Opioid-Related Hospitalization and Its Association With Chronic Diseases: Findings From the National Inpatient Sample, 2011–2015

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Objective

Patients with chronic conditions such as cancer, stroke, asthma, and obesity often experience chronic pain and have a higher likelihood of receiving one or more opioid prescriptions (1). In this study, we examined whether the prevalence of opioid-related hospitalization was associated with chronic diseases among inpatients. This study is the first to examine the prevalence of opioid-related hospitalization and chronic disease among patients admitted to community hospitals. Opioid-related inpatient stays (2) have increased, mainly due to opioid abuse, addiction, poisoning, and dependence, resulting from misuse of opioid pain relievers that are often originally prescribed (3) to treat chronic pain.

Methods

In this cross-sectional study, we analyzed data on patients aged 18 years or older from the National Inpatient Sample (NIS) from January 1, 2011, to September 30, 2015. Claims occurring from October through December of 2015 were not included because of the transition from the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) to the 10th revision (ICD-10-CM) coding system on October 1, 2015. We included arthritis, spinal disease, asthma, liver disease, stroke, cancer, and obesity because these diseases are most likely to be prescribed opioids in the internal and family medicine specialties. Family medicine (21.8%) and internal medicine (17.6%) reportedly write the most opioid prescriptions, followed by physical medicine/rehabilitation, anesthesiology/pain, hematology/oncology, and neurology (4–6). Relationships between asthma and opioid abuse and dependence (7) and between chronic liver disease and opioid use (8) have been established, as has a relationship between stroke and opioid abuse among young stroke patients (9). Cancer patients rely on opioid medications for relief from cancer pain (10). Obesity was included because of its significant association with chronic pain (11). Using the NIS sample, we identified 3,239,136 opioid-related hospitalization cases for from January 1, 2011, to September 30, 2015.

Abstract

Chronic disease and opioid-related hospitalizations in the United States are increasing. We analyzed nationally representative data on patients aged 18 years or older from the 2011–2015 National Inpatient Sample to assess the association between opioid-related hospitalization and chronic diseases. We found that most patients with opioid-related hospitalization were white, aged 35–54 years, in urban hospitals, and had 2 or more comorbid conditions. Patients with 2 or more chronic conditions accounted for more than 90% of opioid-related hospitalizations in all years. The results suggest a need for targeted interventions to prevent opioid misuse in patients with multiple chronic conditions.
We combined opioid dependence and unspecified use, adverse effects of opioids, opioid abuse, and opioid poisoning to create a single variable, opioid-related hospitalization (specific ICD-9-CM codes are available in Appendices A and B). The data were weighted by using sampling weights provided by the NIS Healthcare Cost and Utilization Project (12). For creating national estimates for the prevalence of opioid-related hospitalizations and all analyses, we implemented Stata’s trend weight (TRENDWT) for 2011 and discharge weight (DISCWT) from 2012 through 2015 (StataCorp LLC). Because of the redesign of NIS data in 2012, we used TRENDWT for 2011, which allowed the national estimates for trend analysis in 2011 to be consistent with data from 2012–2015. To use trend weight, we merged the trend weight file (www.hcup-us.ahrq.gov/db/nation/xis/trendwghts.jsp) into the original NIS 2011 data. We analyzed the trends in opioid-related hospitalizations by type of chronic disease for 2011–2015 and used the Pearson χ² test to test for significance. Significance was set at P < .05.

Results

The highest total number of opioid-related hospitalization cases was in 2014 (n = 704,670) (Table 1). From 2011 to 2015, the highest prevalence of opioid-related hospitalization was among patients aged 35–54 years (5-year average, 37%), followed by those aged 18–34 years. The percentages of men and women with opioid-related hospitalizations were approximately equal. The highest prevalence of opioid-related hospitalization was among white patients (5-year average, 72%), and the second-highest was among black patients (5-year average, 15%). The prevalence was higher in urban hospitals (5-year prevalence range, 58%–64%) than in rural hospitals (5-year prevalence range, 36%–42%). The prevalence was also higher among patients who used Medicaid and Medicare than among those who did not. The prevalence of opioid-related hospitalization was highest (94%) among patients with 2 or more comorbid conditions. In 2014 and 2015, as many as 95% of the patients hospitalized for opioid-related causes had 2 or more comorbid conditions.

