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# Temporal trend of opioid and nonopioid pain medications: results from a national in-home survey, 2001 to 2018

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## Abstract

**Introduction:** The opioid epidemic persists in the United States. The use of opioid medications is often assessed by claims data but potentially underestimated.

**Objectives:** We evaluated the temporal trend in the use of opioid and nonopioid pain medications from a national survey.

**Methods:** Using data from the 2001 to 2018 National Health and Nutrition Examination Survey (NHANES), we examined the current use of prescription analgesics in the past 30 days among 50,201 respondents aged 20 years or older. Joinpoint regressions were used to test statistically meaningful trends of opioid vs nonopioid analgesics.

**Results:** The mean percentage of people who had pain medications in the past 30 days was 6.4% (5.3%-7.1%) for opioid and 11.3% (9.0%-14.8%) for nonopioid analgesics. The availability of opioid and nonopioid prescriptions at home has remained stable, except for the slight decline of opioids among cancer-free patients in 2005 to 2018. The most frequently used opioid analgesic medications included hydrocodone/acetaminophen, tramadol, and hydrocodone.

**Conclusion:** We uniquely measured the proportion of people who had opioid and nonopioid pain medications at home in the United States and supplemented the previous knowledge of prescription rates mainly obtained from claims data.

**Keywords:** Prescription pain reliever, Analgesics, Opioid

## 1. Introduction

The opioid crisis is a pervasive public health threat in the United States.<sup>6</sup> The existing analyses of opioid pain medications mainly

rely on claims data.<sup>3,7,9</sup> However, the claims data failed to capture the nonmedical use of prescription opioids, given that approximately half of those who misused prescription painkillers obtained these medications from a friend or relative.<sup>10</sup> The National Health and Nutrition Examination Survey (NHANES) may serve as an appropriate data source to illustrate the secular trend of patients' actual use of opioid and nonopioid analgesics at home.

Sponsorships or competing interests that may be relevant to content are disclosed at the end of this article.

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## 2. Material and methods

The NHANES is a program under the Centers for Disease Control and Prevention (CDC) designed to collect nationally representative data for noninstitutionalized civilians in the US population and assess the health and nutritional status through interviews, physical examinations, and laboratory analysis of biological specimens.<sup>16</sup> The NHANES survey provided the weights and strata for oversampling, complex sampling methods, and nonresponse, which we used for all analyses.<sup>15</sup> We extracted a total of 9 cycle data from the NHANES from 2001/02 to 2017/18, a population-based home interview survey among nationally representative civilian, noninstitutionalized adults aged 20 years or older in the United States. The most recent 2019 to 2020 cycle data were not complete because of the coronavirus disease 2019 pandemic and therefore excluded. In short, participants were asked whether they had taken any medicines in the past 30 days for which they needed a prescription. Those responding yes were asked to show the containers of all medications; when unavailable, the participants

verbally reported the medication name. Medications were coded using the Multum Lexicon Therapeutic Classification Scheme.<sup>15</sup> Opioids (methadone, buprenorphine, and naloxone) often used in the treatment of opioid use disorder were excluded from opioid pain medications. Pain medication was classified for on-label<sup>12</sup> use as analgesics.<sup>5,15</sup>

We first estimated each 2-year survey cycle's prevalence rate for opioid and nonopioid pain medications (drug codes shown in Supplementary Table 1, available at <http://links.lww.com/PR9/A161>),<sup>13</sup> respectively, in total, cancer patients/survivors, and cancer-free patients. We classified participants as cancer patients/survivors if they answered yes to "Ever told you had cancer or malignancy?" Second, we quantified the average bi-annual percentage change (b-APC) by the joinpoint regression (Joinpoint Statistical Software, version 4.2.0.2)<sup>10</sup> to characterize statistically meaningful trends with a significance level of 0.05 in rates over time. We reported only significant b-APC in this report, which indicated a statistically significant change in trend (namely the increasing or decreasing slope) before and after a time point. Finally, we identified the top 10 most prevalent prescription analgesics in each survey wave (Supplementary Table 2, available at <http://links.lww.com/PR9/A161>). Our study was deemed exempt from ethics review due to the use of publicly accessible nonidentifiable data. We adjusted the sampling weights in all analyses to account for the complex survey design and nonresponse bias.

### 3. Results

Among 50,201 respondents from the 9 cycle surveys, 11.3% reported the current use of nonopioid medications, whereas 6.4% reported having opioid pain medications at home in the past 30 days. From 2001/02 to 2017/18, the prevalence rates of opioid and nonopioid prescription use (**Fig. 1**) remained at stable levels of 5.3% to 7.1% and 9.0% to 14.8%, respectively. We observed only a statistically meaningful decline of opioid analgesics among individuals without a history of cancer (accounting for 90.5% of the total sample), diminishing from 6.3% in 2005/2006 to 5.1% in 2017/2018 at a bi-annual decline rate of 2.02% (b-APC =  $-2.02$ ,  $P < 0.05$ ).

