Opioid-involved Emergency Department Visits in the National Hospital Care Survey and the National Hospital Ambulatory Medical Care Survey

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Abstract

Purpose—This report compares 2014 National Hospital Care Survey (NHCS) emergency department (ED) data with national estimates of ED visits due to opioid use (i.e., "opioid-involved visits") from the 2013–2015 National Hospital Ambulatory Medical Care Survey (NHAMCS) to determine the potential of researching the impact and outcomes of opioid use on hospital EDs with non-nationally representative NHCS data. The 2014 NHCS data are also linked to records in the 2014 and 2015 National Death Index (NDI) to examine mortality after the opioid-involved ED visit.

Methods—A previously published algorithm, which uses a list of *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD–9–CM) diagnosis codes and external-cause-of-injury codes denoting opioid use, was used to identify opioid-involved visits in NHCS and NHAMCS, which are compared by sex and age. Weighted percentage estimates and their 95% confidence intervals (CIs) are shown for all demographic characteristics using NHAMCS data. Unweighted percentages are presented for all demographic and health care characteristics using NHCS data. Standard errors and CIs are also presented for the NHCS unweighted percentages as a measure of variability.

Results—The percentage of opioid-involved ED visits from NHCS fell within measures of statistical variation from NHAMCS by sex and several age groups. Less consistency of NHCS results compared with NHAMCS was seen for sex-specific age groups. NHCS has a higher percentage of opioid-involved ED visits and a higher percentage of opioid-involved ED visits for those aged 25–34, but a lower percentage for those aged 25 and under. NHCS data show that 19.2% of patients with any opioid-involved ED visit made two or more such visits, and 1.2% died within 30 days post-discharge.

Keywords: opioids • health care • mortality

Introduction

The opioid overdose epidemic continues to contribute to thousands of deaths in the United States annually. In 2018, 67,367 drug overdose deaths were seen, a 4.1% decrease from 2017, although provisional data indicate that deaths may be rising again (1,2). Drug and opioid overdoses also add burden to emergency departments (EDs). From 2005 through 2014, it is estimated that the rate of ED visits due to opioid use increased 99.4%, from 89.1 per 100,000 population in 2005 to 177.7 per 100,000 population in 2014 (3). ED data complement mortality data because they capture nonfatal overdoses (4). In addition, ED data can provide critical information on opioid use-related treatments, such as opioid use disorder treatment, detoxification for safe opioid withdrawal, and management of adverse effects (5). The National Center for Health Statistics' (NCHS) hospital surveys can be used to monitor trends in opioid overdoses, as well as other opioid-related morbidity and mortality measures.

Since 1992, the National Hospital Ambulatory Medical Care Survey (NHAMCS) has provided nationally representative data on ED visits, as well as outpatient department (OPD)

visits. In 2011, the National Hospital Care Survey (NHCS) was launched to integrate NHAMCS and the National Hospital Discharge Survey, which was discontinued after 2010 to streamline collection of hospital inpatient and ambulatory data.

While low response rates have prevented NHCS from being nationally representative, NHCS collected information on more than 4.5 million ED visits in 2014, providing an opportunity to explore important public health concerns such as the opioid overdose epidemic. In addition, unlike other sources of hospital data, NHCS is designed to be linked to other data sources, including the National Death Index (NDI), to permit the longitudinal examination of outcomes among those admitted to the ED or hospital.

In this report, NHAMCS national estimates by patient age and sex for ED visits due to opioid use, referred to in this report as opioid-involved ED visits, are compared with NHCS unweighted data. These are compared to determine whether the NHCS data show similar patterns as NHAMCS data for opioid-involved ED visits even though NHCS data are not currently nationally representative. Based on the results of the comparison, this report will further demonstrate the analytical capabilities of NHCS data not possible with NHAMCS data, such as identifying patients with repeat opioid-involved ED visits and examining in-hospital and post-acute 30-, 60-, and 90-day mortality for patients using opioids.

Methods

Data sources

NHAMCS ED visit data for 2013–2015 were used for this analysis. NHAMCS is a nationally representative survey of nonfederal general and short-stay hospitals conducted by NCHS (6). NHAMCS uses a multistage probability design with samples of geographic primary sampling units (PSUs), hospitals within PSUs, and patient visits within EDs and OPDs. Between 2013 and 2015, data were abstracted from a range of 21,061 to 24,777 ED visits per year

and entered into a standard patient record form. Collected diagnosis codes were limited to three for ED visits and inpatient discharges in 2013 and five in 2014–2015. Up to three external-cause-of-injury codes (E-codes) could also be reported during the 2013–2015 time period. When algorithms designed to identify opioid involvement were applied to each individual year of NHAMCS data, the number of flagged visits (about 100 visits per year) were too small to make reliable national estimates of opioid-involved ED visits. Multiple years of NHAMCS data were necessary to make reliable estimates of opioid-involved ED visits by age and sex. The weighted annual average number of all ED visits was 136,238,820 for the 3-year period.

ED data from the 2014 NHCS were also used for this analysis. The target universe for NHCS is inpatient discharges and in-person visits made to EDs and OPDs in noninstitutional, nonfederal hospitals in the 50 states and the District of Columbia that have 6 or more staffed inpatient beds (7). Data are extracted from hospital billing or electronic health record (EHR) systems and then transmitted electronically directly to NCHS or its designated agent. The 2014 sample consisted of 581 hospitals, 506 acute care hospitals, and 75 other specialty hospitals, including children's, psychiatric, long-term acute care, and rehabilitation hospitals. Since the launch of the survey in 2011, the participation rate has remained relatively low and was 16% in 2014. Because of the low participation rate, the data are currently unweighted and are not nationally representative. Data are reported from 83 sample hospitals in the 2014 NHCS, representing an unweighted total of 4,530,360 ED visits. In 2014, all NHCS data collected were from Uniform Bill (UB)–04 administrative claims, which allow for up to 25 diagnosis codes and up to 12 E-codes. Unlike NHAMCS, NHCS collects personally identifiable information (PII) (patient name and patient address), which allows for following a patient across hospital settings and linkage to external data sources such as NDI.

Both NHCS and NHAMCS collect data shown to be important in examining

opioid-involved visits, such as age and sex. Past research has shown that hospital visits related to opioid use differ among age groups. In 2012, people aged 45–64 had the highest rate of opioid-related hospitalizations (8).

2014 National Hospital Care Survey data linked to the 2014–2015 National Death Index

Through its data linkage program, NCHS has expanded the analytic utility of the data collected from NHCS by linking it with mortality data from NDI, a component of the National Vital Statistics System. NDI is a centralized database of death record information compiled from state vital statistics offices. In collaboration with the states, NCHS established NDI as a resource for epidemiological follow-up studies and other types of health and medical research that require determination of the mortality status of study subjects. These mortality data are provided by the states under contract agreements with NCHS that specify how these data may be used, for what purposes, and at what cost. Currently, NDI contains about 85 million records from 1979 through 2018 from the 50 states, the District of Columbia, New York City, Puerto Rico, and the U.S. Virgin Islands (9).

The linkage between 2014 NHCS patient records and the 2014–2015 NDI death certificate records was based on both deterministic and probabilistic methods. The probabilistic linkage method performed weighting and link adjudication as described in the Fellegi–Sunter paradigm, the foundational methodology used for record linkage (10). More information on the linkage methodology and the process for determining patient mortality status is available elsewhere (11).

Cause of death in the NDI is coded in *International Classification of Diseases, 10th Revision* (ICD–10). Using the multiple-cause-of-death codes, researchers can identify opioid-involved overdoses. The ICD–10 codes used for identifying opioid-involved overdoses are underlying-cause-of-death codes X40–44, X60–64, X85, or Y10–Y14, and a multiple cause code of T40.0–T40.4 or T40.6.

Survey design differences of NHCS and NHAMCS

There are important differences in the survey design of NHCS and NHAMCS that may lead to differences in the identification and enumeration of certain types of ED visits and the type of comparisons that can be conducted. NHCS uses a single-stage sample of visits to nonfederal, noninstitutional hospitals with 6 or more beds staffed for inpatient use in the 50 states and the District of Columbia. NHAMCS uses a four-stage probability design with samples of area PSUs, hospitals within PSUs, clinics within outpatient departments, and patient visits within clinics or emergency service areas. PSUs consist of a county, a group of counties, towns, townships, or a metropolitan statistical area (MSA). Like NHCS, NHAMCS includes nonfederal, noninstitutional hospitals in the 50 states and the District of Columbia. NHCS used a stratified list sample of 581 hospitals, with strata defined by four types of hospitals (general acute, children's, psychiatric, and other). NHAMCS included general (medical or surgical) and children's general hospitals. More than 8% of NHCS hospitals are children's hospitals, but only 4% of NHAMCS hospitals are children's hospitals.