The prevalence of opioid-related hospitalizations significantly increased among patients with cancer, stroke, obesity, asthma, liver disease, and arthritis across all years (Table 2). The most prevalent chronic disease significantly associated with opioid-related hospitalization was asthma, followed by obesity and liver disease. There was a significant association between opioid-related hospitalization and cancer, stroke, obesity, asthma, and liver disease every year of the study period, with the exception of cancer in 2013 and obesity in 2015. The association between arthritis and opioid-related hospitalizations was significant only in 2014 and 2015, and the association between spinal diseases and opioid-related hospitalizations was significant only in 2012 and 2015.

Discussion

We found that more than 90% of opioid-related hospitalizations were among patients with 2 or more chronic diseases and that the trend in opioid-related hospitalization among patients with chronic diseases is increasing. This finding is salient given that 1 in 4 US adults are living with 2 or more chronic diseases (13). Both the opioid crisis and rising rates of chronic disease have been described as epidemics; however, they are currently being treated separately. The US Department of Health and Human Services’ 5-point strategy to combat the opioid crisis focuses on the treatment of addiction, which is important for addressing the epidemic in the short term (14). A population-level approach to preventing and treating chronic diseases is also needed. Health services must address the 2 issues — opioid misuse and management of chronic disease — simultaneously.

Using alternative approaches to pain management is one public health strategy for addressing the opioid crisis (15) and is consistent with the Centers for Disease Control and Prevention’s (CDC’s) Guideline for Prescribing Opioids for Chronic Pain (16). Based on our findings, this approach may be particularly important in patients with multiple chronic diseases. Consistent with the CDC guideline, nonpharmacologic treatment including exercise therapy and cognitive behavioral therapy, as well as multimodal therapies combining exercise therapy with psychologically based approaches, should be used to decrease pain and improve functional ability (16). When opioids are used for pain management, patients with multiple chronic diseases may require close monitoring and additional education on risks of misuse.

This study has several limitations. Because we analyzed data from 2011 to 2015, our findings are not generalizable to more recent years. Our analysis was cross-sectional and examined the associations between opioid-related hospitalization and chronic diseases without controlling for covariates, which prevents us from drawing causal conclusions about the direction of the observed relationship. Furthermore, the nature of the data did not allow us to explore why the associations were not significant in some years. Opioid prescriptions for patients with arthritis have increased in recent years, so that could be an explanation for the strong correlation we found (17). Finally, we studied a small number of chronic diseases and did not assess any diseases related to mental health.

Despite these limitations, our findings show an increasing trend in opioid-related hospitalization among patients with chronic diseases and a high prevalence of opioid-related hospitalization among patients with multiple chronic conditions. The observed as-
sociation warrants further research to determine causal inference. Results from this study can help clinicians develop strategies to prevent opioid misuse in patients with multiple chronic conditions and inform strategies for addressing both the opioid epidemic and rising rates of chronic disease.

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### Table 1. Prevalence of Opioid-Related Hospitalizations Among Adults Aged 18 or Older, National Inpatient Sample, 2011–2015

