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Original Contribution

National opioid prescribing trends in emergency departments by provider type: 2005–2015

Bo Kyum Yang, PhD, RN [a,*], Carla L. Storr, ScD, MPH [b], Alison M. Trinkoff, ScD, RN [b], Minji Sohn, PhD [c], Shannon K. Idzik, DNP, CRNP [d], Mark McKinnon, DHSc, PA-C [a]

[a] Department of Health Sciences, College of Health Professions, Towson University, Towson, MD, United States of America
[b] Department of Family and Community Health, University of Maryland School of Nursing, Baltimore, MD, United States of America
[c] Department of Pharmaceutical Sciences, College of Pharmacy, Ferris State University, Big Rapids, MI, United States of America
[d] Department of Organizational System and Adult Health, University of Maryland School of Nursing, Baltimore, MD, United States of America

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ABSTRACT

Purpose: To describe opioid prescribing practice patterns and trends in emergency department visits (EDs) by provider type: physicians and advanced practice providers (APPs), which include nurse practitioners (NPs) and physician assistants (PAs).
Methods: The data source was the ED visit files of the 2005–2015 National Hospital Ambulatory Care Survey. The study sample was opioid prescription-related ED visits. Descriptive and multinomial logistic regression analyses were conducted to assess the proportion of opioid prescription-related visits by provider type over time in total and by patient age group. We then characterized opioid prescribing practices of NPs, PAs, and physicians according to type of opioid and pain-related diagnosis.
Results: From 2005 to 2015, there was a 116.7% increase in the proportion of the opioid prescription-related visits seen by NPs and a 61.2% increase seen by both APPs and physicians. In contrast, the proportion of the physician-only visits decreased (−8.3%). When stratified by age group, the growth was particularly notable among the visits with patients aged 65 and older seen by both APPs and physicians (AOR = 2.35, 95% CI = 1.69, 3.25). Proportionally less hydromorphone and morphine was prescribed by APPs than by physicians. Opioids were prescribed more often by APPs in visits involving dental and injury-related pain, whereas physicians prescribed opioids more in abdominal and chest pain-related visits.
Conclusions: From 2005 to 2015, APPs, particularly NPs played an increasing role in opioid prescribing in EDs. Opioid prescribing practices of APPs and physicians varied by patient condition as well as by opioid type.

1. Introduction

Emergency departments (EDs) are one of the major sources of opioid prescriptions for patients who seek treatment for acute or chronic pain related-conditions. Approximately 19% of ED discharges are opioid prescription related; representing 18.8 million prescriptions per year [1]. While prescribing opioids may improve quality of life of patients who suffer from uncontrolled pain in the short term, there have been growing concerns over the potential for opioid misuse and unintentional initiation of long-term opioid use that could occur following an opioid prescription obtained in EDs [2,3]. EDs are particularly vulnerable healthcare settings for prescription opioid misuse due to increased pressure to rapidly turn over patients, limitations in available centralized medical records and pharmacy data, and a lack of provider continuity [1,4].

The major types of providers who can prescribe opioids in EDs include physicians and advanced practice providers (APPs) such as nurse practitioners (NPs) and physician assistants (PAs). Among them, the numbers of APPs working in EDs are growing in response to an increasing service demand and a shortage of ED physicians [5]. During a span of 15 years (1993–2009), the proportion of ED visits seen by an NP grew by approximately 2.5% with more rapid growth in recent years [6,7]. Similarly, the proportion of PA visits has grown by 6% over the same time period [8,9].

APPs treat, diagnose, and prescribe medications for pain-related conditions, although their ability to prescribe opioids varies by state. In some states they can prescribe schedule III-V controlled substances with physician supervision only, while other states allow APPs to

* Corresponding author at: Towson University, 8000 York Rd, Towson, MD 21252, United States of America.
E-mail addresses: byang@towson.edu (B.K. Yang), cstorr@umaryland.edu (C.L. Storr), atrinkoff@umaryland.edu (A.M. Trinkoff), MinjiSohn@ferris.edu (M. Sohn), idzik@umaryland.edu (S.K. Idzik), mmckinnon@towson.edu (M. McKinnon).