In NHCS, among the acute care hospitals, strata are also defined by bed size (less than 50, 50–99, 100–199, 200–499, and 500 or more) and area type (central city of large MSA, fringe of large MSA, small MSA, and non-MSA). NHAMCS defined size by the volume of ED and outpatient department visits and defined area type by MSA and non-MSA. Average length of stay (ALOS) is not used as an exclusion criterion for NHCS, thus expanding the sampling frame beyond short-stay hospitals with an ALOS of less than 30 days. Hospitals with an ALOS of more than 30 days is an exclusion criterion for NHAMCS. In addition, unlike NHAMCS, NHCS has no geographic qualifiers and no large certainty hospitals included in the sampling frame.

The mode of data collection is different for NHCS and NHAMCS. NHCS is an all-electronic data collection with administrative claims or billing data submitted by participating hospitals. Sampled hospitals are requested to transmit all their inpatient, ED, and OPD visits over a 12-month period. Data collected in NHCS consist of patient PII (including patient name, address, and Social Security number) and patient demographics, diagnoses, procedures, laboratory tests, and medications. Patient PII is used to create unique patient identifiers to follow patients over time and link to external data sources such as the NDI, providing a more complete picture of patient care and post-acute mortality.

NHCS UB–04 administrative claims data excludes some types of ED visits, including those with an expected source of payment of charity care or self-pay, because a hospital bill may not have been created for these visits. Some NHCS data were collected from claims representing multiple hospital visits for ease of billing. An attempt was made to identify unique visits on bundled claims, but some ED visits may have been overcounted. It was not always possible to distinguish between services delivered in the ED and the inpatient department on bundled claims.

NHAMCS relies on medical record abstraction by U.S. Census Bureau field representatives. NHAMCS data are collected during a 4-week period. A random sample of about 100 ED visits are selected from all visits during the reporting period, and data are manually abstracted directly from medical records by Census staff. Data collected include patient demographics, reason for visit, diagnoses, procedures, and medications, but do not contain PII. More information on the sample design of NHAMCS is published elsewhere (6). Charity and self-pay ED visits are included in NHAMCS.

Opioid-involved ED visit definition

An opioid-involved ED visit was defined as an ED visit with a diagnosis or E-codes for past or present opioid use (including opium, heroin, methadone, and other opiates and related narcotics), abuse, dependence, adverse effects in therapeutic use, and poisoning; narcotics affecting the fetus or newborn; and poisoning by opiate antagonists (e.g., naloxone). Two algorithms have been developed to search for evidence of opioid involvement in the NHCS data (12). The general algorithm exclusively uses a list of *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD–9–CM) diagnosis codes and E-codes denoting opioid use, while the enhanced algorithm includes an additional set of symptom and procedure codes generally associated with substance use only at the time of a specific hospital visit, potentially excluding past opioid-involved ED visits. The inclusion of the symptoms and procedures with a diagnosis code of opioid use increase the likelihood that the present hospital visit is associated with opioid use. The general algorithm was selected for use in this analysis because the opioid-use code list could be applied to similar coded diagnosis and injury fields available in both NHAMCS and NHCS. Differences in coded fields for symptoms and procedures between the surveys precluded applying the enhanced algorithm. Due to the application of the general algorithm, historical opioid-involved ED visits will be included in this study.

Analysis

This report presents the total number of opioid-involved ED visits and compares selected characteristics of these visits between NHAMCS and NHCS, including patient age and sex. Weighted percentage estimates and their 95% confidence intervals (CIs) are shown for all demographic characteristics using NHAMCS data. Unweighted percentages are presented for all demographic and health care characteristics using NHCS data. Standard errors and CIs are also presented for the NHCS unweighted percentages as a measure of variability. If an NHCS unweighted percentage falls within the 95% CI of the corresponding NHAMCS percentage, they are similar.

To evaluate the impact of fewer diagnosis codes and E-codes in NHAMCS, the number of opioid-involved ED visits in NHCS were calculated using the same number of diagnosis codes and E-codes in NHAMCS. Two sets of percentages of

NHCS opioid-involved ED visits are shown in the tables and figures: one using all available diagnosis and E-code values, labeled "all ICD–9–CM codes," and a second using the same number of diagnosis and E-code values available in the 2013–2015 NHAMCS, labeled "comparable number of ICD–9–CM codes," which is the main comparison in this report.

The ability of NHCS data to track patients across hospital settings and to link to the NDI are unique features of the NHCS, which allow analyzing in-hospital and post-discharge mortality. This report also presents unweighted percentages for patients with multiple opioid-involved visits and selected mortality outcomes of patients with opioid-involved visits using NHCS data, including inpatient discharge status following admission from the ED; the time to mortality among all patients, by sex and age; and whether the cause of death was an opioid-involved overdose among all patients and by sex.

Results

The results are divided into two sections. The first section provides comparisons between unweighted NHCS data and weighted NHAMCS data for age and sex. The second section focuses on the unique feature of NHCS, which allows for an examination of repeat ED visits and mortality for patients with opioid-involved ED visits.

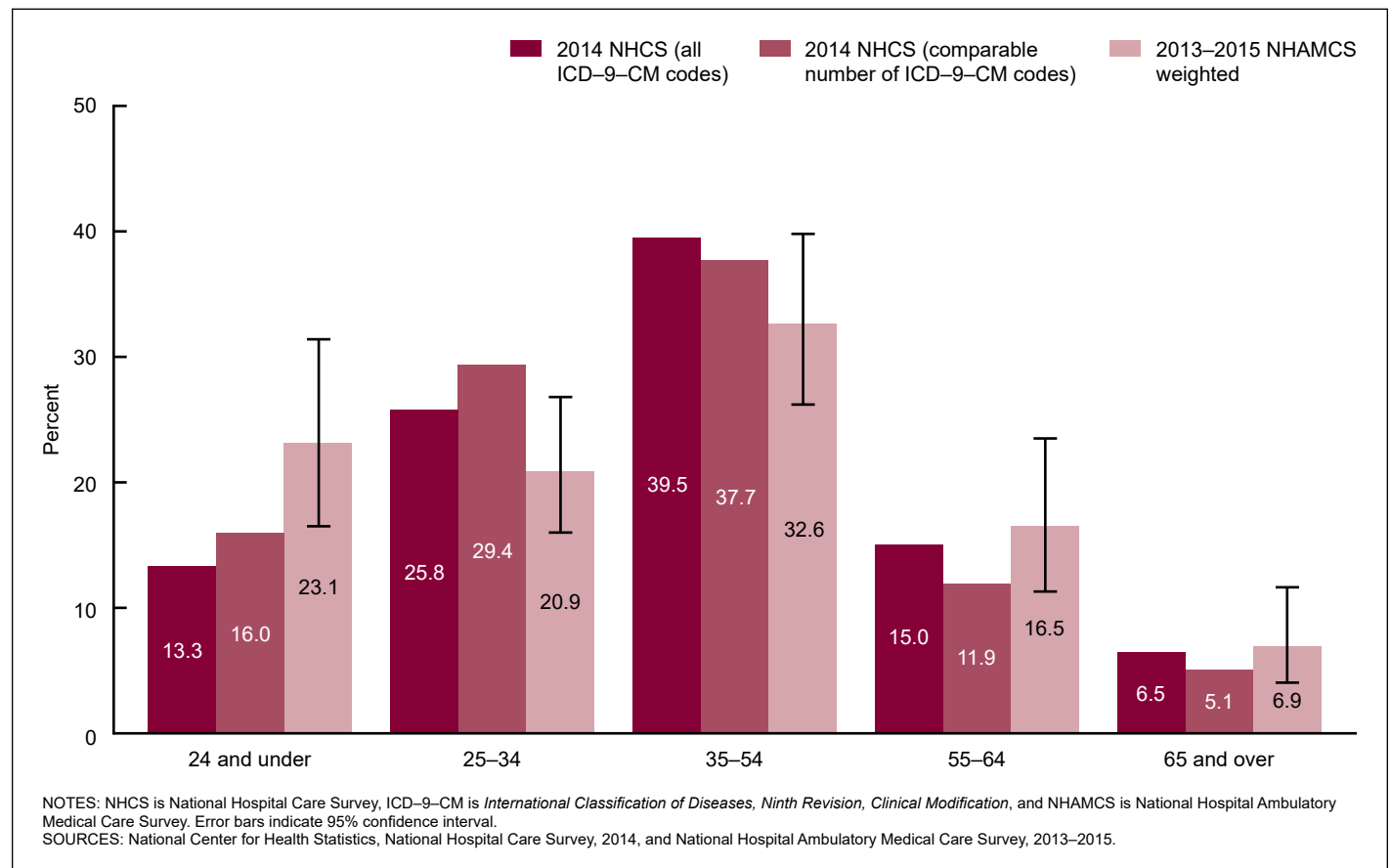## Number of opioid-involved ED visits in NHAMCS and NHCS

