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Title
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Permalink
https://escholarship.org/uc/item/5r21914r

Journal
Pediatrics, 133(5)

ISSN
0031-4005

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Publication Date
2014-05-01

DOI
10.1542/peds.2013-3171

Peer reviewed

National Patterns of Codeine Prescriptions for Children in the Emergency Department

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WHAT'S KNOWN ON THIS SUBJECT: Owing to genetic variability in its metabolism, codeine can lead to fatal toxicity or inadequate treatment in pediatric subpopulations and several guidelines have recommended against its use in children. Little is known about codeine prescribing for children in the United States.

WHAT THIS STUDY ADDS: There has been a small decline in pediatric codeine prescriptions overall in emergency departments, but no change in prescription for children who have cough or upper respiratory infection, despite professional recommendations against this practice. Substantial numbers of children are being prescribed codeine annually.

abstract

BACKGROUND AND OBJECTIVES: National guidelines have recommended against codeine use in children, but little is known about prescribing patterns in the United States. Our objectives were to assess changes over time in pediatric codeine prescription rates in emergency departments nationally and to determine factors associated with codeine prescription.

METHODS: We performed a serial cross-sectional analysis (2001–2010) of emergency department visits for patients ages 3 to 17 years in the nationally representative National Hospital Ambulatory Medical Care Survey. We determined survey-weighted annual rates of codeine prescriptions and tested for linear trends over time. We used multivariate logistic regression to identify characteristics associated with codeine prescription and interrupted time-series analysis to assess changes in prescriptions for upper respiratory infection (URI) or cough associated with two 2006 national guidelines recommending against its use for these indications.

RESULTS: The proportion of visits (N = 189 million) with codeine prescription decreased from 3.7% to 2.9% during the study period (P = .008). Odds of codeine prescription were higher for children ages 8 to 12 years (odds ratio [OR], 1.42; 95% confidence interval [1.21–1.67]) and among providers outside the northeast. Odds were lower for children who were non-Hispanic black (OR, 0.67 [0.56–0.8]) or with Medicaid (OR, 0.84 [0.71–0.98]). The 2006 guidelines were not associated with a decline in codeine prescriptions for cough or URI visits.

CONCLUSIONS: Although there was a small decline in codeine prescription over 10 years, use for cough or URI did not decline after national guidelines recommending against its use. More effective interventions are needed to prevent codeine prescription to children. *Pediatrics* 2014;133:e1139–e1147

Over the past decade, serious safety concerns have been raised about codeine use in children because of genetic variability in its metabolism.[1] Codeine is a pro-drug that is metabolized to its active metabolite, morphine, by cytochrome P450 CYP2D6. However, children who are poor metabolizers (up to one-third of the population)[2] convert very little codeine, leading to inadequate symptom relief.[3] More concerning, ultra-rapid metabolizers convert 5 to 30 times more than is typical, which can lead to fatal toxicity.[1] Case reports describe over a dozen fatalities associated with standard doses of codeine in ultra-rapid metabolizers,[4] and the ethnic subpopulation prevalence of this phenotype ranges from 2% to 40%.[1]

Because of the unreliable effect of the drug and its associated risk for death, national and international guidelines have recommended against codeine use in children for both of its common indications, analgesia and cough suppression. Professional guidelines from the American Academy of Pediatrics (AAP) issued in 1997 and reaffirmed in 2006 warn about codeine's potential dangers and lack of documented efficacy in children who have cough or upper respiratory infection (URI).[5,6] The American College of Chest Physicians' (ACCP) guideline on treatment of pediatric cough in 2006 also recommends against codeine.[7] In 2012, the World Health Organization removed codeine from its analgesic ladder[8] and the Food and Drug Administration issued a black box alert against postoperative use after pediatric tonsillectomy and/or adenoidectomy for obstructive sleep apnea.[9] In June 2013, the Canadian Ministry of Health and the European Medicines Agency restricted codeine use to only those aged over 12 years.[10,11]

It is unclear whether insights into the dangers of codeine and the guidelines recommending against its use in children have impacted provider practice in the emergency department, where the top 2 reasons for pediatric visits are injuries and respiratory illness.[12] Two recent studies found that codeine was the second most widely used opioid drug in medical practice worldwide[13] and the most commonly prescribed opioid to children in Europe.[14] However, there are no studies to our knowledge characterizing codeine prescribing patterns for the >25 million annual emergency department pediatric visits[12] in the United States.