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prescribe any type of schedule II-V controlled substances without physician supervision. As states consider granting more practice independence to APPs [10], the presence of APPs with capacity to prescribe opioids will also increase. A recent study using data from the IMS Health's National Prescription Audit (NPA) reported that 11% of opioid prescriptions were written by APPs, making them the third largest opioid-prescribing group, after family practice and internal medicine doctors [11]. Other studies found that PAs were more likely to prescribe controlled substances than other types of providers in primary office settings [12] and were significantly more likely to prescribe opioids than physicians for chronic pain in EDs [13]. NPs have also been found to prescribe opioids proportionally more than physicians compared to other types of medications in primary care settings [14]. In a study comparing opioid prescribing trends by specialty in Medicare beneficiaries, significant growth of opioid prescribing in both NPs (117.6%) and PAs (112.1%) was found between 2006 and 2012, with 2–5% of total filled prescriptions by these providers among all opioid prescriptions [15].

Though there are a few previous studies showing trends and patterns in opioid prescribing practices by APPs, no studies have examined this practice in ED settings by provider type. Furthermore, the lumping of NPs and PAs together or the inclusion of only either NPs or PAs in previous studies makes it difficult to compare opioid prescribing trends and patterns among these three distinct types of providers (NP, PA, and physician). The major purpose of our study is to describe national trends in opioid prescription-related ED visits by NPs, PAs, and physicians and to characterize their opioid prescribing practices (including types of opioids prescribed and associated pain-related diagnoses).

2. Methods

2.1. Data source and study sample selection

The study data were derived from ED visits in the National Hospital Ambulatory Medical Care Surveys (NHAMCS) from 2005 to 2015 [16]. NHAMCS data are collected annually by the National Center for Health Statistics (NCHS) to provide information on ambulatory care delivered in hospital outpatient and emergency departments [17]. We limited our analysis to the ED visit files obtained via a multistage probability design generated by NCHS to produce nationally representative visit estimates. The sample includes visits to non-institutional general and short-stay hospitals, and excluded federal, military, and Veteran's Administration hospitals in the 50 US states and the District of Columbia [16]. Within each hospital, all emergency service areas were selected. Patient visits were chosen systematically among the emergency service areas over a randomly assigned 4-week reporting period [18]. Details on data collection procedures and survey reports can be obtained directly from the CDC website [16,18].

Approximately a quarter (24%) of all ED visits from 2005 to 2015 were identified as an opioid prescription-related visit. Among the 78,162 visits, 2% (1566 visits) were excluded, either because the prescription-related visits involved a combination of NP and PA providers or because the provider information was missing. Our study focused on the remaining 77,213 opioid prescription-related visits in the survey database.

2.2. Measures

Provider type was identified from the survey question: "*Mark all providers seen at this visit*" and was initially grouped into three categories as follows: visits seen by APP-only (APP), physician-only (physician), and both APPs and physicians (APP/physician). APP was further divided into NP-only (NP) and PA-only (PA) in order to examine the difference in NP and PA practice separately.

The survey years served as a primary independent variable, and were grouped into three-time periods: 2005–2008, 2009–2012, and 2013–2015 in order to derive more stable estimates. Patient sociodemographic characteristics were categorized as they appeared in the survey by NCHS and served as study covariates: age (0–17, 18–64, and 65+ years of age), sex, race/ethnicity (White, African-American, or other), payment type (private insurance, Medicaid/Medicare, or other), and US census region (Northeast, Midwest, South, or West). The variables that assessed the clinical characteristics of opioid prescription-related visits included Drug Enforcement Agency (DEA) classification of controlled substances which was recoded into three categories (Schedules II, III, and IV/V) in our study. We also included the variable indicating whether an opioid was administered during the ED visit and/or prescribed at discharge.

ED visits with prescriptions of opioid analgesics alone and in combination with other drugs were identified using NCHS drug ID codes. Opioids included in our study were as follows: codeine, hydrocodone, hydromorphone, morphine, oxycodone, fentanyl, methadone, meperidine, and propoxyphene. According to the NCHS guidelines, estimates based on fewer than 30 observations are considered unreliable [17]. Thus, we combined types of drugs with fewer than 30 mentions into one group: "other" to ensure sufficient sample size within each provider type. The category: "other" includes methadone, meperidine, or propoxyphene-related visits. We further added the visits with fentanyl to "other" when performing subgroup analyses with opioids prescribed at ED discharge due to the same reason.

