State variation in opioid and benzodiazepine prescriptions between independent and nonindependent advanced practice registered nurse prescribing states

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**Abstract**

Background: Many people lack access to primary care services in the United States. One possible solution is to increase utilization of advanced practice registered nurses (APRNs). A common patient safety concern about independent prescribing by APRNs is that prescribers will increase prescriptions for medications with abuse/dependence potential, such as opioids or benzodiazepines.

Purpose: The purpose was to investigate the relationship in opioid- and benzodiazepine-prescribing rates between independent vs. nonindependent APRN prescribing states.

Methods: Tertiary analysis of a Centers for Disease Control and Prevention study reporting state variation in prescribing rates of opioids and benzodiazepines using 2012 Intercontinental Marketing Services Health retail prescription data representing 259,000,000 prescriptions. Analyses were performed using different definitions for independent states: (a) states allowing at least one APRN type independent prescribing and (b) states allowing all APRN types independent prescribing. ANOVA tests were used to test for differences in mean number of opioid- and benzodiazepine-prescribing rates per 100 residents. Analysis of Covariance tests were employed controlling for state characteristics previously determined to affect controlled substance-prescribing rates (e.g., Medicare rates, race, socioeconomic status, number of physicians/capita).

Results/Discussion: There were significantly higher opioid and benzodiazepine prescriptions in states with nonindependent APRN prescribing laws than those in states with independent APRN prescribing laws and no significant differences in long-acting opioids or high-dose opioids. This study found no evidence to support the argument that independent prescribing increases prescriptions with abuse potential.

Conclusion: Independent prescriptive authority, only one piece of APRN practice, has been one of the most controversial issues but one with great potential to help ease access to U.S. health care problems. Empirical evidence demonstrating the safety of this practice can help promote this potential.

Introduction

The United States has an access to health care problem, particularly in primary care (Davis, Stremikis, Shoen, & Squires, 2014). Patients in the United States are more likely to have difficulties obtaining a primary care appointment than patients in other industrialized countries. These difficulties are expected to worsen due to population growth, an increasing number of insured patients under the Affordable Care Act, an aging population, and a shortage of primary care physicians (Health Resources and Services Administration [HRSA], 2013). One possible solution is to increase utilization of advanced practice registered nurses (APRN); however, many barriers prevent implementation of this solution (Auberbach et al., 2013; Institute of Medicine [IOM], 2011; National Governors’ Association [NGA], 2012).

State-based regulations restricting practice, specifically for prescribing medication, are one of the most frequently cited barriers to full utilization of APRNs in primary care (IOM, 2011; National Council of State Boards of Nursing [NCSBN], 2012; Safriet, 2011). Great variation exists in APRN prescriptive authority across states, with 16 states allowing fully independent APRN prescribing for all four APRN types: certified nurse midwives, certified nurse practitioners, clinical nurse specialists, and certified registered nurse anesthetists (NCSBN, 2015). Others restrict what type of medication may be prescribed or impose physician supervision or collaboration requirements on prescribing authority on one or all of the APRN types. Many states are taking measures to reduce these barriers, with a record number of bills introduced in 2014 to reduce APRN practice restrictions (NCSBN, 2015). Common arguments against independent APRN prescribing involve the differences in education length between physicians and APRNs and concerns about patient safety (Nuzzo, 1998; Phillips, Harper, Wakefield, Green, & Fryer, 2002).

One commonly expressed patient safety concern is that independent APRN prescribing practices will increase the number of prescriptions for medications with abuse/dependence potential, such as opioids or benzodiazepines. One possibility is that increased prescriptions for opioids or benzodiazepines will exacerbate problems, such as increased overdoses or the resurgence of pill mills (Florida Medical Association [FMA], 2014). Deaths from drug overdoses are a leading cause of death in the United States (Centers for Disease Control and Prevention [CDC], 2015), and prescription medications, mostly opioids, are a major source of these deaths. Pill mills, or medical facilities that unlawfully prescribe and dispense controlled substances outside sanctioned medical practices, have been implicated as a significant source of abused opioids (CDC, 2011). States have been aggressively undertaking actions to restrict these facilities. Reductions in the numbers of these facilities have resulted from implementing Prescription Drug Monitoring Programs along with other policy changes. Although abuse of prescription medication is a serious problem, there is no empirical evidence that links independent APRN prescribing with higher rates of opioid or benzodiazepine prescriptions.