We identified 2 medication patterns from 2001 to 2018. First, of the top 10 most prevalent analgesic medications in each cycle, at least 2 were opioid pain medications in cancer patients and cancer-free individuals. The most prevalent analgesic medications included hydrocodone/acetaminophen (equivalent to morphine opioid), gabapentin, ibuprofen, naproxen, tramadol (weaker than morphine), aspirin, celecoxib, venlafaxine, meloxicam, and hydrocodone (equivalent to morphine) (Supplementary Table 2, available at <http://links.lww.com/PR9/A161>). Hydrocodone/acetaminophen ranked the most often used analgesic from 2005 to 2012 but lost its top ranking in 2013/2014 (Supplementary Table 2, available at <http://links.lww.com/PR9/A161>). The opioid tramadol has become a popular drug since 2005. Ibuprofen and naproxen continued to be the most prevalent nonsteroidal anti-inflammatory drugs (NSAIDs) (Supplementary Table 2, available at <http://links.lww.com/PR9/A161>). We seemed to observe a bump in gabapentin prescriptions, a drug commonly used to treat neuropathic pain (Supplementary Table 2, available at <http://links.lww.com/PR9/A161>).

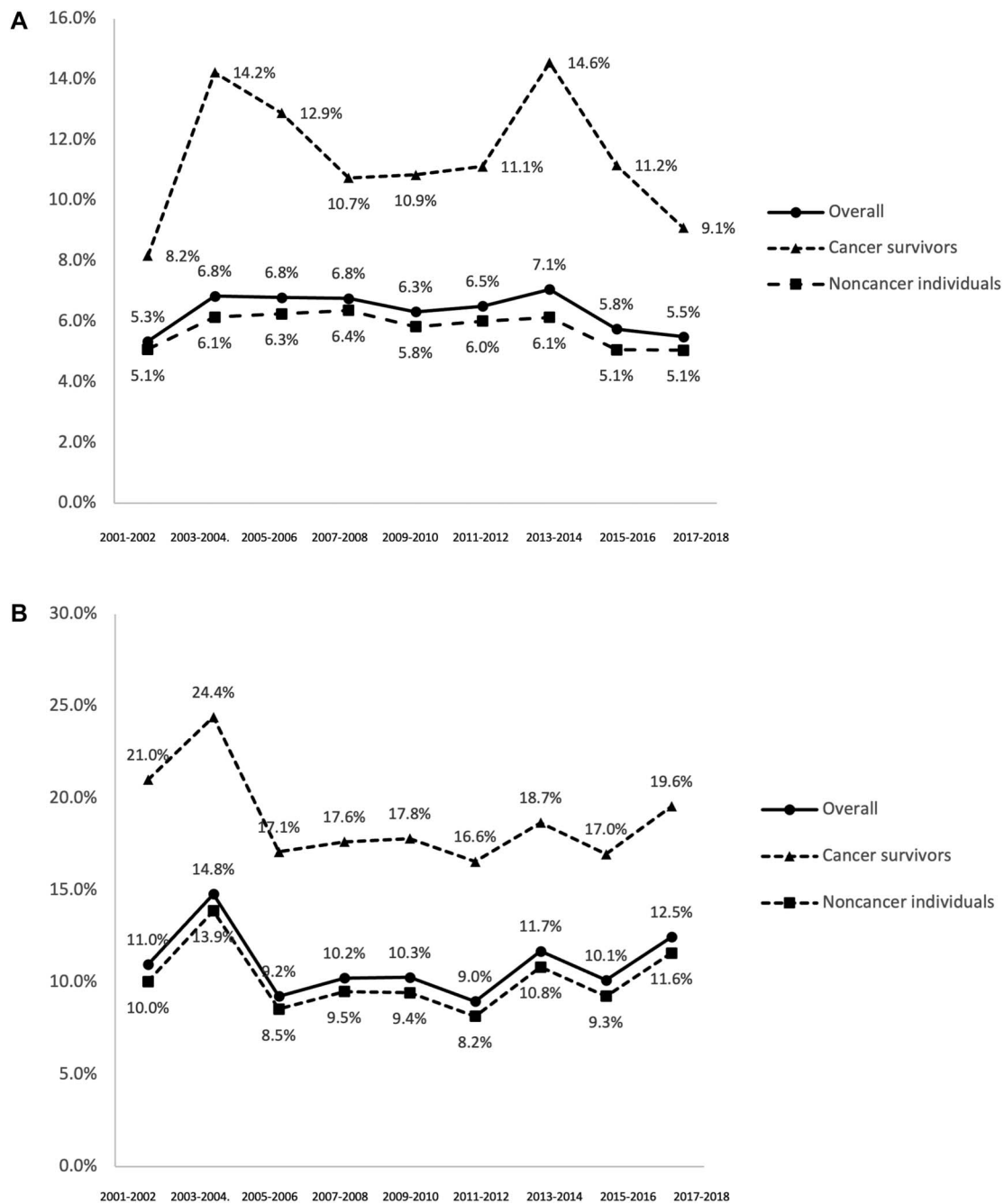
### 4. Discussion

We assessed the use of opioid vs nonopioid analgesics in a large nationally representative US sample over time. Findings indicate that the use of opioid and nonopioid analgesics held relatively stable from