We address this knowledge gap by estimating the frequency of codeine prescriptions to children during emergency department visits in the United States, assessing for changes over time in prescriptions for all children, and for the subpopulation of children who have injuries. We also examine changes in prescriptions for patients who have cough or URI, assessing whether there was a change in provider behavior associated with the 2006 AAP and ACCP guidelines warning about its use for these indications.

METHODS

Data Source and Study Design

In this serial cross-sectional analysis, we used the National Hospital and Ambulatory Medical Care Survey (NHAMCS) database. The National Center for Health Statistics administers the NHAMCS annually at a nationally representative sample of visits to hospital outpatient departments and emergency departments (see Appendix 1 for sampling design). For each visit sampled, a survey instrument is used onsite to collect patient demographics, discharge diagnoses (using codes from the International Classification of Diseases, 9th Revision, Clinical Modification [ICD-9-CM]), medications prescribed, types of providers seen, and facility characteristics. We analyzed emergency

department visits and excluded visits to hospital outpatient departments.

Study Population

The study population included all sampled visits for patients aged 3 to 17 years to emergency departments in the United States between 2001 and 2010, the 10 most recent years available in NHAMCS. We excluded children younger than 3 years because this is the minimum age at which codeine products are authorized for use in the United States.[1]

We performed a subgroup analysis of visits with injuries; these visits were identified as having a diagnosis of injury based on the ICD-9-CM Tabular Index code grouping for injury, including codes between 800 and 957.9.[15] We did not use the NHAMCS survey item inquiring about injury because it defines a broader group of visits, including injuries, poisonings, and adverse effects of medical treatments.

We also performed a subgroup analysis of visits with cough or URI as the primary diagnosis, using the Agency for Healthcare Research and Quality Clinical Classifications Software (CCS) to define this subpopulation. CCS groupings are clinically meaningful diagnostic categories using ICD-9-CM codes.[16] The CCS groupings used to define URI and cough were 8.1.2, 8.1.4, 8.1.5, 8.2.4, 8.3, 8.9, 79.99, and 786.2.

Analysis

Rates of Codeine and Opioid Prescriptions

Our primary outcomes were the number and percent of all pediatric emergency department visits with codeine prescription annually during the study period. Per NHAMCS definition of medication prescription, codeine prescription was defined by the physician recording on the survey that a codeine product had been administered during the visit or prescribed at discharge. Data were analyzed at the visit level, and

any number of codeine prescriptions during a visit led to that single visit being counted as a codeine visit. We used the Ambulatory Care Drug Database System tool from NHAMCS[17] to define drugs containing codeine and drugs containing opioids (Appendix 2).

Using survey weights, we estimated the number and frequency of codeine prescriptions annually in all visits, in visits with diagnoses of injuries, and in visits with diagnosis of cough or URI. We used logistic regression in a simple model of codeine prescription for each group of visits with study year as a predictor to assess whether there was a linear trend over time in the proportion of visits with codeine prescription. In addition, to further understand the relationship between age group and codeine prescription, we performed a stratified analysis assessing, for each age group, linear changes over time in annual codeine prescriptions in all visit types.

To assess whether changes in the overall use of opioid medications might explain changes observed in codeine prescription, we (1) estimated the annual frequency of opioid prescriptions in all visits and assessed for a linear trend over time and, in a sensitivity analysis, (2) included opioid prescription in the logistic regression model for codeine prescription for all visits, hypothesizing that any year effect in the model would be diminished if changes in opioid prescribing trends explained changes observed in codeine prescription.

Predictors of Codeine Prescription

We used multivariable logistic regression to assess whether characteristics of patients or providers were associated with codeine prescription in all visits and, separately, in visits for URI/cough. Patient characteristics included age, gender, race, and payment source. Provider characteristics included

geographic region, type of provider (physician, resident, nurse practitioner, or "other" [unlicensed and missing or unknown provider types]), and Metropolitan Statistical Area status (urban vs rural). χ^2 testing was used to determine which variables were nominally ($P < .2$) associated with codeine prescription. Variables nominally associated with codeine prescription were included in the multivariable model.[18] We also included a variable for study year to adjust for changes over time.

We performed a sensitivity analysis to assess whether racial associations with codeine prescriptions might reflect prescribing patterns of any opioid. For the analysis, we used the same covariates from the multivariable logistic model of codeine prescriptions to assess patient and provider characteristics associated with any opioid prescription.