The purpose of the present study was to investigate the relationship between APRN prescribing status (nonindependent vs. independent) and opioid- and benzodiazepine-prescribing rates in the United States. Specifically, we examined whether state-based regulations allowing for independent APRN controlled substance prescribing increase the amount of opioid and benzodiazepine prescriptions written in that state. Follow-up analyses were planned to examine if any differences remained after controlling for characteristics of states that might be related to prescribing rates, for example, the number of practicing physicians in a geographic area (Paulozzi, Mack, & Hockenberry, 2014), ethnicity (McDonald, Carlson, & Izrael, 2012; Olsen, Daumit, & Ford, 2006), Medicaid and Medicare rates (Luo, Pietrobon, & Hey, 2004; Olsen et al., 2006), and socioeconomic status (Luo et al., 2004; McDonald et al., 2012).

Methods

Prescription Rate

The number of prescriptions per 100 people in 50 U.S. states and the District of Columbia (D.C.) was described in a recent CDC study (Paulozzi et al., 2014), using the IMS Health Incorporated’s National Prescription Audit. (IMS Health is recognized as the world’s largest health care data source; IMS Health, 2015). Data represent 258.9 million prescriptions written in 2012 (the most recent data available) from 57,000 retail pharmacies (Paulozzi et al., 2014). Retail pharmacies account for about 90% of all opioids dispensed (McDonald et al., 2012). The following four categories were used: total opioids, long-acting opioids, benzodiazepines, and high-dose opioids (HDOs). Long-acting (or extended release) opioids are those that should be taken only 2–3 times a day, such as methadone, OxyContin, and Opana ER. HDOs are defined as the highest formulations available (e.g., total daily dosage of ≥100 morphine milligram equivalents when taken at the usual frequency of 4–6 hours; Paulozzi et al., 2014).

Scope of Prescriptive Practice

A state is defined as independent if no restrictions are placed on prescribing ability outside length of time from APRN-licensed status to granting of prescribing authority (i.e., some states require a specified number of practice hours before an APRN can apply for...
unrestricted prescriptive authority). A state is considered nonindependent, which is sometimes called reduced or restricted, if there are any restrictions to APRN prescribing certain medications or supervision/collaboration requirements by another profession (NCSBN, 2012). For the initial analysis, independent scope of prescriptive practice is defined as states with any APRN (i.e., nurse practitioner, nurse midwife, nurse anesthetist, or clinical nurse specialist) with no legal restrictions (Table 1). In a follow-up analysis, a more restricted definition of independent states as those where all types of APRN have no legal restrictions was used.

### Socioeconomic Status

Income per capita in $1,000 increments from each state and D.C. was taken from online estimates for 2012 from the U.S. Department of Commerce, Bureau of Economic Analysis (https://bber.unm.edu/econ/uspcih.htm; United States Department of Commerce Bureau of Economic Analysis, 2012).

### Ethnicity

Ethnicity in each state and D.C. was assessed using the proportion of white, non-Hispanic residents in the state in 2012 as estimated by the U.S Census Bureau (Bureau of Business & Economic Research, 2015).

### Medicare Beneficiaries

The number of Medicare beneficiaries, as a percentage of the population from 2012, was taken from a state health facts report using Centers for Medicare & Medicaid Services data prepared by The Henry J. Kaiser Family Foundation (http://kff.org/medicare/state-indicator/total-medicare-beneficiaries/; The Henry J. Kaiser Family Foundation [KFF], 2012a).

### Medicaid Enrollees


### Number of Providers

The number of active licensed physicians (scaled per one million residents) in 2012 was taken from a state health facts report prepared by The Henry J. Kaiser Family Foundation (http://kff.org/other/state-indicator/total-active-physicians/; KFF, 2012c). The number of nurse practitioners in 2011 (the most recent data available) with active licenses (scaled per 100,000 residents) was also obtained from a state health facts report prepared by The Henry J. Kaiser Family Foundation (http://kff.org/other/state-indicator/total-nurse-practitioners/). Both data sets were prepared from a data request from Redi-Data, Inc. (KFF, 2011).