Pain-related diagnoses were identified using the International Classification of Diseases, 9th revision, Clinical Modification (ICD-9-CM). We classified the diagnoses into the following categories using the algorithm adapted from a previous study [1]: back pain, headache, abdominal pain, neck pain, chest pain, cholelithiasis, nephrolithiasis, pelvic pain, dental/jaw pain, fractures, non-fracture injuries (such as sprains and strains, or concussion), arthritis/joint pain, sickle cell anemia, and cancer-related pain. Due to too few visits in each provider type category, we combined back and neck pain into one group "back/neck pain" and nephrolithiasis, cholelithiasis, sickle cell anemia, and cancer-related pain into one group, "other".

2.3. Statistical analysis

SAS 9.4 statistical software was used for all analyses and accounted for weighting, clustering, and stratification to derive national estimates. Visit served as the unit of analysis. First, we estimated the weighted proportion of visits by provider type for all three survey periods (2005–2008, 2009–2012, and 2013–2015) and calculated absolute and relative percentage differences between 2005–2008 and 2013–2015 with the earlier period as a reference. Then, we stratified the visits by age group. Using multivariate multinomial logistic regression models, 1) the odds of visits treated by APPs only in 2013–2015 were estimated compared to those in 2005–2008 and 2) similarly the odds of visits treated by APPs/physicians were estimated. These models were adjusted for patient age, gender, race/ethnicity, payment type, and US census region. In these analytical models, provider type was the dependent variable (physician-only served as the reference group) and the survey year was an independent variable with the earliest period (2005–2008) serving as the reference group.

When comparing patient demographic and clinical characteristics, opioid prescribing practice, and pain-related diagnosis by physician, APP (NP-only and PA-only), and APP/physician, we combined all survey year data from 2005 to 2015 into one. The weighted proportion of each characteristic was compared among visits seen by physician, NP, PA, and APP/physician. The number and the weighted proportion of the opioid prescription-related visits by provider type were assessed for each type of opioid and for each type of pain-related diagnosis. We further conducted the subgroup analysis only including visits involving opioid prescriptions at ED discharge to compare the frequency and proportion of type of opioids by NP, PA, physician, and APP/physician.

3. Results

3.1. Trends in opioid prescription-related ED visits by provider type

During 2005–2015, opioids were prescribed in 24% of all ED visits (estimated to be 337,231,230 visits nationally) with 25.7% in 2005–2008, 23.8% in 2009–2012, and 24.3% in 2013–2015. An assessment of trends in opioid prescription-related ED visits revealed that the proportion of the visits seen by APP increased from 2005–2008 to 2013–2015 (for NP by 116.7% ↑, for PA by 15.5% ↑, and for APP/physician by 61.2% ↑), while the proportion of the visits by physician decreased (8.4% ↓) (Table 1).

Table 2 provides data on the patient age group among those prescribed opioids in the ED by provider type over time. Increases were the most substantial among patients aged 65 and older being treated by APP/physician (adjusted odds ratio [AOR] = 2.35, 95% confidence interval [CI] = 1.69, 3.25). The visits with those aged 18–64 years served by APP or APP/physician also increased, while there was no significant increase among patients aged 0–17 years served by APP or APP/physician, compared to the visits served by physician. Overall, the odds of an opioid prescription-related visit served by APP and by APP/physician were both higher than the odds of the physician-only-served visits over the same time period (APP: AOR = 1.59, 95% CI = 1.10–2.33; APP/physician: AOR = 1.02, 95% CI = 1.36–2.38).

3.2. Patient and clinical characteristics of ED visits with opioid prescriptions by provider type

There was variation in patient and clinical characteristics of the visits where an opioid was prescribed (Table 3). Compared to patients treated by physician, NPs and PAs treated patients aged 18–64 years and black more frequently. In the Northeast, the opioid prescription-related visits provided by PA were proportional more than by physician (18.8% vs 12.4%). On the other hand, the opioid prescription-related visits provided by NP were significantly less frequent in the West region of the US (18.8% vs 23.4%) and slightly more in the rest of the US regions compared to physician counterparts. DEA Schedule III opioids were more commonly prescribed in visits provided by NP or PA than in physician-provided visits (NP = 63.1%; PA = 58.2%; physician = 44.7%). NPs and PAs also prescribed the medications at discharge more frequently than administered them in EDs (NP = 51.6%; PA = 52.6%; physician = 39.6%).