| Characteristic | 2011 (n = 639,586) | 2012 (n = 655,520) | 2013 (n = 664,480) | 2014 (n = 704,670) | 2015 (n = 574,880) |
|---------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| **Age, y**    |                   |                   |                   |                   |                   |
| 18–34         | 29.35             | 30.30             | 30.37             | 29.98             | 29.22             |
| 35–54         | 39.51             | 38.23             | 37.07             | 36.29             | 35.97             |
| 55–64         | 15.86             | 16.50             | 17.06             | 17.60             | 18.37             |
| ≥65           | 15.29             | 14.97             | 15.50             | 16.12             | 16.44             |
| **Sex**       |                   |                   |                   |                   |                   |
| Male          | 49.73             | 49.34             | 49.02             | 49.15             | 49.63             |
| Female        | 50.27             | 50.66             | 50.98             | 50.85             | 50.37             |
| **Race/ethnicity** |             |                   |                   |                   |                   |
| White         | 70.76             | 71.26             | 72.67             | 73.16             | 72.99             |
| Black         | 16.30             | 15.36             | 14.22             | 14.12             | 14.44             |
| Hispanic      | 8.33              | 8.70              | 8.79              | 8.30              | 8.38              |
| Asian         | 0.69              | 0.78              | 0.75              | 0.84              | 0.88              |
| Native American | 0.65           | 0.70              | 0.65              | 0.74              | 0.77              |
| Other         | 3.27              | 3.20              | 2.84              | 2.84              | 2.59              |
| **No. of comorbidities** |             |                   |                   |                   |                   |
| None          | 0.69              | 0.57              | 0.54              | 0.39              | 0.40              |
| One           | 5.39              | 5.41              | 4.97              | 4.49              | 4.23              |
| Two or more   | 93.91             | 94.02             | 94.48             | 95.12             | 95.37             |
| **Rural/urban status** |         |                   |                   |                   |                   |
| Rural         | 35.59             | 40.81             | 42.04             | 41.57             | 41.71             |
| Urban         | 64.41             | 59.19             | 57.96             | 58.43             | 58.29             |
| **Payer**     |                   |                   |                   |                   |                   |
| Medicaid      | 30.74             | 31.61             | 31.29             | 37.66             | 39.30             |
| Medicare      | 30.20             | 30.62             | 31.56             | 31.85             | 31.53             |
| Private       | 21.22             | 21.06             | 20.72             | 19.62             | 19.61             |
| Self-pay      | 13.35             | 12.19             | 12.02             | 7.80              | 6.45              |
| Other         | 4.49              | 4.52              | 4.41              | 3.08              | 3.11              |

*a* Data are percentages, per 100,000 hospitalizations; sampling weight adjusted in all statistics.

*b* Values for n indicate the total number of opioid-related hospitalizations for the year.
Table 2. Prevalence of Opioid-Related Hospitalizations Among Adults Aged 18 or Older, by Chronic Disease, National Inpatient Sample, 2011–2015

| Chronic Disease | Year       | P Value\(^b\) |
|-----------------|------------|---------------|
|                 | 2011 | 2012 | 2013 | 2014 | 2015 |          |
| Cancer          | 1.11\(^c\) | 1.16\(^c\) | 1.32 | 1.40\(^c\) | 1.58\(^c\) | <.001 |
| Stroke          | 0.90\(^c\) | 0.93\(^c\) | 1.04\(^c\) | 1.04\(^c\) | 1.07\(^c\) | <.001 |
| Obesity         | 8.18\(^c\) | 8.92\(^c\) | 9.67\(^c\) | 10.21\(^c\) | 10.80\(^c\) | <.001 |
| Asthma          | 10.77\(^c\) | 11.18\(^c\) | 10.93\(^c\) | 11.49\(^c\) | 11.91\(^c\) | <.001 |
| Liver Disease   | 4.76\(^c\) | 4.77\(^c\) | 5.12\(^c\) | 5.21\(^c\) | 5.35\(^c\) | <.001 |
| Spinal Disease  | 0.83  | 0.75\(^d\) | 0.77 | 0.77 | 0.80\(^c\) | .09 |
| Arthritis       | 1.65  | 1.67  | 1.73 | 1.83\(^d\) | 1.96\(^c\) | <.001 |

\(^a\) Data are percentages, per 100,000 hospitalizations; sampling weight adjusted in all statistics.

\(^b\) Trend analysis was calculated by using χ² test.

\(^c\) \(P < .001\). P values calculated by using χ² test.

\(^d\) \(P < .05\). P values calculated by using χ² test.
Appendix A. *International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM)* Diagnosis Codes Used to Identify Opioid-Related Hospitalization

| Hospitalization Type                  | ICD-9-CM Code                      |
|--------------------------------------|-----------------------------------|
| Opioid dependence and unspecified use | 304.00, 304.01, 304.07, 304.71      |
| Adverse effects of opioids           | E935.1, E935.2, E940.1             |
| Opioid abuse                         | 305.50, 305.51, 305.52             |
| Opioid poisoning                     | 965.00, 965.01, 965.02, 965.09, 970.1, E850.0, E850.1, E850.2 |
Appendix B. *International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM)* Diagnosis Codes Used to Identify Comorbidities