Impact of National Guidelines Recommending Against Codeine Use in URI and Cough

We performed a subgroup analysis of codeine prescriptions in visits with a diagnosis of URI or cough. To examine the impact of the 2006 AAP guideline reaffirmation and ACCP guideline discouraging the use of codeine for these indications, we performed an interrupted time-series analysis comparing prescribing trends in the interval up to 2007 and the interval from 2007 to 2010.

The interrupted time-series approach uses the multivariable model adjusting for patient and provider characteristics and assesses the effects of the guidelines in the following measures: (1) the change in the rate of prescription at the time of release of the guidelines, or immediate effects; (2) the change in secular trend comparing the secular trend before the intervention to the secular trend after the guidelines, reflecting cumulative intervention effects; and (3) the net effect of the guidelines,

estimated as the adjusted difference between the fitted mean at the end of the post-intervention period and the expected mean if the pre-intervention trend had continued without change.[19]

Non-Codeine Management in URI and Injury Visits

Lastly, we analyzed the populations of children who had injury, and separately, URI/cough, excluding those who received codeine and generated a list of all medications prescribed.

All analyses were done using Stata 12 (StataCorp LP, College Station, TX). Statistical significance was determined at $P < .05$.

RESULTS

Changes in Codeine Prescriptions

During the study period from 2001 to 2010, there were 56 375 emergency department visits by children ages 3 to 17 years sampled in the NHAMCS. When survey weights were applied, the sample represented 189 028 628 total emergency department visits. All remaining results represent survey-weighted analyses. The rate of codeine prescription decreased from 3.7% to 2.9% of visits from the start to the end of the study period ($P = .008$ for linear test of trend). The number of visits with a codeine prescription ranged from 558 805 to 876 729 per year. There was no statistically significant change in codeine prescription for injury visits during the study period ($P = .70$), with the number of visits with codeine prescription ranging from 262 350 to 492 948 per year (Fig 1). When analyzing each age subgroup separately, we found that among 3- to 7-year-olds the rate of codeine prescription decreased from 3.8% to 3.0% during the study period ($P = .007$ for linear trend over time). There were small downward trends over time for 8- to 12-year-olds and for 13- to 17-year-
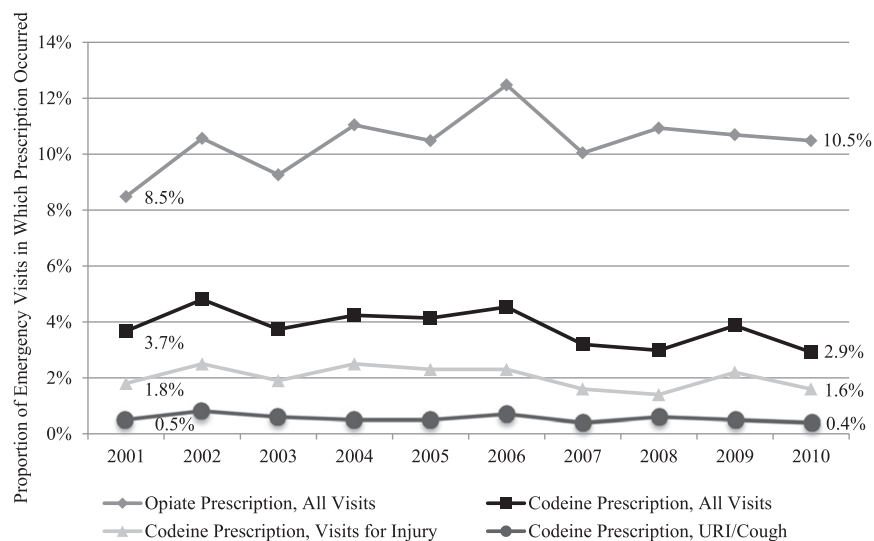
FIGURE 1
Frequency of codeine and opiate prescription during pediatric emergency department visits, 2001 to 2010. There was a statistically significant decline in frequency of codeine prescriptions for all visits ($P =$ .008). There was no statistically significant change in frequency of codeine prescriptions for injury visits ($P =$ .72) or URI/cough visits ($P =$ .28), or in opiate prescriptions for all visits ($P =$ .06).

olds, but they were not statistically significant.