3.3. Opioid prescribing practice by provider type

Nearly 90% of all ED visits where an opioid was prescribed involved three types of opioids: hydrocodone (47.6%), hydromorphone (21.0%) and morphine (21.3%) (Table 4). Not surprisingly, the provider type in the majority of opioid prescription-related visits was physician (83%), followed by APP/physician (11.0%), PA (4.1%), and NP (1.9%). Compared to physician-visits, PA-visits were significantly more involved in codeine (22.1% vs physician = 15.8%), whereas NPs prescribed hydrocodone (63.2% vs physician = 46.6%) more frequently (Table 4). Both NP and PA providers had significantly fewer visits involving hydromorphone (NP = 10.6%, PA = 12.9% vs physician = 21.6%), morphine (NP = 9.7%, PA = 10.1% vs physician = 22.2%), and fentanyl (NP = 2.4%, PA = 1.0% vs physician = 3.0%) than physician providers. No significant difference was observed in oxycodone prescription-related visits by provider type (Table 4). This practice difference between APP and physician providers remained unchanged after excluding the visits with opioids administered in EDs, although the differences of both codeine and hydrocodone prescription-related visits by provider type were no longer significant (Fig. 1).

The most common pain-related conditions seen in the ED visits where an opioid was prescribed were “injuries excluding fracture” (20.5%), followed by abdominal pain (12.3%), back/neck pain (9.4%), fracture (8.2%), pelvic pain (5.6%), headache (5.0%), chest pain (4.2%), dental pain (4.1%), and joint pain (1.4%) (data not shown). As shown in Fig. 2, comparison of the distribution of pain-related diagnoses by provider type revealed that the distribution of diagnoses treated by NP was similar to that of PA, except PA providers treated back/neck pain-related conditions more frequently than NP and physician providers (NP = 9.3%, PA = 11.9%, physician = 8.5%). On the other hand, the types of pain-related diagnoses from the visits seen by APP/physician were very similar to those from the visits seen by physician. Both NP and PA saw dental pain (NP = 9.6%. PA = 9.1% vs physician = 3.6%) and injury related pain (NP = 27.9%, PA = 29.0% vs physician = 19.7%) more frequently, whereas physicians treated more chest pain (NP = 1.1%, PA = 1.6% vs physician = 4.4%), abdominal pain (NP = 6.5%, PA = 6.7% vs physician = 12.9%), and other conditions (cancer-related pain, sickle cell anemia, nephrolithiasis, and cholelithiasis) (NP = 2.1%, PA = 2.5%, physician = 6.3%).

4. Discussion

During 2005–2015, the number of the opioid prescription-related visits in EDs remained stable, however there was substantial growth in the number of ED visits where an APP provided the opioid prescription. This trend was particularly evident in opioid prescription-related visits served by NP who independently work without physician involvement. Factors that presumably have affected this trend are the growth of APPs employed in EDs [8] or their expanded scope of practice in the US [10,19] that may have led to the increased number of opioid prescriptions written per APP. Between 2005 and 2015, several states changed their regulations to allow NPs to independently prescribe any type of medication without physician involvement in order to accommodate increasing healthcare demands since the enactment of the Affordable Care Act [10,19]. We observed the same trend in a previous study with Medicare beneficiaries that reported an increase in opioid prescribing by NP and PA in 2006–2012 [20]. On the other hand, a

Table 1
Trends in opioid prescription-related visits by provider type in emergency departments in 2005–2015 (NHAMCS, ED[a] 2005–2015).