| Comorbidity                             | ICD-9-CM Code |
|-----------------------------------------|---------------|
| **Cancer**                              |               |
| Buccal cavity and pharynx               | 140.00 to 149.00 |
| Digestive system                        | 150.00 to 159.00 |
| Respirator system                       | 160.00 to 165.00 |
| Bones and joints                        | 170.00        |
| Soft tissue including heart             | 171.00        |
| Skin                                    | 172.00 to 173.00 |
| Breast                                  | 174.00 to 175.00 |
| Kaposi’s sarcoma                        | 176.00        |
| Female genital system                   | 179.00, 180.00 to 184.00 |
| Male genital system                     | 185.00 to 187.00 |
| Urinary system                          | 188.00 to 189.00 |
| Eye and orbit                           | 190.00        |
| Brain and other nervous system          | 191.00 to 192.00 |
| Endocrine system                        | 164.00, 193.00 to 194.00 |
| Ill-defined                             | 195.00 to 196.00, 199.00, 202.00 |
| Lymphoma                                | 200.00 to 202.00, 202.10, 202.20, 202.80, 202.90 |
| Multiple myeloma                        | 203.00, 203.80 |
| Leukemia                                | 202.40, 203.10, 204.00 to 208.00 |
| Benign neoplasms                        | 210.00 to 229.00 |
| Carcinoma in situ                       | 230.00 to 234.00 |
| Neoplasms of uncertain behavior         | 235.00 to 238.00 |
| Neoplasms of unspecified nature         | 239.00        |
| **Stroke**                              |               |
| Occlusion and stenosis of basilar artery| 433.01, 433.10, 433.11, 433.21, 433.31, 433.81, 433.91 |
| Cerebral thrombosis with/without cerebral infarction | 434.00, 434.01, 434.11, 434.91 |
| Acute, but ill-defined, cerebrovascular | 436.00        |
| Subarachnoid hemorrhage                 | 430.00        |
| Intracerebral hemorrhage                | 431.00        |
| **Asthma**                              |               |
| Extrinsic asthma                        | 493.00, 493.01, 493.02 |
| Intrinsic asthma                        | 493.10, 493.11, 493.12 |
| Chronic obstructive asthma              | 493.20, 493.21, 493.22 |
| Other forms of asthma                   | 493.81, 493.82 |
| Asthma unspecified                      | 493.90, 493.91, 493.92 |
| **Liver disease**                       |               |
| Acute and subacute necrosis of liver    | 570.0         |
| Chronic liver disease and cirrhosis     | 571.0, 571.1, 571.2, 571.3, 571.4, 571.5, 571.6, 571.8, 571.9 |

(continued on next page)
| Comorbidity                              | ICD-9-CM Code                  |
|-----------------------------------------|-------------------------------|
| Liver abscess                           | 572.0, 572.1, 572.2, 572.3, 572.4, 572.8 |
| Other disorders of liver                | 573.0, 573.1, 573.2, 573.3, 573.4, 573.5, 573.6, 573.8, 573.9 |
| **Arthritis**                           |                               |
| Psoriatic arthritis                     | 696.0                         |
| Diffuse disease of connective tissue    | 710.0, 710.1, 710.2, 710.3, 710.4, 710.5, 710.8, 710.9 |
| Infectious arthropathies                | 711.0, 711.1, 711.2, 711.3, 711.4, 711.5, 711.6, 711.7, 711.8, 711.9 |
| Crystal arthropathies                   | 712.1, 712.2, 712.3, 712.8, 712.9 |
| Rheumatoid arthritis                    | 714.0, 714.2, 714.3, 714.4, 714.8, 714.9 |
| Osteoarthritis and allied disorders      | 715.0, 715.1, 715.2, 715.3, 715.8, 715.9 |
| Other/unspecified arthropathies         | 716.0, 716.1, 716.2, 716.3, 716.5, 716.6, 716.8, 716.9 |
| **Obesity**                             |                               |
| Obesity                                 | 278.00                        |
| Morbid obesity                          | 278.01                        |
| Overweight                              | 278.02                        |
| Obesity hypoventilation syndrome        | 278.03                        |
| **Spinal disease**                      |                               |
| Spondylosis                             | 721.0                         |
| Intervertebral disc disorder            | 722.0                         |
| Other cervical disorders                | 723.0                         |
| Low back pain                           | 724.0                         |