### Analysis

The relationship between state prescriptive authority and number of prescriptions was tested using four separate ANOVA tests for different classifications of prescriptions: opioids, long-acting opioids, HDOs, and benzodiazepines. A state was considered partially-independent if it allowed at least one APRN type independent prescribing rights. Next, ANCOVA controlled for state characteristics previously linked with rates of opioid and/or benzodiazepine prescribing: socioeconomic status, ethnicity, Medicare and Medicaid populations, and number of physicians in a geographic area. In follow-up analyses, a state was considered to have independent status only if all types of APRN had no restrictions on prescribing practice. Similar ANOVA and ANCOVA procedures were followed as previously described.

### Findings

States with independent practice ($M = 76.82$, standard deviation $[SD] = 9.79$) had significantly lower opioid prescriptions than states with nonindependent practice ($M = 94.14$, $SD = 25.60$); $F(1, 49) = 8.32; p = .006$. There was a significant difference in long-acting
opioid prescriptions between states with independent practice ($M = 13.39$, $SD = 4.36$) and nonindependent practice ($M = 11.05$, $SD = 3.25$); $F(1,49) = 4.83; p = .097$. There was no difference in HDOs between states with independent practice ($M = 4.39$, $SD = 1.55$) and non-independent practice ($M = 4.59$, $SD = 1.66$), $F(1,49) = 0.19; p = .662$. States with independent practice ($M = 34.49$, $SD = 9.22$) had significantly lower benzodiazepine prescriptions than states with nonindependent practice ($M = 42.34$, $SD = 11.29$); $F(1,49) = 6.76; p = .012$. Figure 1 shows the mean number of prescriptions in states with independent- vs. nonindependent-prescribing practice.

Next, ANCOVA was used to control for characteristics of states that have been previously linked with rates of opioid prescribing. Table 2 shows the full results of all ANCOVA with the four types of prescription medications tested. Differences between states with independent or nonindependent opioid prescribing, $F(1, 43) = 14.78, p < .001$, and benzodiazepine prescribing, $F(1, 43) = 10.82, p = .002$, remained statistically significant, after controlling for all of the state characteristics. Socioeconomic status was related to opioid prescriptions, $F(1, 43) = 16.33, p < .001$. After controlling for state characteristics, the difference in long-acting opioids was no longer significant, $F(1, 43) = 3.30, p = .076$. The number of Medicare beneficiaries was significantly related to the number of long-acting opioids, $F(1, 43) = 8.18, p = .007$, high-dose opioids, $F(1, 43) = 4.46, p = .040$, and benzodiazepines, $F(1, 43) = 14.73, p < .001$.

In the follow-up analyses, states with independent prescribing practice of all APRN types ($M = 75.06$, $SD = 10.79$) had significantly lower opioid prescriptions than states with nonindependent practice ($M = 90.72$, $SD = 23.67$); $F(1, 49) = 4.50, p = .039$. There was no difference in long-acting opioid prescriptions between states with independent practice ($M = 11.92$, $SD = 3.95$) and nonindependent practice ($M = 11.98$, $SD = 3.89$); $F(1, 49) = 0.00; p = .965$. There was no difference in HDOs between states with independent practice ($M = 4.19$, $SD = 1.81$) and nonindependent practice ($M = 4.60$, $SD = 1.55$); $F(1, 49) = 0.57; p = .456$. States with independent practice ($M = 31.55$, $SD = 6.29$) had significantly lower benzodiazepine prescriptions than states with nonindependent practice ($M = 41.38$, $SD = 11.27$); $F(1, 49) = 7.64; p = .008$.

There were no changes in the levels of significance, after controlling for state characteristics in follow-up ANCOVA. Differences between states with independent or nonindependent practice in opioid prescribing, $F(1, 43) = 13.83, p = .001$, and benzodiazepine prescribing, $F(1, 43) = 10.56, p = .002$, remained statistically significant, after controlling for all of the state characteristics. The differences between states with independent or nonindependent practices in long-acting opioid prescriptions, $F(1, 43) = 0.05, p = .823$, and HDO prescriptions, $F(1, 43) = 0.04, p = .851$, remained nonsignificant.