	2005–2008 (ref)		2009–2012		2013–2015		Absolute difference, %*	Relative difference, %*
	n	wt%	n	wt%	n	wt%		
Physician	28,081	86.60	25,641	82.16	10,987	79.34	−7.26	−8.38
APP[b]								
NP[c]	424	1.36	577	1.71	380	2.94	1.58	116.65
PA[d]	1063	3.71	1338	4.36	540	4.28	0.57	15.46
APP/physician[e]	2594	8.33	3544	11.77	2044	13.44	5.10	61.20

[a] National Hospital Ambulatory Care Survey, Emergency Department.
[b] APP is advanced practice provider including nurse practitioner and physician assistant.
[c] Nurse practitioner.
[d] Physician assistant.
[e] APP/physician indicates visits provided by both APP and physician.
* The proportion of the visits in 2013–2015 was compared to the proportion of the visits in 2005–2008 to calculate absolute and relative differences.

Table 2
Trends in opioid prescription-related visits by provider type in emergency departments according to patient age group from 2005 to 2015 (NHAMCS, ED 2005–2015[a]).

	2005–2008 (ref)		2009–2012		2013–2015		AOR[b]	95% CI*
	n	wt%	n	wt%	n	wt%		
Total								
Physician	28,081	86.60	25,641	82.16	10,987	79.34	1.00	
APP[c]	1487	5.07	1915	6.07	920	7.22	1.59	(1.10, 2.33)
APP/physician[d]	2594	8.33	3544	11.77	2044	13.44	1.80	(1.36, 2.38)
Patient age 0–17 years								
Physician	2082	86.49	1641	81.49	629	83.07	1.00	
APP	115	5.37	113	5.46	45	5.98	1.12	(0.60, 2.10)
APP/physician	200	8.14	236	13.05	108	10.95	1.46	(0.93, 2.27)
Patient age 18–64 years								
Physician	22,462	85.95	20,619	81.41	8608	78.34	1.00	
APP	1272	5.39	1670	6.51	797	7.94	1.67	(1.14, 2.45)
APP/physician	2143	8.66	2929	12.08	1667	13.72	1.77	(1.33, 2.37)
Patient age 65 and older								
Physician	3537	91.03	3381	87.41	1750	83.52	1.00	
APP	100	2.71	132	3.54	78	3.70	1.56	(0.89, 2.75)
APP/physician	251	6.26	379	9.04	269	12.77	2.35	(1.69, 3.25)

[a] National Hospital Ambulatory Care Survey, Emergency Department.
[b] AOR is odds ratio adjusted for patient age, sex, race/ethnicity, payment type, and region to assess the temporal change in the latest period (2013–2015) compared to the earliest period (2005–2008).
[c] APP is advanced practice provider including nurse practitioner and physician assistant.
[d] APP/physician indicates visits provided by both APP and physician.
* Significant if 95 % confidence interval does not cross 1.

study using IMS Health's National Prescription Audit (NPA) data reported that the APP prescribing rate dropped after 2010, whereas opioids prescribed by specialty doctors had a steady increase over the same period [11].

As opioid prescription-related ED visits seen by APP increase, it is prudent to examine if APPs follow the national opioid prescribing standard guidelines [21] to limit the quantity of unnecessary prescriptions. Unfortunately, we were unable to answer this question in our current

Table 3
Characteristics of opioid prescription-related visits by provider type in emergency departments in 2005–2015 (NHAMCS ED 2005–2015[a]).

