HHS Public Access

Author manuscript

Subst Abus. Author manuscript; available in PMC 2023 January 01.

Published in final edited form as:

Subst Abus. 2022 ; 43(1): 253–259. doi:10.1080/08897077.2021.1941505.

The impact of obesity in patients hospitalized with opioid/opiate overdose

Paul Archibald, DrPH, LCSW-C[1], **Kavitha Subramoney, MD**[2], **Hind A. Beydoun, PhD, MPH**[3], **Ché Matthew Harris, MD MS FACP**[4]

[1] School of Health Sciences, Department of Social Work, City University of New York, United States of America

[2] Department of Medicine, Division of Hospital Medicine, University of Indiana, United States of America

[3] Department of Research Programs, Fort Belvoir Community Hospital, Fort Belvoir, Virginia, United States of America

[4] Department of General Internal Medicine, Johns Hopkins School of Medicine, Division of Hospital Medicine, Johns Hopkins Bayview Medical Center, Baltimore, Maryland, United States of America

Abstract

BACKGROUND: Although a direct link between opioid use in obese patients and risk of overdose has not been established, obesity is highly associated with higher risk for opioid/opiate overdose. Evidence for clinical impact of obesity on patients with opioid/opiate overdose is scarce. The aim of this study was to determine effects of obesity on healthcare outcomes and mortality trends in hospitalized patients who presented with opioid/opiate overdose in the United States between 2010 and 2014.

Corresponding author: Paul Archibald, DrPH, LCSW-C, College of Staten Island, City University of New York, paul.archibald@csi.cuny.edu.

Authors' Contributions

PA, CH, and KV were involved in conceptualization for the study and its design. CH and HB contributed to the statistical analysis of the study. PA, CH, and KV all helped in writing and editing the manuscript. All authors reviewed and approved the final manuscript.

Competing interests

The authors declare that they have no competing interests.

DECLARATIONS SECTION

Ethics approval and consent to participate

The study was not submitted for research ethics approval as the activities described were conducted as part of the National Inpatient Sample (NIS), which is part of the family of databases and software tools developed for the Healthcare Cost and Utilization Project (HCUP) and uses de-identified data collected from hospitalized patients. The study activities obtained from NIS are exempt from the Johns Hopkins' Institutional Review Board and do not require informed consent. For additional details, please refer to the following website links: https://www.hopkinsmedicine.org/institutional_review_board/guidelines_policies/guidelines/exempt_research.html; https://www.ecfr.gov/cgi-bin/retrieveECFR?gp=&SID=83cd09e1c0f5c6937cd9d7513160fc3f&pitd=20180719&n=pt45.1.46&r=PART&ty=HTML#se45.1.46_1104.

Consent for publication

Not applicable.

Disclaimer: The views expressed in this article are those of the authors and do not necessarily reflect the official policy or position of Fort Belvoir Community Hospital, the Defense Health Agency, Department of Defense, or U.S. Government. Reference to any commercial products within this publication does not create or imply any endorsement by Fort Belvoir Community Hospital, the Defense Health Agency, Department of Defense, or U.S. Government.

DESIGN: Multivariate logistic and linear regression analysis compared clinical outcomes and hospital resource utilization between obese and non-obese patients. Trend analysis of in-hospital mortality was also analyzed.

SETTING: United States.

PARTICIPANTS: 302,863 adults ?18 years and hospitalized with a principle diagnosis of opioid/opiate overdoses between 2010 and 2014.

MEASUREMENTS: Primary measurement was in-hospital mortality. Secondary measurements included respiratory failure, cardiogenic shock, mechanical ventilations/intubations, hospital charges, and length of stay.

FINDINGS: Prevalence for in-hospital mortality was lower in patients with obesity (2.2% vs 2.9%). Obese patients had higher adjusted odds for respiratory failure (aOR = 1.7, [(CI) 1.6–1.8]) and mechanical ventilation/intubation (aOR = 1.17, [(CI) 1.10–1.2]). They also had longer length of stays (aMD = 0.4 days, [(CI) 0.25–0.58 days] and higher total hospital charges (aMD = $5,561, [(CI) $3,638-$7,483]. Trends of in-hospital mortality for patients with obesity did not significantly increase (2.1% in 2010 to 2.4% in 2014, p trend=0.37), but significantly increased for non-obese patients (2.4% in 2010 to 3.4% in 2014; p trend <0.01).

CONCLUSIONS: Prevalence and trends of mortality was lower in patients with obesity hospitalized for opiate/opioid overdose compared to those without obesity between 2010–2014 in the United States.