### Table 2 — Results of ANCOVA Controlling for Characteristics of State When At Least One Advanced Practice Registered Nurse Type Is Independent Prescriber

<table>
<thead>
<tr>
<th>State Characteristic</th>
<th>Opioids</th>
<th>Long-Acting Opioids</th>
<th>High-Dose Opioids</th>
<th>Benzodiazepines</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$F$</td>
<td>$p$</td>
<td>$F$</td>
<td>$p$</td>
</tr>
<tr>
<td>Socioeconomic status</td>
<td>16.33</td>
<td>&lt;.001</td>
<td>3.7</td>
<td>.061</td>
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<td>Ethnicity</td>
<td>0.69</td>
<td>.140</td>
<td>0.21</td>
<td>.652</td>
</tr>
<tr>
<td>Medicare beneficiaries</td>
<td>3.00</td>
<td>.091</td>
<td>8.18</td>
<td>.007</td>
</tr>
<tr>
<td>Medicaid enrollees</td>
<td>2.57</td>
<td>.116</td>
<td>2.19</td>
<td>.146</td>
</tr>
<tr>
<td>Physicians</td>
<td>0.14</td>
<td>.715</td>
<td>0.03</td>
<td>.859</td>
</tr>
<tr>
<td>Nurse practitioners</td>
<td>0.33</td>
<td>.568</td>
<td>0.9</td>
<td>.349</td>
</tr>
<tr>
<td>Scope of practice</td>
<td>14.78</td>
<td>&lt;.001</td>
<td>3.3</td>
<td>.076</td>
</tr>
</tbody>
</table>

**Note.** All tests were 1 df using ANCOVA.
**Discussion**

Significantly less opioid and benzodiazepine prescriptions are written in independent- vs. non-independent prescribing states. These differences remained significant after controlling for a number of state characteristics, such as number of physicians/1,000,000 population (McDonald et al., 2012; Webster, Cifuentes, Verma, & Pransky, 2009), race or ethnicity (McDonald et al., 2012; Olsen et al., 2006), Medicaid and Medicare rates (Luo et al., 2004; Olsen et al., 2006), and socioeconomic status (SES) status (Luo et al., 2004; McDonald et al., 2012) that have been empirically or theoretically linked to controlled substance-prescribing rates. After controlling for state characteristics, in particular, the number of Medicare beneficiaries, the difference in the number of long-acting opioids was no longer statistically significant. That is, the higher number of long-acting opioid prescriptions found in the initial analysis was likely due to differences in Medicare beneficiaries in those states. No differences were found in HDO prescribing rates among the states.

Follow-up tests were conducted with a different operational definition of independent prescribing practice to investigate whether differences in levels of prescriptions would be apparent with a stricter definition of a state with independent practice. The patterns of statistical significance were consistent, regardless of which definition of a state with independent practice was used. The first definition was a state with independent practice being defined as having any one of four types of APRN with no legal restrictions on prescribing. The second definition of a state with independent practice was having all of four types of APRN without legal restrictions. The operational definition in the follow-up analyses was chosen to examine whether increased opioid prescriptions would occur only if multiple types of APRN were prescribing legally in state. The results provided no evidence to support that proposition.

An international systematic review in 2014 investigated differences in physician and nurse prescribing and found comparable ways of prescribing, and similar or better health, perceived quality, and patient satisfaction with nurses (Gielen, Dekker, Francke, Mistiaen, & Kroezen, 2014). The present study adds to the body of knowledge by examining prescriptions rates for controlled substances, which were not considered in any studies reviewed by Gielen et al. The findings of this study are consistent with those of a study in a community mental health setting, where APRNs were less likely than physicians to prescribe benzodiazepines (Fisher & Vaughan-Cole, 2003), and a second study that found APRNs less likely to prescribe opioids in chronic pain management (Upshur, Luchmann, & Savageau, 2006).

Several studies have cited geographic location as being a predictor of opioid prescribing, with Appalachian (McDonald et al., 2012), southern (McDonald et al., 2012; Olsen et al., 2006; Paulozzi et al., 2014; Webster et al., 2009), and western (McDonald et al., 2012; Olsen et al., 2006) states having higher prescribing rates. The present study used a more fine-grained approach, examining characteristics of individual states, not geographic area. In Figure 2, visual inspection showed that states with independent APRN prescribing practices are predominantly located in the Pacific Northwest, southwest, and northeast locations and appeared unconnected to areas of noted high or low opioid prescribing. The only state characteristic that was associated with opioid prescriptions was SES, defined here as per capita income in the state. It is plausible that geographic differences are explained by SES in the states. These results suggest that research examining geographic differences in prescribing rates should account for SES.