	Physician		APP[b]				APP/physician[e]		P-value
			NP[c]		PA[d]				
	n	wt%	n	wt%	n	wt%	n	wt%	
Patient characteristics									
Age									<0.001
0–17 years	4352	6.63	87	7.12	186	5.55	544	6.38	
18–64 years	51,689	79.91	1211	86.9	2528	86.92	6739	82.93	
65 and over	8668	13.46	83	5.98	227	7.53	899	10.69	
Gender									0.004
Female	37,015	57.89	755	56.13	1612	54.27	4597	56.29	
Male	27,694	42.11	626	43.87	1329	45.73	3585	43.71	
Race/ethnicity									<0.001
White	49,652	77.24	1043	74.51	2265	73.98	6130	74.23	
Black	12,548	19.49	300	23.18	582	23.07	1821	23.45	
Other	2509	3.27	38	2.31	94	2.95	231	2.33	
Payment type									0.004
Private insurance	22,374	34.07	427	30.22	937	35.09	2665	32.64	
Medicaid/Medicare	24,462	37.87	470	33.69	1088	35.29	3155	37.52	
Other[f]	17,873	28.06	484	36.1	916	29.63	2362	29.85	
Region									0.013
Northeast	9828	12.38	258	13.49	724	18.79	1642	16.24	
Midwest	14,769	23.09	349	25.5	669	21.94	2279	27.62	
South	25,250	41.11	538	42.19	953	38.85	2895	40.21	
West	14,862	23.42	236	18.82	595	20.42	1366	15.93	
Clinical characteristics									
DEA controlled substance schedule									<0.001
Schedule II	30,987	52.06	354	32.14	909	37.66	3675	48.99	
Schedule III	26,396	44.71	751	63.14	1580	58.15	3439	48.4	
Schedule IV or V	2038	3.23	42	4.72	105	4.18	206	2.61	
Time opioid was given									<0.001
Administered in ED	31,173	48.79	419	32.09	877	31.39	3816	46.57	
Prescribed at discharge	25,376	39.61	734	51.61	1557	52.64	3193	38.86	
Both administered in ED and prescribed at discharge	7382	11.6	221	16.3	478	15.97	1111	14.57	

[a] National Hospital Ambulatory Care Survey, Emergency Department.
[b] Advanced practice provider.
[c] Nurse practitioner.
[d] Physician assistant.
[e] Both APP and physician.
[f] Includes self-pay and charity.

Table 4
Opioid prescription-related visits (both administered in ED and prescribed at discharge) by provider type according to type of opioids in emergency departments (NHAMCS ED 2005–2015[a]).

	Total		Physician		NP[b]		PA[c]		APP/physician[d]		P-value[f]
	N	%	N	%	N	%	N	%	N	%	
Total visits with opioid prescribing[*]	77,213	100.00	64,709	83.00	1381	1.90	2941	4.11	8182	11.00	
Codeine	13,389	16.10	11,016	15.79	256	14.95	613	22.11	1504	16.43	<0.001
Hydrocodone	36,272	47.57	29,765	46.55	871	63.17	1736	57.20	3900	48.94	<0.001
Hydromorphone	14,117	20.97	12,287	21.59	112	10.64	299	12.86	1419	21.00	<0.001
Morphine	16,256	21.28	14,048	22.21	135	9.72	322	10.06	1751	20.46	<0.001
Oxycodone	7060	9.16	5996	9.29	96	7.27	219	8.29	749	8.87	0.475
Fentanyl	2257	3.04	2027	3.26	30	2.35	27	1.04	173	2.25	0.004
Other[e]	2911	3.40	2480	3.43	46	3.72	124	4.11	261	2.78	0.961

[a] National Hospital Ambulatory Care Survey, Emergency Department.
[b] Nurse practitioner.
[c] Physician assistant.
[d] APP/physician indicates visits provided by both advanced practice provider (NP or PA) and physician.
[e] Includes meperidine, propoxyphene, and methadone; the visits with each opioid are not mutually exclusive and may have been counted more than one time.
[f] Significant if $p < 0.05$.
[*] Column percent described the proportion of the visits with 6 types of opioid prescriptions; raw percent described the proportion of the total visits with all opioid prescriptions.

study, because the NHAMCS data does not capture the volume or dosage of medications prescribed per provider. Given that EDs are perceived as high risk contributors to the prescription opioid epidemic [22,23], our findings emphasize the need for further investigation on opioid prescribing practices of APPs in EDs by dosage and duration of opioid therapy compared to national or emergency practice guidelines (e.g., CDC guideline for opioid prescribing for chronic pain [21] and the emergency department opioid prescribing guidelines in Washington and New York [24,25]).

There are national recommendations that APP educational programs increase an opioid prescribing content. For example, in 2016, >200 American Association of Colleges of Nursing member schools pledged to educate their nursing students on the CDC Guideline for Prescribing Opioids for Chronic Pain [26]. Consistent with these recommendations, our findings highlight the need of enhanced educational curriculum and continuing education targeting pain management and opioid prescribing for APPs working in EDs, so they are equipped for adequate and safe opioid prescribing.

