison. Previous work by Meeker et al. reported a decrease in inappropriate antibiotic prescriptions for upper respiratory tract infections by requiring a specific antibiotic justification to be entered into the patient's chart or by comparing provider prescription data to their peers, both of which were noted to have a social motivation [10]. The passive, non-social measure of a suggested list of alternative therapies did not produce a statistically significant change. The recent work by Michael et al. lends further support to this approach, and specifically supports the relevance of this approach to opioid prescribing in the ED [7].

Last year, Barnett et al. looked at the impact of a Massachusetts state policy intending to decrease the number of opioids prescribed by physicians in the state [11]. The Department of Public Health emailed all prescribers a report on the number of opioids they prescribed in the past year, as well as the mean and median rates for other clinicians in their specialty. Barnett found no evidence this intervention reduced opioid prescription rates among primary care physicians in Massachusetts compared with other states [11]. Our intervention was different in a number of important ways. First, providers received multiple, more frequent reports detailing their individual prescribing practices over a period of time. Additionally, the peer comparison was with colleagues who were working in the same ED. Finally, the physicians who were identified as

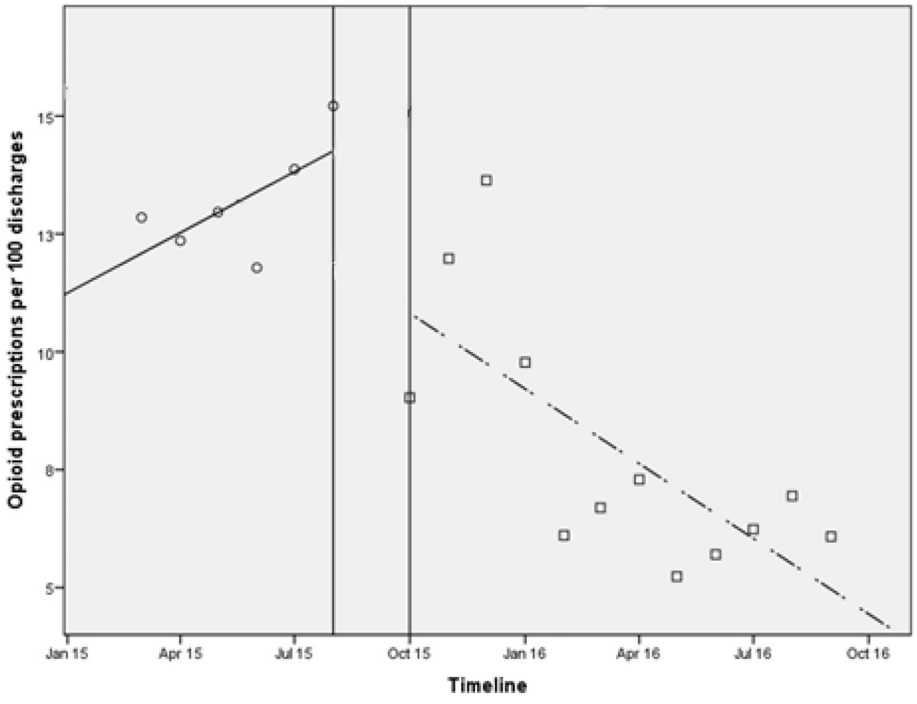


**Fig. 1.** Trend in median Opioid prescriptions over trial time period.

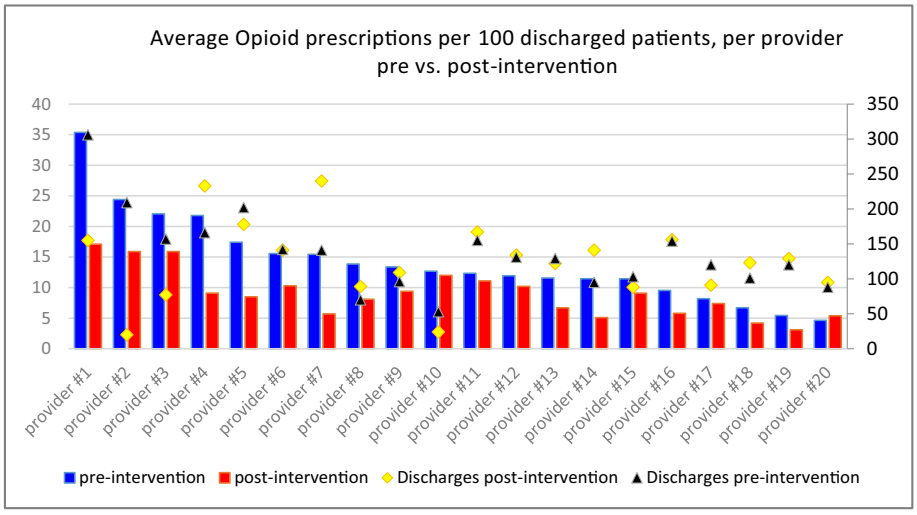


**Fig. 2.** Average of total Opioid prescriptions per 100 patients discharged by provider per month pre vs. post intervention (left axis), and total discharges per provider during each period (right axis).