We found no statistically significant change in the frequency of opioid prescriptions during the study interval ($P =$ .06 for linear trend). The percent of opiates prescribed to children containing codeine ranged from 27% to 45% per year during the study period (Fig 1). When we included opioid prescription into the logistic model of codeine prescription and year, the year effect was not attenuated (0.97 decreased odds of codeine prescription per year in model only including year, and 0.93 decreased odds of codeine prescription per year when the variable for any opioid was included).

Characteristics Associated With Codeine Prescription

Table 1 shows the patient and provider characteristics that were independently associated with codeine prescription. Codeine prescription was more likely among children ages 8 to 12 years (odds ratio [OR], 1.42; 95% confidence interval [1.21–1.67]) compared with children ages 3 to 7 years, and among

providers in regions outside the northeast (ORs midwest, 1.86 [1.51–2.29]; south, 1.85 [1.49–2.31]; west, 2.09 [1.64–2.68]). Codeine prescription was less likely in non-Hispanic black children (OR, 0.67 [0.56–0.80]) compared with non-Hispanic white children, and among children with Medicaid (OR, 0.84 [0.71–0.98]) compared with children who had private insurance. Providers in the category "Other" were less likely to prescribe codeine (OR, 0.30 [0.19–0.48]) compared with physicians. Among children who had URI/cough, codeine prescription was more likely among providers in the midwest (OR, 1.89 [1.15–3.09]) and west (OR, 3.00 [1.92–4.65]) (Appendix 3). In the sensitivity analysis assessing patient and provider characteristics associated with any opioid prescription, prescribing opioids was less likely in non-Hispanic black children (OR, 0.62 [0.54–0.70]) compared with non-Hispanic white children.

Changes in Codeine Prescriptions for URI or Cough

For the 37 352 264 emergency department visits ($n =$ 10 838 unweighted

visits) in which children ages 3 to 17 years were diagnosed with URI or cough, 1 042 740 (2.8%) were prescribed codeine, with the number ranging from 69 057 to 145 857 per year. In the interrupted time-series analysis, there was no statistically significant change in codeine prescription rate at the release of the 2006 guidelines ($P =$ .50) nor any change in the trend in the period after the guideline, relative to the preceding period ($P =$ .30). The prescription rate at the end of the study period did not statistically significantly differ from the rate predicted by pre-guidelines trend ($P =$ .21) (Fig 2).

Non-Codeine Management in URI and Injury Visits

Among visits for URI/cough without a codeine prescription, albuterol (12.7%), acetaminophen (12.4%), and ibuprofen (11.5%) were the most frequently prescribed medications, and 12.5% of visits had no medications prescribed. Among visits for injury without codeine prescription, ibuprofen (21.8%), acetaminophen (10.0%), and acetaminophen-hydrocodone (3.9%) were the most frequently prescribed, and 36.2% of visits had no medications prescribed.

DISCUSSION

This nationally representative serial cross-sectional analysis from 2001 to 2010 found a statistically significant decline in the prescription of codeine to children during emergency department visits in the United States. However, a substantial number of children are still being prescribed codeine, ranging from 558 805 to 876 729 prescriptions per year.

Changes in overall opioid prescribing did not explain the decline seen in codeine prescribing; we found no statistically significant change in the rate of opioid prescription and we did not observe an

TABLE 1 Patient and Provider Characteristics Associated with Codeine Prescription During Pediatric Emergency Department Visits

Characteristic	No. of Unweighted ED Visit Records With Codeine Rx ($N = 56\,375$)	Weighted Proportion of Visits With Codeine Rx, %	P (χ^2)	Adjusted OR (95% CI) for Codeine Rx[a]	P (Adjusted OR)
All visits with codeine Rx	2059	3.8	—	—	
Year	2059	3.8	.009	0.97 (0.95–0.99)	.026
Age group (y)					
3 to 7	657	3.3		Reference	
8 to 12	699	4.5	<.001	1.42 (1.21–1.67)	<.001
13 to 17	685	3.4		1.04 (0.87–1.24)	.69
Gender					
Male	980	3.7	.11	Reference	
Female	1079	3.6		1.07 (0.95–1.21)	.28
Race/ethnicity					
White, non-Hispanic	1256	4.3		Reference	
Black, non-Hispanic	331	2.6	<.001	0.67 (0.56–0.80)	<.001
Hispanic	328	3.2		0.83 (0.68–1.01)	.07
Other	63	3.0		0.88 (0.59–1.30)	.52
Payment source					
Private insurance	991	4.2		Reference	
Medicaid	751	3.4	<.001	0.84 (0.71–0.98)	.03
Other	53	4.2		0.86 (0.72–1.04)	.11
US census region					
Northeast	267	2.0		Reference	
Midwest	565	4.4	<.001	1.86 (1.50–2.29)	<.001
South	775	3.9		1.85 (1.49–2.31)	<.001
West	452	4.6		2.09 (1.63–2.68)	<.001
Type of provider					
Physician	1882	3.8		Reference	
Resident/trainee physician	28	2.6	<.001	0.69 (0.41–1.15)	.15
Nurse practitioner/physician assistant	119	3.9		1.06 (0.86–1.32)	.56
Other[b]	30	1.3		0.30 (0.19-0.48)	<.001
Metropolitan statistical area[c]					
Metropolitan	1725	3.6	.38	—[d]	
Nonmetropolitan	334	4.2		—[d]	