Table 1 shows the number of opioid-involved ED visits identified using the general algorithm in the 2014 NHCS data and the 2013–2015 NHAMCS weighted data. In the 2014 NHCS data, 0.9% of ED visits are identified as opioid-involved using all available ICD–9–CM codes (Table 1). When the 2014 NHCS data are constrained to the same number of diagnosis and

E-codes as in NHAMCS, the percentage of opioid-involved ED visits in NHCS decreases to 0.6%. In the 2013–2015 NHAMCS weighted annual average data, 0.4% of ED visits are estimated to be opioid-involved. The percentage of ED visits in the unweighted NHCS data is higher and does not fall within the 95% confidence interval of the NHAMCS estimate, which is consistent with the increased ability of NHCS to identify rare events due to obtaining all ED visits from a given hospital and not just a sample of visits.

Demographics of opioid-involved ED visits in NHAMCS and NHCS

In comparing the demographics, Figure 1 and Table 2 show the percentage distribution by age group for opioid-involved ED visits for NHCS and NHAMCS. For both data systems, the percentage of opioid-involved ED visits is highest among those aged 35–54.

Figure 1. Age distribution of opioid-involved emergency department visits: National Hospital Care Survey, 2014, and National Hospital Ambulatory Medical Care Survey, 2013–2015

NOTES: NHCS is National Hospital Care Survey, ICD–9–CM is *International Classification of Diseases, Ninth Revision, Clinical Modification*, and NHAMCS is National Hospital Ambulatory Medical Care Survey. Error bars indicate 95% confidence interval.
SOURCES: National Center for Health Statistics, National Hospital Care Survey, 2014, and National Hospital Ambulatory Medical Care Survey, 2013–2015.

Percentages from NHCS fell within the confidence intervals of percentages from NHAMCS for all age groups 35 and over.

- For the age group categories 35–54, 55–64, and 65 and over, the unweighted NHCS percentages when using the comparable number of ICD–9–CM codes to NHAMCS were within the NHAMCS 95% confidence intervals for the respective age groups. Using the comparable number of ICD–9–CM codes, estimates of opioid-involved visits among patients aged 24 and under (16.0%) and those aged 25–34 (29.4%) fell outside of NHAMCS confidence intervals (23.1% [95% CI: 16.5%–31.4%] and 20.9% [16.0%–26.8%], respectively).

Figure 2 and Table 2 show the distribution of opioid-involved ED visits in the 2014 NHCS and the 2013–2015 NHAMCS by sex. Opioid-involved ED visits by sex are similar for NHCS and NHAMCS. Both surveys show more opioid-involved visits for males than females.

- NHAMCS data show that 57.8% (95% CI: 50.1%–65.5%) of opioid-involved visits were made by males. NHCS unweighted data using comparable ICD–9–CM codes to NHAMCS indicate 57.5% were male, which fell within the NHAMCS 95% confidence interval.
- For the 2014 unweighted NHCS data using comparable ICD–9–CM codes, females comprised 42.5% of opioid-involved ED visits, which fell within the confidence intervals of the 42.2% (34.8%–49.9%) of visits among females in NHAMCS.

Figure 3 and Table 2 show the percentage of opioid users by age group for males and females. The age distribution pattern for men aged 35 and over is similar for the unweighted NHCS using comparable ICD–9–CM codes and the nationally representative NHAMCS but differs in the younger age categories. Among females, age distributions for NHCS and NHAMCS were similar for those aged 24 and under, 25–34, and 55–64. However, differences were observed between NHCS and NHAMCS for females aged 35–54 and 65 and over.

- The 2014 unweighted NHCS percentages using comparable ICD–9–CM codes show 39.0% of opioid-involved visits by males aged 35–54, 12.6% by males aged 55–64, and 4.1% by males aged 65 and over. In NHAMCS, 38.0% (95% CI: 29.2%–47.4%) of opioid-involved visits were by males aged 35–54, 16.6% (9.7%–27.1%) by males aged 55–64, and 3.4% (0.6%–9.9%) by males aged 65 and over.
- For visits by male patients under 35, the NHCS estimates did not fall within the NHAMCS confidence intervals. The 2014 NHCS unweighted percentages using comparable ICD–9–CM codes show 15.2% of opioid-involved visits by males aged 24 and under, and 29.1% for those aged 25–34. In NHAMCS, 24.6% (16.2%–35.5%) of males aged 24 and under had an opioid-involved visit, and 17.4% (11.5%–25.4%) of males aged 25–34 did.
- The 2014 unweighted NHCS percentages using comparable ICD–9–CM codes show 17.1% of opioid-involved visits by females aged 24 and under, 29.8% by females aged 25–34, and 10.8% by females aged 55–64. In NHAMCS, 21.1%
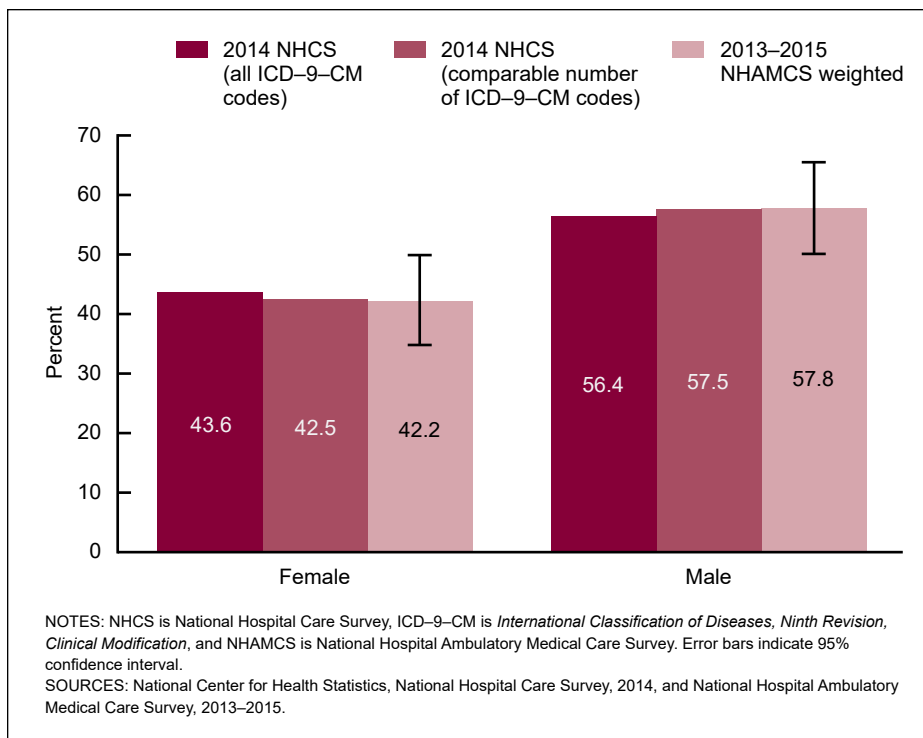
(11.1%–36.0%) opioid-involved visits by females aged 24 and under, 25.6.% (17.6%–35.7%) by females aged 25–34, and 16.4% (9.8%–26.2%) by females aged 55–64.
- For other age groups among females, percentages from NHCS were close but did not fall within the NHAMCS 95% confidence intervals. For females aged 35–54, the unweighted NHCS percentage using comparable ICD–9–CM codes was 36.0%; for NHAMCS, the percentage was 25.2% (17.6%–35.7%). Females aged 65 and over comprised 11.7% (6.5%–20.1%) of opioid-involved visits in NHAMCS. In NHCS using comparable ICD–9–CM codes, females aged 65 and over comprised 6.3%.
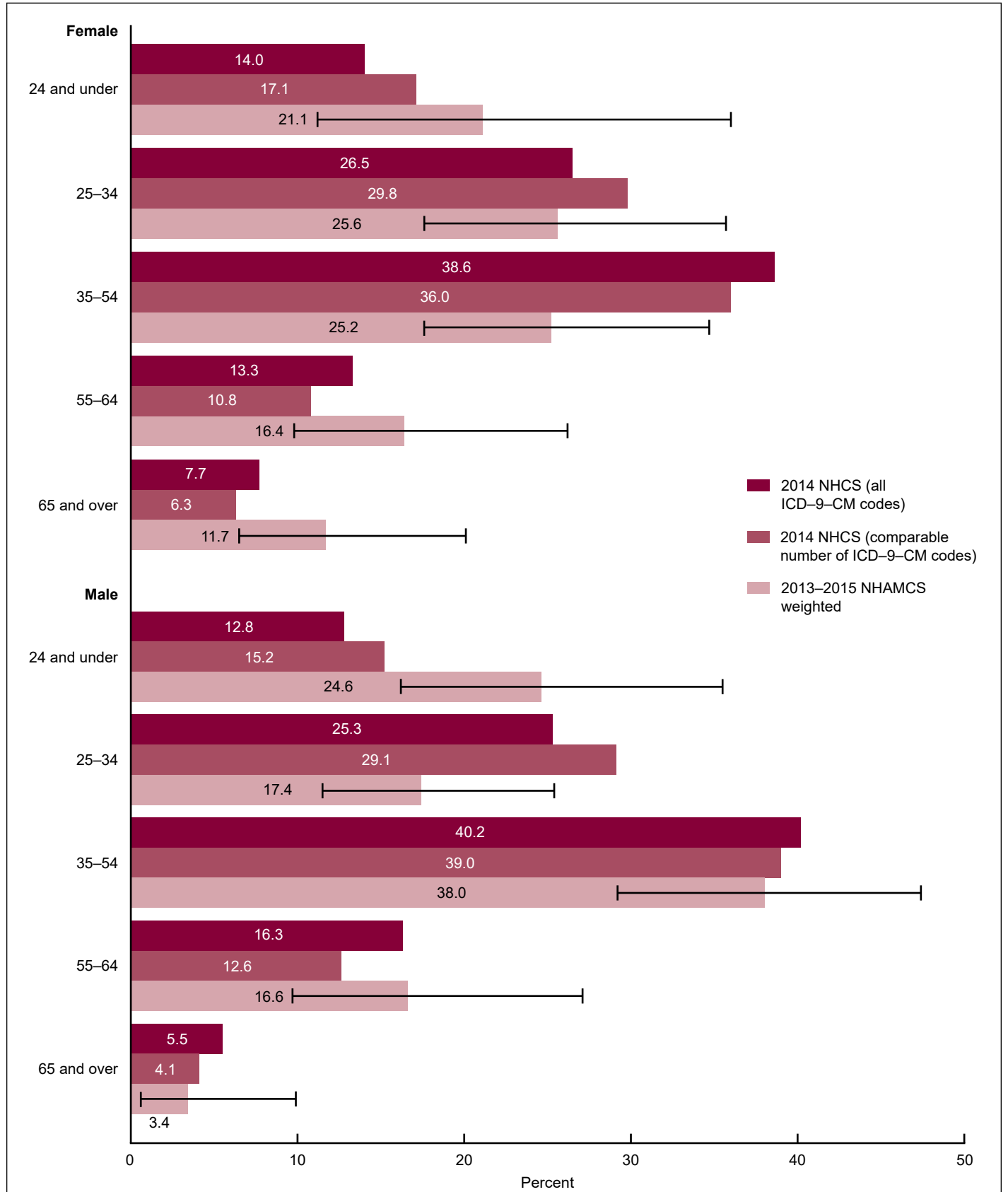
Summary of NHCS and NHAMCS comparison