2001 to 2018, except for a slight decline of opioid pain medications in 2005 to 2018 among individuals without a history of cancer. We measured the proportion of people who self-reported using opioid and nonopioid prescriptions from an in-home survey to supplement the literature estimates mainly from claims data. Retail prescription data from Quintiles and IMS Health Inc. indicated that opioid prescribing peaked in 2010 (81.2 prescriptions per 100 persons) and decreased annually until 2015.<sup>9</sup> The national opioid dispensing rate map<sup>3</sup> found that the total number of opioid prescriptions peaked in 2012 after a steady increase since 2006. In another study of Medicare beneficiaries, researchers<sup>7</sup> found a significant decline (21% among oncologists and 23% among other doctors) of opioid prescriptions from 2013 to 2017. We uniquely studied the proportion of opioid and nonopioid prescriptions at home and observed a stable trend of opioid and nonopioid prescriptions among cancer patients. The public health implications of our findings are significant, especially considering that approximately 20% of individuals who misuse prescription pain relievers obtained these medications from health-care providers.<sup>11</sup> Together with the existing literature, our analysis results indicated that prescription opioids were often used to treat pain at home, but fewer cancer-free patients have had opioids since 2005. Even among individuals without a history of cancer, we found that of the top 10 most prevalent analgesic medications, 3 were opioid medications. Acetaminophen/hydrocodone (equivalent to morphine) was the most prevalent analgesic drug. Unlike other countries,<sup>4</sup> the United States puts minimal constraints on the medical use of hydrocodone, a long-acting and highly addictive opioid medication. Hydrocodone was once a Schedule III drug in the United States, rather than the more restrictive Schedule II drug. People could obtain a prescription of Schedule III drug refilled at the pharmacy without seeing a doctor.<sup>14</sup> To reduce misuse, the Drug Enforcement Administration (DEA) changed the schedule of hydrocodone combination products from Schedule III to Schedule II (indicating substance has a higher potential for abuse). Our results show changes coincided with the implementation of this policy since 2014.<sup>14</sup> The historically safer opioid tramadol has increased since 2007. Recent research reported that tramadol is more likely than other opioids to result in prolonged use.<sup>16</sup> However, the Drug Enforcement Administration (DEA) still treats tramadol as a Schedule IV controlled substance (indicating a lower potential for abuse than substances in Schedules I–III). Given its increasing popularity (from the seventh most common analgesic in 2003/2004 to the fifth in 2017/18), the Schedule IV classification of tramadol should be reassessed.

In an earlier survey conducted in 1997, ibuprofen-based drugs were the most frequently used nonopioid drug.<sup>17</sup> Our analysis showed that gabapentin was favored beyond ibuprofen during 2007 to 2016. However, gabapentin was approved by the FDA under the classification of anticonvulsants and only had on-label use for pain relief for postherpetic neuralgia.<sup>1</sup> There was no strong evidence that the wide use of gabapentin was only for pain relief purposes. We might say that ibuprofen remained to be the most persuasive nonopioid pain medication. As of July 2018, Tennessee, West Virginia, and Kentucky have classified gabapentin as a Schedule V medication in the controlled substance schedule. More states require the report of gabapentin to prescription drug monitoring programs. The current widespread use of gabapentin that we identified was quite alarming.

There are several noteworthy limitations. NHANES relied on respondents' self-report of medication use and lacked an assessment of the amount and duration of the medication use. While we captured self-reported opioid medication use, we were uncertain for which medical purpose these medications were taken and whether they obtained the drug from multiple sources (for instance, from their friends or family). Each NHANES survey



**Figure 1.** (A) Temporal trends of opioid analgesic use in the United States in all cancer patients and noncancer individuals, 2001 to 2018. (B) Temporal trends of nonopioid analgesic use in the United States in all cancer patients and noncancer individuals, 2001 to 2018.

intentionally oversampled certain subgroups of population to increase the national representativeness but may overestimate some populations (such as undersampling of other than non-Hispanic Black and Mexican American minority groups and intentionally overweighting non-White populations).<sup>8</sup> Similarly, the focus on persons in dwelling units excluded the homeless, which then underestimated opioid use.

## 5. Conclusions

In summary, we found that approximately 6% and 11% of people had opioid and nonopioid analgesics at home in the past 30 days. The availability of opioid and nonopioid drugs remained stable, except for the slight decline of opioids among cancer-free patients

since 2005. The most frequently used opioid analgesic medications included hydrocodone/acetaminophen, tramadol, and hydrocodone. Public health policymakers should supplement survey data with claims data to improve the understanding of the trends of opioid misuse to design effective interventional programs.

## Disclosures

The authors have no conflict of interest to declare.

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Author contributions: Y. Wang designed the study, wrote the protocol, conducted literature searches and statistical analysis,

and provided summaries of previous research studies. All other authors helped revise the manuscript, provided expertise, and contributed to and have approved the final manuscript.

## Appendix A. Supplemental digital content

Supplemental digital content associated with this article can be found online at <http://links.lww.com/PR9/A161>.

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