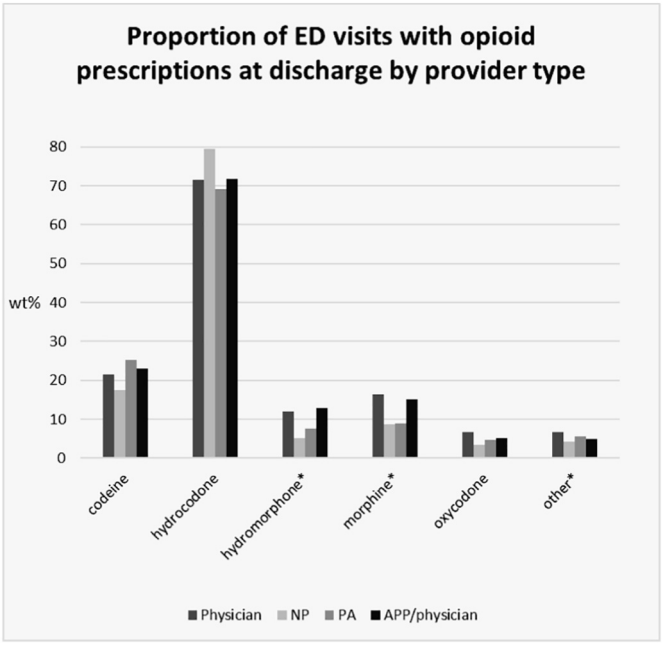

Fig. 1. Proportion of visits with opioids prescribed at ED discharge by provider type (NHAMCS ED 2005–2015[a]). [a]National Hospital Ambulatory Care Survey, Emergency Department; *$p < 0.05$; other category includes meperidine, propoxyphene, and methadone.

Interprofessional care collaboration in EDs is essential for the effective and efficient care delivery, particularly when dealing with complex healthcare needs often found in older adults in the ED [27]. We found increasing opioid prescription-related visits seen by both APP and physician among older adults during the study period. Interestingly, APPs working alongside with physicians served very similar patients conditions for opioid prescribing compared to the patient group served by physician providers. This finding could be interpreted as either APP/physician teams acting as physician only teams or physician's influence on an individual APP's prescribing practice.

The characteristics of opioid prescription-related ED visits significantly differed by provider type. APPs more frequently served African-American patients and those whose primary payer type were self-pay or charity compared to physician providers, which reflects the characteristics of overall ED populations served by APP [8]. Consistent with previous findings [28], a greater proportion of the NP-served visits was from the southern region, whereas the PA-served visits were proportionally greater in the northeast and midwest regions than physician-served visits.

In visits involving APPs, opioids were more likely to be prescribed at discharge rather than administered in the ED. This is probably because the types of the opioids prescribed by APP were mostly for oral-administration such as hydrocodone or codeine, whereas physicians dealt with a higher proportion of opioids (e.g., morphine or hydromorphone) that are typically administered in EDs through intravenous or intramuscular injection. The most prescribed type of opioids at ED discharge (Fig. 1) was hydrocodone, which was more frequently prescribed by NP than other provider types, although the difference was not statistically significant. It is expected that this pattern is likely to change in the near future with the recent change in DEA regulation in which hydrocodone was rescheduled from a schedule III to a schedule II controlled substance.

It appears that APPs and physicians in EDs served different patient conditions treated with opioid prescriptions. More specifically, APPs were involved in the opioid prescription-related visits for dental or injury-related pain significantly more than physician providers. On the other hand, a higher proportion of physician-involved visits were for abdominal, chest, and cancer-related pain, which requires more complex clinical judgement and patients tend to have multiple comorbid conditions in addition to the pain. A previous study examining factors associated with opioid prescriptions for dental diagnoses reported that patients with dental diagnoses were more likely to receive opioids by ED providers, particularly NPs, than by dentists [29], which was similar to our findings. Dental pain can be acute, abrupt, and intense, often