Despite differences in survey design and the fact that the NHCS data are not nationally representative, NHCS and NHAMCS show several similarities when examining opioid-involved ED visits. NHCS and NHAMCS data yielded comparable estimates for some age groups and for males and females. The

Figure 2. Sex distribution of opioid-involved emergency department visits: National Hospital Care Survey, 2014, and National Hospital Ambulatory Medical Care Survey, 2013–2015

NOTES: NHCS is National Hospital Care Survey, ICD–9–CM is *International Classification of Diseases, Ninth Revision, Clinical Modification*, and NHAMCS is National Hospital Ambulatory Medical Care Survey. Error bars indicate 95% confidence interval.
SOURCES: National Center for Health Statistics, National Hospital Care Survey, 2014, and National Hospital Ambulatory Medical Care Survey, 2013–2015.

Figure 3. Age distribution of opioid-involved emergency department visits, by sex: National Hospital Care Survey, 2014, and National Hospital Ambulatory Medical Care Survey, 2013–2015

NOTES: NHCS is National Hospital Care Survey, ICD–9–CM is *International Classification of Diseases, Ninth Revision, Clinical Modification*, and NHAMCS is National Hospital Ambulatory Medical Care Survey. Error bars indicate 95% confidence interval.
SOURCES: National Center for Health Statistics, National Hospital Care Survey, 2014, and National Hospital Ambulatory Medical Care Survey, 2013–2015.

NHCS percentages using comparable ICD–9–CM codes to NHAMCS for patients aged 35 and over fall within the 95% confidence interval for the weighted 2014–2015 NHAMCS data. The percentage of males and females in NHCS with opioid-involved visits are very similar to the NHAMCS estimates and within the 95% confidence intervals of the NHAMCS estimates. When examining age group by sex, the percentages of males aged 35–54, 55–64, and 65 and over with opioid-involved ED visits are similar to the percentages in NHAMCS. Likewise, the age distribution patterns for females aged 24 and under, 25–34, and 55–64 are similar in NHCS and NHAMCS.

There are also several differences between the unweighted NHCS and NHAMCS data. The overall percentage of opioid-involved ED visits with a comparable number of codes from NHCS was somewhat higher than NHAMCS and fell outside of the confidence interval. This is consistent with NHCS being better able to capture rare events because all ED visits in a calendar year for a sampled hospital are collected. In contrast, NHAMCS only collects a sample of 100 visits per sampled hospital, making it more difficult to catch rare encounters.

There are also differences between the two surveys by certain age groups. Unweighted NHCS data using a comparable number of ICD–9–CM codes show a higher percentage of visits compared with NHAMCS for those aged 25–34 (29.4% compared with 20.9%), but a lower percentage for those aged 24 and under (16.0% compared with 23.1%), and the NHCS estimates fell outside of the confidence intervals of the NHAMCS estimates. The differences by age carry over to the combined comparisons by sex and age. Unweighted NHCS data using comparable ICD–9–CM codes show a lower percentage of males aged 24 and under with opioid-involved visits (15.2% compared with 24.6%), but a higher percentage for patients aged 25–34 (29.1% compared with 17.4%) than NHAMCS. For females aged 35–64, unweighted NHCS data using comparable ICD–9–CM codes indicate a higher percentage of opioid-involved

visits than NHAMCS estimates (36.0% compared with 25.2%). The opposite is the case for females aged 65 and over. Unweighted NHCS data using comparable ICD–9–CM codes show a lower percentage of females aged 65 and over compared with NHAMCS (6.3% compared with 11.7%). Users of these data should be aware of these differences when using NHCS to examine age groups aged 35 and under and opioid-involved ED visits by certain age groups by sex.

Analysis unique to NHCS data

Unlike NHAMCS, NHCS collects PII, which allows analyses not possible with NHAMCS data, such as examining repeat ED visits and post-acute mortality. In the section below, repeat ED visits and post-acute mortality for opioid-involved ED visits using NHCS data are presented and are not constrained by the NHAMCS definition as in the previous sections to show the full analytical capability of NHCS. That is, all ICD–9–CM diagnoses and E-codes listed in the NHCS ED encounter are used and not limited to five diagnoses and three E-codes in NHAMCS.