outliers saw this reflected on their report and received additional feedback and education. These important distinctions may have contributed to the reduced number of opioid prescriptions observed in our study compared to the Massachusetts Department of Public Health intervention.

## 5. Limitations

Our most notable limitation is that this is a single institution study, although we suspect our results are generalizable to many other communities EDs. Applying a similar intervention at academic centers could prove challenging given frequent resident turnover and the extent to which these prescriptions are overseen by attending physicians. Similar limitations would exist for facilities that employ large numbers of locum tenens physicians.

Additionally, we do not have a control group for comparison. The focus around the opioid epidemic may have played a role in the reduction of prescriptions seen in our study and limit the benefit of this intervention on a wider scale, although we hypothesize this to be additive to the external pressures placed on providers.

Finally, as Fig. 1 shows, there is an increase in per-capita prescribing seen after an initial sharp decline. Some of this is likely regression to the mean, but it will be important to track our prescriptions over a longer period of time. We anticipate that to remain effective, the intervention needs to continue to remind providers of the importance of appropriate opioid prescribing and our individual roles in managing the opioid epidemic.

## 6. Conclusion

In summary, our study demonstrates that interventions in the form of individualized feedback about personal opioid prescribing patterns with comparison to peers can reduce the number of opioid prescriptions

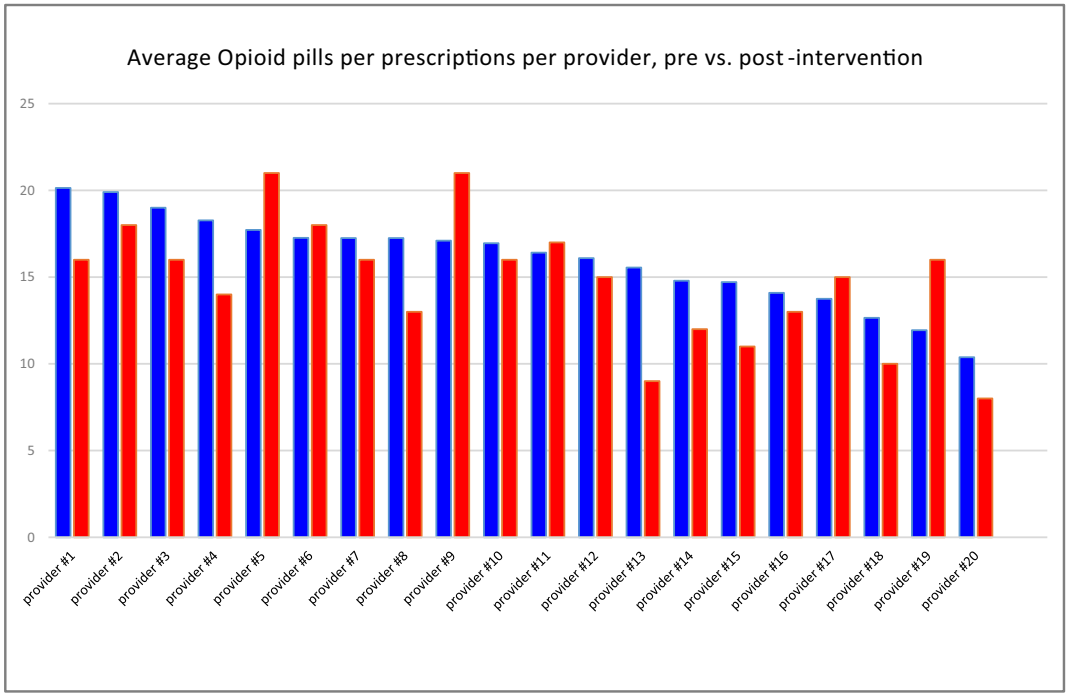


**Fig. 3.** Average of total Opioid pill per prescription rates, prescribed by each provider per month pre vs. post intervention.

written by emergency physicians on patient discharge from a single community ED.

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