CI, 95% confidence interval; ED, emergency department; Rx, prescription.

[a] Logistic regression analysis using survey weights with the following variables included in the model: year, age, gender, race/ethnicity, payment source, US census region, and type of provider.

[b] "Other" providers included unlicensed and missing or unknown provider types.

[c] Metropolitan statistical area reflects whether a provider was practicing in an urban or non-urban setting.

[d] Metropolitan statistical area was not included in the multivariable model because this variable was not nominally associated with codeine prescription in χ^2 testing.

attenuation of the year effect on codeine prescription in our sensitivity analysis incorporating opioid prescription. We also examined the rate of codeine prescriptions to children who had injuries and found no statistically significant changes over the study interval.

We found several patient and provider characteristics predictive of codeine use, suggesting potential foci for interventions to decrease codeine prescribing. Children ages 8 to 12 years of age were more likely to receive codeine, and we found no statistically significant change in prescribing rates over time for this age group. We did, however, find a decline in codeine prescription rates to the youngest age

group (3–7 years), which is reassuring, as these children are at greatest risk for potential toxicity. We also found non-Hispanic black children were less likely to receive codeine. Consistent with prior literature,[20] these children were also less likely to be prescribed any opioid. Decreased prescribing of codeine in these children therefore may reflect general opioid prescribing avoidance rather than provider knowledge that poor codeine metabolizers are more common among non-Hispanic blacks.[21] The lower rates of codeine prescription in children who have Medicaid/SCHIP may reflect differences in provider prescribing patterns based on insurance status, but

additional data are needed to test that hypothesis.[22]

The lower rate of codeine prescription we observed in the northeast may be attributable to regional variability in provider practices, differences in training, or other regional factors. Other studies have demonstrated large, unexplained geographic variation in prescription of opioid pain medication to adults.[23] Further research assessing factors that drive regional variation in pediatric codeine prescription could inform interventions to decrease codeine prescription nationally. Our findings also suggest that trainees may be less likely to prescribe codeine compared with other physicians. However,
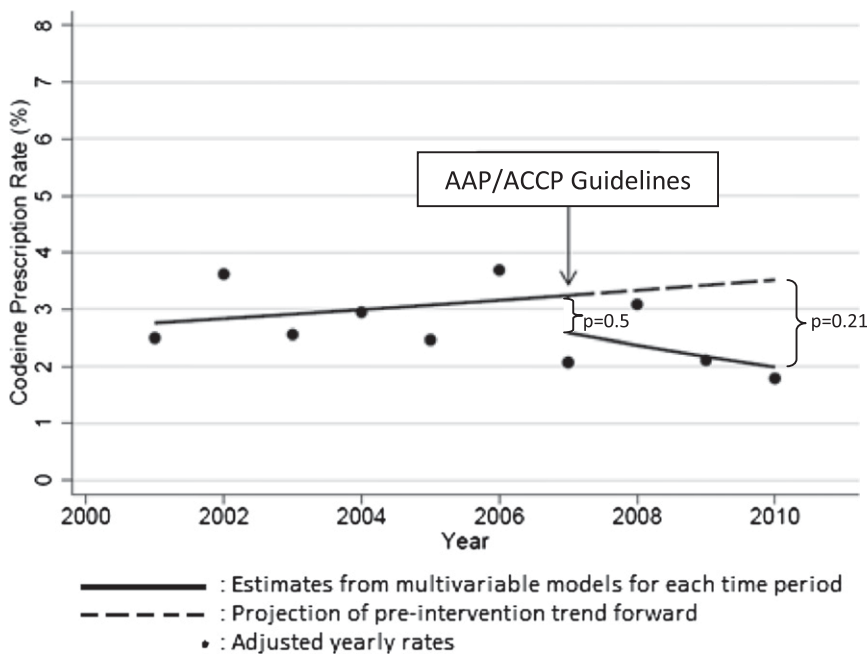
FIGURE 2
Adjusted codeine prescription rate for cough/URI before and after guidelines. There was no statistically significant change in codeine prescription rate at guidelines release (*P* = .50) and no significant difference between prescription rate in 2010 as compared to the rate predicted by pre-guideline trends (*P* = .21).