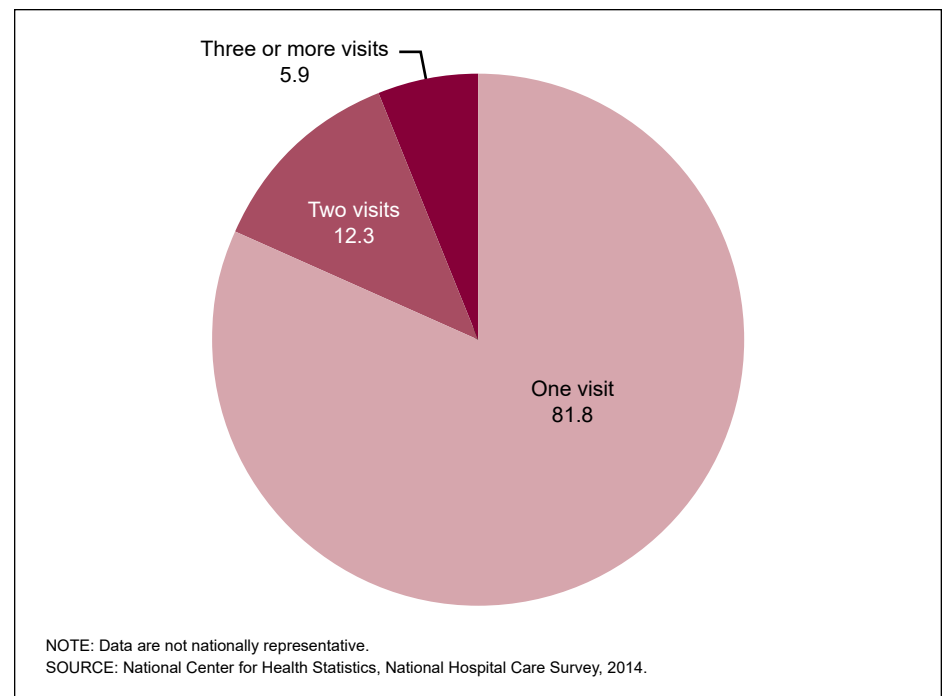## 2014 NHCS repeat opioid-involved ED visits by patients

In the 2014 NHCS ED data, 39,094 opioid-involved ED visits were made by 29,997 unique patients. Using PII data to identify unique patients, multiple ED visits for the same patient were identified. Figure 4 shows the percentage of unique patients who had multiple ED opioid-involved visits in the 2014 NHCS.

- The majority of patients (81.8%) with an opioid-involved ED visit had only one visit during 2014 (Figure 4).
- Of all the patients with an opioid-involved ED visit, 18.2% had two or more visits; 12.3% had two opioid-involved ED visits, and 5.9% had three or more.
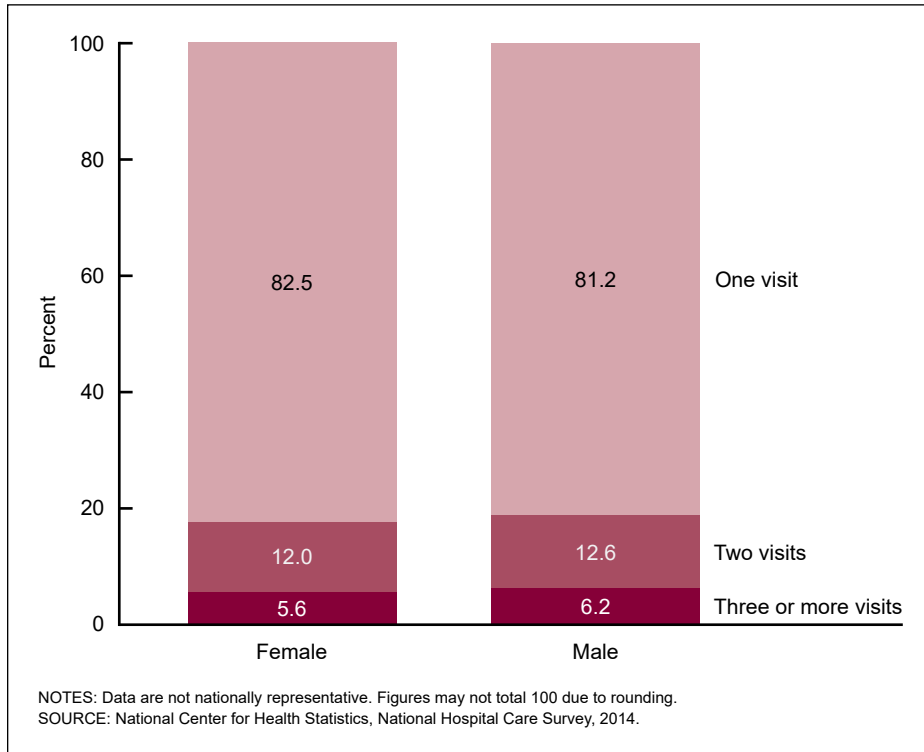
The distributions by sex and age group for patients by number of opioid-involved ED visits are presented in Figures 5 and 6.

- The percentages were similar for female (82.5%) and male (81.2%) patients with only one opioid-involved ED visit (Figure 5).
- Twelve percent of female and 12.6% of male patients had two opioid-involved ED visits.

Figure 4. Number of opioid-involved emergency department visits by patients with an opioid-involved visit: National Hospital Care Survey, 2014

NOTE: Data are not nationally representative.
SOURCE: National Center for Health Statistics, National Hospital Care Survey, 2014.

Figure 5. Number of opioid-involved emergency department visits by patients with an opioid-involved visit, by sex: National Hospital Care Survey, 2014