![Figure 2](image-url)
The number of Medicare beneficiaries was linked to the number of long-acting opioid, HDO, and benzodiazepine prescriptions. The Medicare population is primarily elderly (83%) and disabled (16%; KFF, 2015). These two groups are patients who typically have a higher incidence of chronic pain, possibly due to cancer, and would be expected to have a greater number of opioid prescriptions (American Geriatrics Society, 2009; Morden et al., 2014; Volkow, McLellan, Cotto, Kariathanom, & Weiss, 2011). The authors recommend that future studies investigate the link between Medicare and numbers of prescriptions to explain this relationship more completely.

It has been posited that allowing for independent controlled substance prescribing for APRNs will lead to dangerous outcomes such as the reemergence of pill mills (FMA, 2014). This study found no evidence to support this claim. In fact, states with independent APRN prescribing laws prescribed significantly fewer opioid and benzodiazepines, the two classes of medications responsible for a significant portion of nonmedical prescription use, abuse, overdose, and death (CDC, 2015). Parallel trends have been found between opioid-prescribing rates and opioid overdose deaths, so it is plausible that these independent states experience less opioid-related deaths. Future research should examine whether higher levels of prescriptions are related to adverse outcomes, including deaths related to prescription medications and whether independent prescriptive authority of advanced practice nurses is related to these adverse outcomes.

Several possible explanations exist for the difference in prescribing rates between independent and nonindependent states. It has been suggested that APRN training is more holistic, wellness focused and less disease oriented and cure focused (Moody, Smith, & Glenn, 1999), so nurses may be more likely to incorporate nonopioid pharmacologic and nonpharmacologic treatment modalities to treat pain (D’Arcy, 2009). There is evidence from previous research that advanced practice nurses were less likely than physicians to recommend or prescribe medications (Avorn, Everitt, & Baker, 1991). Moreover, on initiation of independent prescribing status, many states instituted mandatory pharmacology or controlled substance education before an APRN could attain prescribing privileges and continuing education to maintain the privilege (Oregon State Board of Nursing, 2015; State of Rhode Island and Providence Plantations Department of Health, 2012), which could also impact APRN prescribing. This requirement is not always required of physician–prescriber counterparts.

Another plausible explanation is that pain is undertreated in patients of APRNs. McDonald et al (2012), in their description of county-level variation in opioid prescribing rates, cautioned that “...low treatment rates may indicate undertreatment” and “...high rates may indicate overprescribing” (p. 988). The possibility that patients who need opioid and benzodiazepine treatment are not receiving it in independent prescribing states must be entertained, and one study reviewing APRN vs. physician opioid prescribing after state dosing guidelines were instituted found that APRNs were twice as likely to have stopped prescribing them overall (Franklin, Fulton-Kehoe, Turner, Sullivan, & Wickizer, 2015). The data evidencing high levels of patient satisfaction with APRN care, even as compared with physician care, seem to render this possibility unlikely for most patients (Newhouse et al., 2011). The authors recommend further investigation of pain and prescribing to understand these possibilities on a patient level.

Limitations

This study has several limitations which must be taken into account. The data reviewed were limited to retail pharmacy opioid and benzodiazepine prescriptions and do not account for medications dispensed from pain clinics or other sources of opioid and benzodiazepine medications. In addition, data are aggregated by state in which the medication is filled and cannot account for prescriptions obtained by individuals outside their home state, nor account for variations in opioid prescribing within states, for example, at the county level. Patient acuity and diagnosis or condition data are not accounted for. Although a significant relationship was identified between state APRN prescribing laws and opioid- and benzodiazepine-prescription rates, a causal relationship cannot be established with the cross-sectional data used in this study.

Conclusion

The fact that opioid- and benzodiazepine-prescribing rates are significantly lower in independent APRN states, even after controlling for state characteristics, provides empirical evidence that states with independent APRN prescribing are not linked to greater prescribing rates of these commonly abused medications. These findings show it is not likely that APRN prescribing authority is linked to pill mill activities in a state through this mechanism. These results hold whether states with independent practice are defined as those that permit any single type of APRN independent prescriptive authority or those that allow all four types of APRN independent prescriptive powers. Prescriptive authority, although only one piece of APRN practice, has been one of the most controversial legal issues, but one with great potential to help ease access to health care problems the United States is currently facing.
Acknowledgments

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