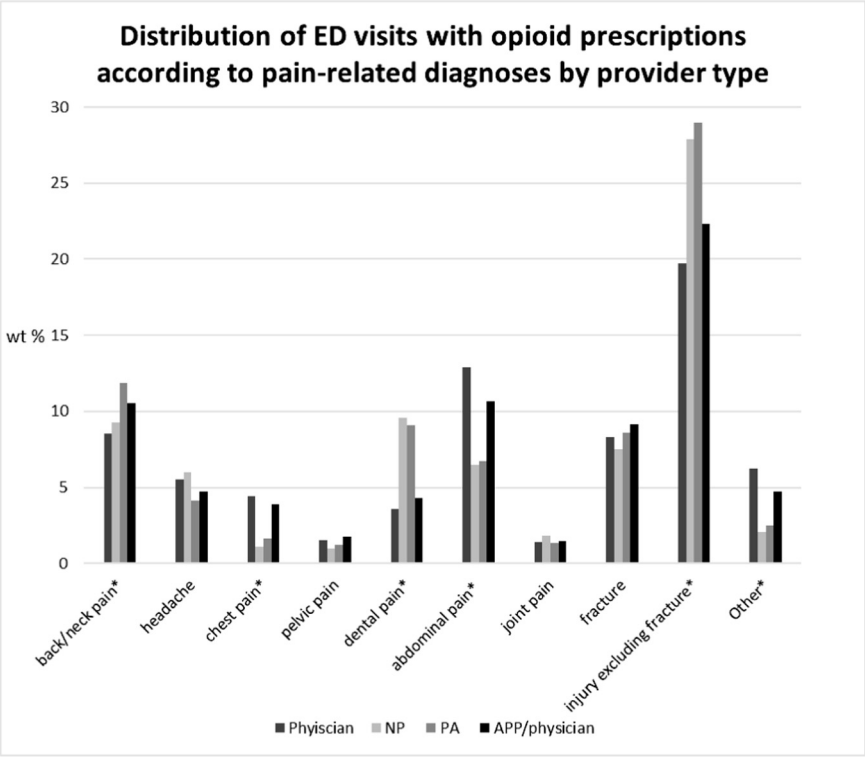

Fig. 2. Proportion of opioid prescribing visits in ED by pain related diagnosis according to provider type (NHAMCS ED 2005–2015[a]). [a]National Hospital Ambulatory Care Survey, Emergency Department; *$p < 0.05$; Other category includes cancer-related pain, cholelithiasis, nephrolithiasis, and sickle cell anemia.

forcing patients to seek opioid pain relief within the EDs, yet ED providers who are not specialized in dental care may find it difficult to identify a definitive diagnosis to treat the cause of pain. A training program specifically targeting newly hired NPs in EDs can focus more on the assessment of dental or injury related pain and an effective and comprehensive pain management plan, while minimizing opioid dependence risk.

5. Limitations

Potential limitations should be acknowledged when interpreting the study findings. Since NHAMCS sampled visits, rather than individuals, some patient duplication may have occurred. Second, there were some changes in the mode of data collection and medication coding over the study period. Between 2005 and 2011, the NHAMCS survey was collected using a paper format with only eight medications recorded per visit. The number of medications recorded was increased to ten since 2012, using the electronic format. There is no specific order in which medications were recorded into the form, thus some opioid medications prescribed prior to 2012 may have not been counted in our study. In order to minimize the changes in the mode and format of NHAMCS data over the study period, we set a total number of opioid prescription-related visits in each survey period as a denominator when calculating the proportion of the opioid prescribing visits by provider type during the same survey period. Despite the above limitations, our findings provide a valuable insight into the national perspective of opioid prescribing practice of APPs compared to physicians employed in EDs. Use of the NHAMCS ED data adding recent years is the greatest strength of this study, because, to our knowledge, this is one of the few databases in which recent trends in the practices of NPs and PAs can be examined separately. This allowed us to compare the opioid prescribing practice among three different types of providers. The NAMHCS data are also known to have high accuracy in the linkage of clinician-reported diagnosis to the prescribed medication data [17].

6. Conclusion

Our study finding highlights the expanded involvement of APPs prescribing opioids in emergency departments. Since physician shortages in EDs are expected to continue [5], opioid prescribing of APPs in EDs are likely to continue to increase. The findings from our study, paired with further research regarding the appropriate prescribing and monitoring of opioids, may help continuing education and training programs better target areas of emphasis. Ultimately, it will foster safer and more appropriate exposure to opioids in patients receiving services in EDs.

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Disclosures

None to declare.

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