NOTES: Data are not nationally representative. Figures may not total 100 due to rounding.
SOURCE: National Center for Health Statistics, National Hospital Care Survey, 2014.
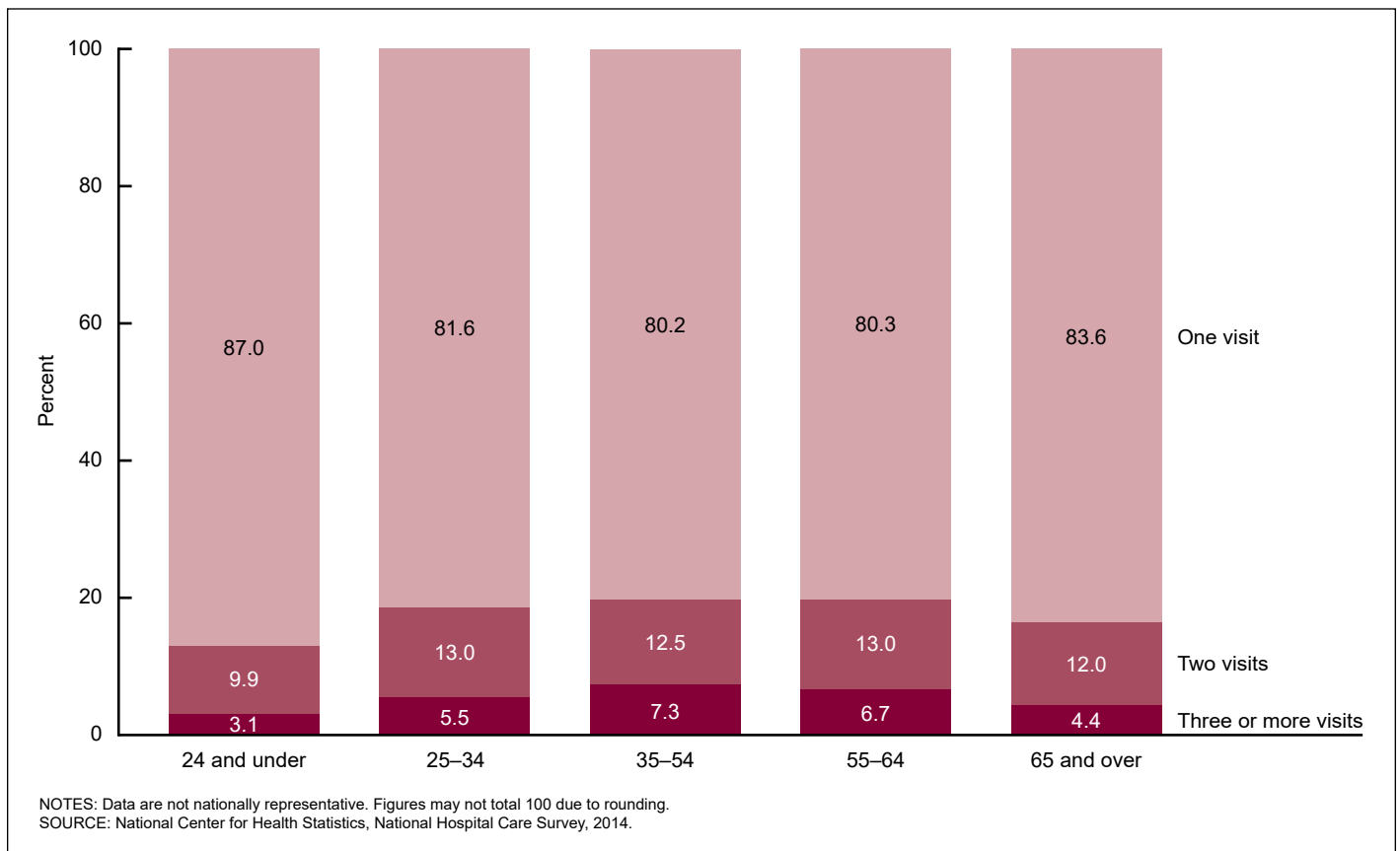
- Approximately 5.6% of female and 6.2% of male patients had three or more opioid-involved ED visits.
- One opioid-involved ED visit was made for a majority of patients across all age groups: 87.0% of patients aged 24 or under, 83.6% of patients aged 65 and over, 81.6% of patients aged 25–34, 80.3% of patients aged 55–64, and 80.2% of patients aged 35–54 (Figure 6).
- Two opioid-involved ED visits were made by 13.0% of patients aged 25–34 and 55–64.
- Three or more opioid-involved ED visits were made by 7.3% of patients aged 35–54, 6.7% of patients aged 55–64, 5.5% of patients aged 25–34, 4.4% of patients aged 65 over, and 3.1% of patients aged 24 or under.
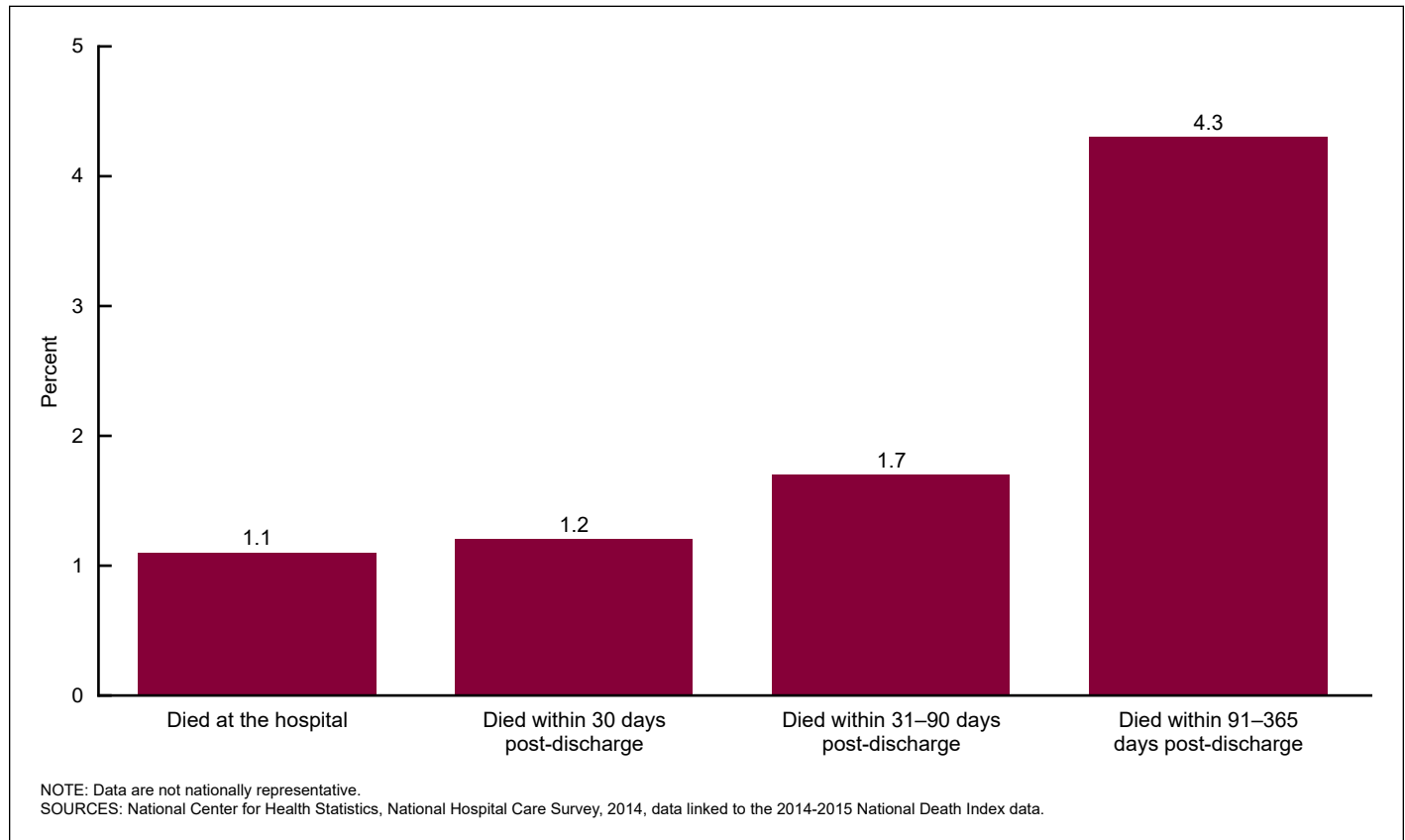
Mortality for patients in the 2014 NHCS with opioid-involved ED visits

To examine patient mortality after a hospital discharge, the patient information collected from the 2014

Figure 6. Number of opioid-involved emergency department visits by patients with an opioid-involved visit, by age: National Hospital Care Survey, 2014

NOTES: Data are not nationally representative. Figures may not total 100 due to rounding.
SOURCE: National Center for Health Statistics, National Hospital Care Survey, 2014.

Figure 7. In-hospital and post-acute mortality of opioid-involved emergency department visits, by patients eligible for linking to the National Death Index: National Hospital Care Survey, 2014

NOTE: Data are not nationally representative.
SOURCES: National Center for Health Statistics, National Hospital Care Survey, 2014, data linked to the 2014-2015 National Death Index data.

NHCS was matched to the 2014 and 2015 NDI. In NHCS, 27,849 patients were eligible for linkage to NDI. Linkage eligibility has been defined elsewhere (10). The percentage of patients who died up to 1 year after their last opioid-involved ED visit in 2014 is shown in Figure 7.

- Approximately 1.1% of patients with an opioid-involved ED visit died at the hospital. This includes patients who died in the ED or as an inpatient after admission at the hospital (Figure 7).
- Approximately 7% of patients died within 1 year of discharge: 1.2% of patients died within 30 days of leaving the hospital, 1.7% died within 31 and 90 days, and 4.3% died within 91 and 365 days after their last opioid-involved ED visit.

Figure 8 shows the percentage of males and females who had an opioid-involved ED visit and died in the hospital or died within 30 days of their last opioid-involved ED visit. The increase in mortality after discharge for opioid-involved ED visits is similar among males and females.

- Among males with an opioid-involved ED visit, 1.1% died in the hospital and 1.3% died within 30 days post-discharge of their last opioid-involved ED visit (Figure 8).
- Among females with an opioid-involved ED visit, 1.0% died in the hospital and 1.1% died within 30 days post-discharge of their last opioid-involved ED visit.