given the small sample size of trainees, this finding warrants further testing.

In our analysis of codeine prescription to children diagnosed with URI or cough, we found no changes in prescription patterns associated with the 2006 guidelines discouraging codeine use for these indications. A recent analysis of the AAP guideline on management of bronchiolitis showed statistically significant impacts on provider practice within 2 years of guideline release.[24] Our data cover 4 years beyond 2006, which suggests that our findings are attributable to lack of impact of the guidelines rather than a lag in effect. Notably, 3 published case reports of codeine-associated respiratory depression and death involved children who had respiratory infections.[4] Our analysis showed a substantial number of children being prescribed codeine for URI or cough, ranging from 69 057 to 145 857 per year. This suggests that cough and URI prescribing may be an important focus

for interventions to change provider behavior.

Given the yearly average number of codeine prescriptions in our study and the phenotypic variation in metabolism of codeine (8% ultra-metabolizers and 36% poor metabolizers in North America),[1,2] our findings indicate that each year up to 57 000 children of the ultra-metabolizer phenotype were at risk for developing toxic levels of codeine and up to 250 000 children of the poor metabolizer phenotype were at risk for low codeine levels leading to inadequate effect. For providers and policymakers seeking codeine alternatives, several studies have shown ibuprofen to have equal to superior efficacy compared with codeine products in treatment of pain for injury.[25–27] Hydrocodone has also demonstrated efficacy as an analgesic agent with good safety profile in children.[28] The 3.9% of injury visits with acetaminophen-hydrocodone prescriptions indicate that some providers are comfortable with

this alternative, suggesting switching from acetaminophen-codeine to acetaminophen-hydrocodone as a potential provider behavior change. With regard to cough suppression, data indicate that codeine-containing products have no benefit over placebo.[29] However, dark-honey–containing products show significant benefit in symptom relief and the AAP supports their use.[30–32]

Our finding that there was no change in codeine prescribing patterns associated with the 2006 guidelines is in line with previous work showing that practice guidelines have limited impact on provider behavior owing to many factors, including awareness, familiarity, agreement, and self-efficacy.[33] However, there have been examples of successful, low-cost initiatives to reduce use of harmful medications. A quality improvement initiative with resident physicians showed a statistically significant decrease in rate of codeine prescription from 13.5% to 5.4% with the introduction of a pocket-sized analgesic reference card.[34] Other interventions may include removal of codeine from hospital formularies or electronic medical record-based decision support for providers. A study by O'Conner et al found formulary restriction, supported by education and computerized order entry, effectively eliminated analgesic meperidine use at a tertiary-care hospital.[35] Our finding that there are few patient or provider characteristics associated with codeine use in URI/cough visits suggests that system-level interventions such as formulary changes may be more effective than interventions targeting particular groups of children or providers. Lastly, changing insurance plan reimbursement policies impact practice; several studies have documented reduced prescriptions with institution of drug-specific Prior Authorization Requirements.[36,37]

There are several limitations to our study. Previous to 2005, medication data collected by NHAMCS were for all medications ordered, supplied, administered, or continued, so a portion of the prescriptions captured may have represented those continued in the emergency department. However, given the majority of prescriptions were in the context of visits for acute conditions such as infections and injuries, this is unlikely to substantially impact our results. Secondly, NHAMCS data are based on provider report on a survey instrument; if codeine prescription was under- or over-reported, this would affect our results. Lastly, we had a relatively small sample size and number of visits with codeine prescription for our analysis of the AAP/ACCP guidelines. This may have affected our ability to detect a statistically significant change in prescribing patterns associated with the guidelines.