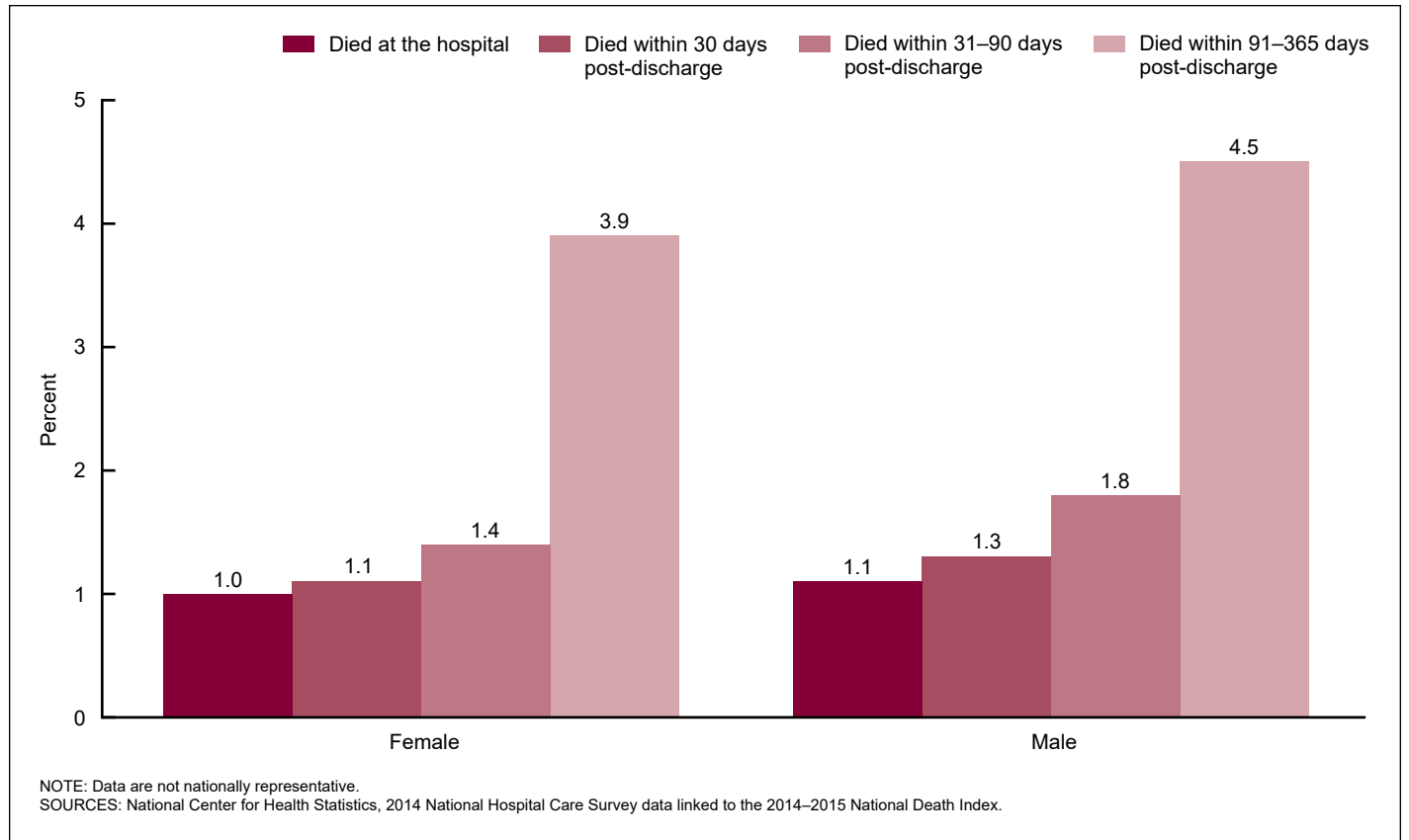## Opioid overdose deaths among NHCS opioid-involved ED visits

The linked NHCS and NDI data also include information on cause of death. Cause of death in the NDI data is coded in ICD–10. Using the multiple cause-of-death codes, researchers can identify deaths due to opioid overdoses as the underlying cause. Figure 9 shows the percentage of opioid overdose deaths among opioid-involved ED patients who died within 1 year of their last opioid-involved ED visit in 2014.

- Among patients with an opioid-involved ED visit who died at the hospital, 20.1% had an opioid overdose as their underlying cause of death (Figure 9).
- Among opioid-involved ED patients who died within 30 days after discharge, 14.8% had an opioid overdose indicated as their underlying cause of death.
- Among opioid-involved ED patients who died between 31 and 90 days after discharge, 15.8% had an opioid overdose indicated as their underlying cause of death.
- Among opioid-involved ED patients who died 91–365 days after discharge, 20.6% had opioid overdose as an underlying cause of death.
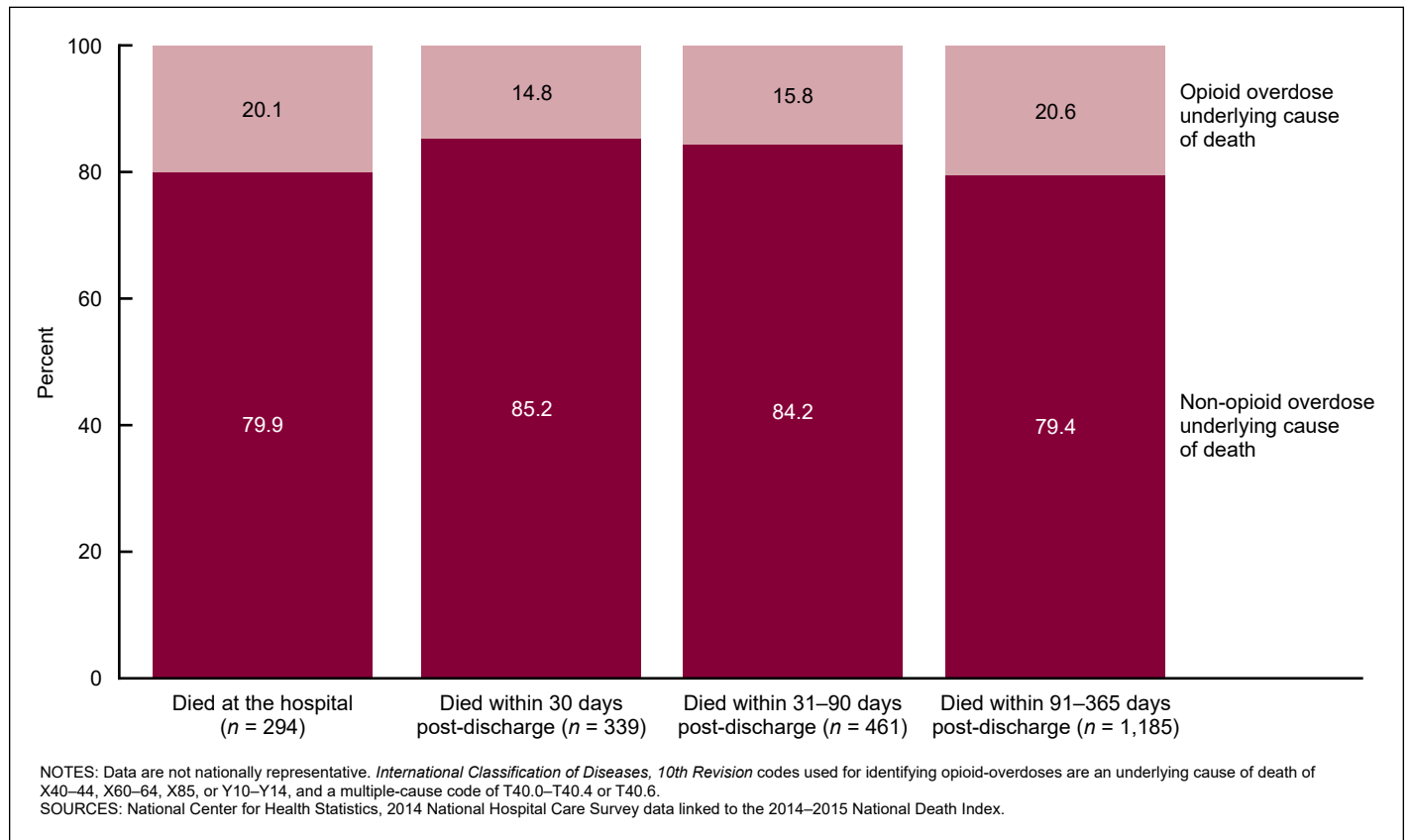
Discussion

Due to the increase in opioid use across the United States, there is a need for data that provide detailed health care information on opioid-involved ED visits that includes the ability to track patients

Figure 8. In-hospital and post-acute mortality of opioid-involved ED patients, by sex: National Hospital Care Survey, 2014

NOTE: Data are not nationally representative.
SOURCES: National Center for Health Statistics, 2014 National Hospital Care Survey data linked to the 2014–2015 National Death Index.

Figure 9. Cause of death, by in-hospital and post-acute mortality of opioid-involved emergency department patients: National Hospital Care Survey, 2014

NOTES: Data are not nationally representative. *International Classification of Diseases, 10th Revision* codes used for identifying opioid-overdoses are an underlying cause of death of X40–44, X60–64, X85, or Y10–Y14, and a multiple-cause code of T40.0–T40.4 or T40.6.
SOURCES: National Center for Health Statistics, 2014 National Hospital Care Survey data linked to the 2014–2015 National Death Index.

across hospital settings, repeated visits to the ED, and post-discharge mortality. Although not nationally representative, NHCS data have the potential to help fill this void. NHCS data can be used for exploratory analyses that provide information on characteristics of patients with opioid-involved ED visits and mortality following these visits. This report illustrates the potential of NHCS data and compares results with nationally representative NHAMCS ED data. Additionally, this report demonstrates the ability of NHCS to gather all diagnoses and E-codes, and therefore to potentially identify more opioid-involved ED visits than by using NHAMCS data alone, which has the limitation of only gathering five diagnosis and three E-code values per hospital visit compared with 25 diagnosis and 12 E-code values in NHCS. NHAMCS abstractors are instructed to capture the primary diagnosis and up to four other diagnoses that existed at the time of the visit if they are of direct concern to that ED visit. If there are more than five diagnoses records for an ED visit, not all diagnosis information will be captured in NHAMCS.