CONCLUSIONS

In this nationally representative study documenting rates of codeine prescription to children in the United States in the emergency department setting, we found that although there has been a decline in codeine prescription over the past 10 years, a large number of children are still being prescribed codeine yearly. In addition, substantial numbers of codeine prescriptions are being given to children who have cough or URI despite professional recommendations warning about this practice. More effective interventions are needed to prevent prescription of this potentially hazardous drug to children.

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APPENDIX

APPENDIX 1: NHAMCS SAMPLING DESIGN

The NHAMCS uses a 4-stage probability sampling design. The first stage samples geographically defined areas, the second stage samples hospitals within these areas, the third stage samples emergency and outpatient departments within these hospitals, and the fourth stage samples patient visits. The National Center for Health Statistics then provides a visit weight equal to the inverse probability of that visit being sampled; these weights allow for the generation of nationally representative estimates.

APPENDIX 2: METHODS FOR DEFINING AND IDENTIFYING DRUG LISTS

We used the Ambulatory Care Drug Database System tool from NHAMCS[17] to define drugs containing codeine and drugs containing opioids. First we used the tool to create a list of drugs containing codeine as an ingredient and included these in our definition of codeine-containing products. Then we separately defined opioid drugs by tabulating a list of all drugs in drug therapeutic category level one: 057 central nervous system agents, level two: 058 analgesics, level three: 060 narcotic analgesic agents. In 2006, NHAMCS changed the coding system for drugs from coding generic ingredients to using Multum drug characteristics. Per NHAMCS recommendations, to analyze pre-2006 drug data we mapped Multum drug characteristics to previous years using the DRUGID mapping program provided by the Centers for Disease Control and Prevention.[38]

In 2001 to 2002, NHAMCS had 6 medication fields, and in the rest of the study period there were 8. To avoid confusion between changes in prescription patterns associated with new survey methods rather than provider behavior, we restricted our data to only include medications from the first 6 medication fields throughout the study period.

APPENDIX 3 Patient and Provider Characteristics Associated With Codeine Prescription During Pediatric Emergency Department Visits for Cough or URI

Characteristic	No. of Unweighted ED Visit Records With Codeine Rx ($N = 56\,375$)	Weighted Proportion of Visits With Codeine Rx, %	$P (\chi^2)$	Adjusted OR (95% CI) for Codeine Rx[a]	P (Adjusted OR)
URI/cough visits with codeine Rx	315	2.8	—	—	
Year	315	2.8	.69	0.96 (0.91–1.01)	.125
Age group (y)					
3 to 7	129	2.4		Reference	
8 to 12	91	3.1	.10	1.28 (0.91–1.80)	.15
13 to 17	95	3.3		1.40 (0.99–1.97)	.052
Gender					
Male	170	3.0	.36	Reference	
Female	145	2.6		0.90 (0.67–1.20)	.47
Race/ethnicity					
White, non-Hispanic	172	3.1		Reference	
Black, non-Hispanic	57	2.0	.12	0.83 (0.58–1.18)	.29
Hispanic	63	3.1		1.04 (0.70–1.56)	.83
Other	11	3.0		0.93 (0.44–1.97)	.85
Payment source					
Private insurance	126	3.0		Reference	
Medicaid	154	2.8	.36	1.02 (0.73–1.42)	.90
Other	9	5.6		0.71 (0.38–1.32)	.28
US census region					
Northeast	37	1.8		Reference	
Midwest	91	3.3	<.001	1.87 (1.15–3.09)	.01
South	97	2.1		1.16 (0.73–1.86)	.53
West	90	5.1		3.00 (1.92–4.65)	<.0001
Type of provider					
Physician	292	2.8		Reference	
Resident/trainee physician	5	1.3	.54	0.35 (0.11–1.08)	.07
Nurse practitioner/physician assistant	13	2.8		1.00 (0.54–1.87)	.99
Other[b]	5	1.8		0.70 (0.21–2.32)	.56
Metropolitan statistical area[c]					
Metropolitan	261	2.8	.75	Reference	
Nonmetropolitan	54	2.9		1.13 (0.75–1.70)	.55

CI, 95% confidence interval; ED, emergency department; Rx, prescription.
[a] Logistic regression analysis using survey weights with the following variables included in the model: year, age, gender, race/ethnicity, payment source, US census region, and type of provider.
[b] "Other" providers included unlicensed and missing or unknown provider types.
[c] Metropolitan statistical area reflects whether a provider was practicing in an urban or non-urban setting.