Of the ED visits in NHCS, 0.9% were identified as opioid-involved. NHAMCS identified 0.4% of ED visits as opioid-involved. The difference in the percentage of visits identified may be due to increased number of diagnosis and E-codes available in NHCS. When the NHCS data were analyzed with the same constraints found in NHAMCS, the percentage of opioid-involved ED visits decreased to 0.6%. The percentage also may be higher due to NHCS' ability to better capture rare events, since sampled hospitals provide all inpatient and ED visits and not just a sample. Analyzing the demographic distributions of the two data sources shows similarities by sex and age distribution, but some age group-specific differences were seen when examined by sex. NHCS and NHAMCS have similar distributions of male and female opioid-involved visits. The two surveys also have similar distributions in age groups for opioid-involved visits among persons aged 35 and over. NHAMCS had a higher percentage of opioid-involved ED visits among those aged 24 or under compared with NHCS. NHCS has a larger

distribution of visits for those aged 25–34 compared with NHAMCS.

The collection of PII in NHCS provides critical additional information on opioid-involved ED visits that is not available elsewhere for hospitals in the United States. It is possible to link NHCS to NDI to evaluate post-acute mortality and examine cause-of-death information (e.g., 30-, 60- and 90-day post-acute mortality) not available in other hospital data sets, including NHAMCS. The mortality information can be a tool for future research on hospital care for patients with opioid-involved ED visits and the risk of overdose after the ED visit. This report demonstrates the current generalizability of NHCS data by sex and age, even though it is not nationally representative and shows that NHCS may serve as an important data source to examine hospital-based care and post-acute mortality.

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Table 1. Percentage and number of opioid-involved emergency department visits: National Hospital Care Survey, 2014, and National Hospital Ambulatory Medical Care Survey, 2013–2015

Characteristic	2014 NHCS (all ICD–9–CM codes)	2014 NHCS (comparable number of ICD–9–CM codes)	2013–2015 NHAMCS weighted annual average
	Percent (95% confidence interval)		
Percentage of opioid-involved ED visits	0.9 (0.8–1.0)	0.6 (0.5–0.7)	0.4 (0.3–0.5)
	Number		
Total opioid-involved ED visits	39,054	28,715	542,274
Total ED visits.	4,530,360	4,530,360	136,238,820

NOTES: ED is emergency deparment. National Hospital Care Survey (NHCS) data are unweighted and not nationally representative. National Hospital Ambulatory Medical Care Survey (NHAMCS) data are weighted and nationally representative. NHCS (all *International Classification of Diseases, Ninth Revision, Clinical Modification* [ICD–9–CM] codes) results are based on information from up to 25 diagnosis codes. NHCS (comparable number of ICD–9–CM codes) results are based on information from up to five diagnosis codes, the same amount available in NHAMCS.

SOURCES: National Center for Health Statistics, National Hospital Care Survey, 2014, and National Hospital Ambulatory Medical Care Survey, 2013–2015.

Table 2. Age and sex distribution of opioid-involved emergency department visits: National Hospital Care Survey, 2014, and National Hospital Ambulatory Medical Care Survey, 2013–2015

Characteristic	2014 NHCS						2013–2015 NHAMCS weighted annual average			
	Total	Opioid-involved (using all ICD–9–CM codes)		Opioid-involved (using comparable number of ICD–9–CM codes)			Total		Opioid-involved	
Number of cases	4,530,360	39,094		28,715			136,238,820		542,274	
	Percent	Percent	Standard error (95% confidence interval)	Percent	Standard error (95% confidence interval)		Percent	Standard error (95% confidence interval)	Percent	Standard error (95% confidence interval)
Percentage of cases......	100.0	0.9	0.0 (0.8–1.0)	0.6	0.0 (0.5–0.7)		100.0	100.0 (…)	0.4	0.0 (0.3–0.5)
Age group (years)										
24 and under	36.6	13.3	0.2 (13.0–13.6)	16.0	0.2 (15.6–16.4)		34.2	0.9 (32.5–36.0)	23.1	3.8 (16.5–31.4)
25–34	13.2	25.8	0.2 (25.4–26.2)	29.4	0.3 (28.9–29.9)		16.1	0.3 (15.5–16.6)	20.9	2.8 (16.0–26.8)
35–54	22.8	39.5	0.2 (39.0–40.0)	37.7	0.3 (37.1–38.3)		24.5	0.4 (23.6–25.3)	32.6	3.5 (26.2–39.8)
55–64	10.3	15.0	0.2 (14.6–15.4)	11.9	0.2 (11.5–12.3)		9.6	0.2 (9.2–10.1)	16.5	3.1 (11.3–23.5)
65 and over.............	17.1	6.5	0.1 (6.3–6.7)	5.1	0.1 (4.8–5.4)		15.6	0.5 (14.8–16.6)	6.9	1.9 (4.0–11.6)
Sex										
Male	44.7	56.4	0.3 (55.9–56.9)	57.5	0.3 (56.9–58.1)		44.6	0.3 (44.0–45.3)	57.8	3.9 (50.1–65.5)
24 and under..........	39.4	12.8	0.2 (12.5–13.1)	15.2	0.2 (14.8–15.6)		36.1	1.0 (34.2–38.1)	24.6	4.9 (16.2–35.5)
25–34	10.7	25.3	0.2 (24.9–25.7)	29.1	0.3 (28.6–29.6)		14.5	0.4 (13.8–15.3)	17.4	3.5 (11.5–25.4)
35–54	22.6	40.2	0.2 (39.7–40.7)	39.0	0.3 (38.4–39.6)		24.6	0.5 (23.7–25.6)	38.0	4.8 (29.2–47.4)
55–64	11.2	16.3	0.2 (15.9–16.7)	12.6	0.2 (12.2–13.0)		10.1	0.3 (9.6–10.7)	16.6	4.4 (9.7–27.1)
65 and over..........	16.1	5.5	0.1 (5.3–5.7)	4.1	0.1 (3.9–4.3)		14.6	0.5 (13.6–15.6)	3.4	2.0 (0.6–9.9)
Female	55.3	43.6	0.3 (43.1–44.1)	42.5	0.3 (41.9–43.1)		55.4	0.3 (54.7–56.0)	42.2	3.9 (34.8–49.9)
24 and under..........	34.4	14.0	0.2 (13.7–14.3)	17.1	0.2 (16.7–17.5)		32.7	0.9 (30.9–34.4)	21.1	6.3 (11.2–36.0)
25–34	15.2	26.5	0.2 (26.1–26.9)	29.8	0.3 (29.3–30.3)		17.3	0.4 (16.6–18.0)	25.6	4.6 (17.6–35.7)
35–54	23.0	38.6	0.2 (38.1–39.1)	36.0	0.3 (35.4–36.6)		24.3	0.5 (23.4–25.2)	25.2	4.4 (17.6–34.7)
55–64	9.5	13.3	0.2 (13.0–13.6)	10.8	0.2 (10.4–11.2)		9.3	0.3 (8.8–9.8)	16.4	4.1 (9.8–26.2)
65 and over..........	18.0	7.7	0.1 (7.4–8.0)	6.3	0.1 (6.0–6.6)		16.5	0.5 (15.6–17.5)	11.7	3.4 (6.5–20.1)

… Category not applicable.
0.0 Quantity more than zero but less than 0.05.

NOTES: National Hospital Care Survey (NHCS) data are unweighted and not nationally representative. National Hospital Ambulatory Medical Care Survey (NHAMCS) data are weighted and nationally representative. NHCS (all *International Classification of Diseases, Ninth Revision, Clinical Modification* [ICD–9–CM] codes) results are based on information from up to 25 diagnosis codes. NHCS (comparable number of ICD–9–CM codes) results are based on information from up to five diagnosis codes, the same amount available in NHAMCS.

SOURCES: National Center for Health Statitics, National Hospital Care Survey, 2014, and National Hospital Ambulatory Medical Care Survey, 2013–2015.

Technical Notes

For detailed information on sample design, data collection, claims deduplication, and patient identification, see the Methods and Technical Notes sections in "National Hospital Care Survey Demonstration Projects: Traumatic Brain Injury," available from: https://www.cdc.gov/nchs/data/nhsr/nhsr097.pdf.

For more NCHS NHSRs, visit:
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