Keywords

Opioid/Opiate Overdose; Obesity; Large Database; Hospitalizations; Hospital Mortality; United States

INTRODUCTION

Opioid overdose is now a leading cause of death in the United States (US), and rates of drug overdose deaths tripled between 1999 and 2014.[1] As a direct consequence, premature opioid overdose deaths have resulted in significant years of life lost in this patient population.[2,3] Hospitalizations for patients with obesity in the US also skyrocketed between the mid-1990s and mid-2000s, yet the impact of the obesity epidemic on patients hospitalized for opioid/opiate overdose is not clear.[4] Obesity and addiction are chronic conditions with a complex interaction between genetic and environmental factors.[5] Research has shown associations between obesity and opioids/opiates with other addictions like sugar consumption.[6] Researchers have proposed that alterations in anatomy and physiology of obese patients may affect their response to opioid exposure.[7] Further, the obesity epidemic may account for increased demand of opioid prescription use linked to chronic pain. Although a direct link between opioid use in obese patients and risk of overdose has not been established, obesity is highly associated with complications of chronic pain and these patients are more likely to be prescribed opioid/opiates.[8]

Opioid Induced Respiratory Disease (OIRD) is the main cause of death in patients who succumb from opioid/opiate overdose.[9] Compared to non-obese patients, OIRD in patients

with obesity may be difficult to treat because of compromised pulmonary physiology, increased restrictive effects on lung function and reduction in functional residual capacity.[10] Zuckerman and colleagues reported that patients with obesity were more likely to have pain, thus, requiring more analgesics.[7] This may theoretically place them at higher risk for overdose of prescribed pain medicines. In addition, critically ill patients with obesity have been noted to have a high morbidity and mortality.[11] Because of these factors, we hypothesized that patients with obesity who presented with opioid/opiate overdose would have poorer clinical outcomes and higher use of hospital resources compared to the general population. We used the Nationwide Inpatient Sample (NIS) database for years 2010–2014 to study the impact of opioid/opiate overdoses on patients with obesity.

METHODS

Data sources and study population

Using the NIS, we pooled data from 2010 to 2014. NIS has patient data obtained by the Agency for Healthcare Research and Quality for the Healthcare Cost and Utilization Project.[12] It is one of the largest national all-payer inpatient care databases. It is a stratified probability sample representing all non-federal acute care inpatient hospitalizations within the United States (US). A twenty percent probability sample of all discharges from US hospitals in each stratum is used with information regarding diagnoses, hospital charges, length of stays, and demographics. Every discharge is weighted to make NIS nationally representative, using de-identified clinical and nonclinical data, protecting privacy of patients, care providers, and hospital systems. From 2010 to 2014, NIS included over 7 million discharges for each study year from over 4,000 hospitals in 44 states across the US.[12]

Study population—Patients were included in the study if they were age ≥18 years, had a principal diagnosis of opiate or opioid overdose (Figure 1). The following ICD-9-CM codes were used to identify eligible admissions:

> Poisoning by analgesic: 965.0 (Opiates), 965.00 (Opium), 965.01 (Heroin), 965.02 (Methadone), 9650.09 (Other: Codeine, Meperidine, Morphine), E850.0 (Accidental poisoning by methadone), E850.1 (Accidental poisoning by methadone), E850.2 (Accidental poisoning by other opiates).

Study outcomes

In-hospital mortality was the primary clinical outcome measure. Secondary clinical outcome measures included respiratory failure (ICD-9 35.11, 35.22, 35.22), cardiogenic shock (ICD-9, 785.51,), and cardiac arrest (ICD-9 35.11, 35.22, 35.22). We also looked at mechanical ventilation/intubations that were coded during hospitalizations (ICD-9 96.70, 96.71, 96.72, 96.0, 96.01, 96.02, 96.03, and 96.04). Additionally, resource utilization outcome measures included hospital length of stay (LOS) and total hospital charges. Finally, we investigated trend analysis of in-hospital mortality for patients with obesity over the 5-year study period.

Patient and hospital characteristics

The exposure of interest was obesity status, and the following ICD-9-CM codes were used to determine those patients who were obese (≥ 30):

> BMI 30 to 31.9 [ICD-9 V85.30–V85.31], BMI 32 to 33.9 [ICD-9 V85.32–V85.33], BMI 34 to 35.9 [ICD-9 V85.34–V85.35], BMI 36 to 37.9 [ICD-9 V85.36–V85.37], BMI 38 to 39.9 [ICD-9 V85.38–V85.39], BMI 40 to 49.9 [ICD-9 V85.41–V85.42], BMI ≥ 50 [ICD-9 V85.43–V85.45], and 278.01.

Patient and hospital level variables characteristics were analyzed and included as confounders in the model. The patient level variables included: age, race, gender, co-morbidities, insurance, and median household income in the patient's zip code. In addition, if the patient had any history for benzodiazepine use or overdose, this was included in the model based on the following ICD-9 code (969.4, E853.2, and E939.4). Patient comorbidities were obtained using the Charlson comorbidity index. The Charlson comorbidity index variable can be downloaded using Stata©.[12] Hospital variables were: location (region in the U.S), volume capacity, and teaching status. The Johns Hopkins University School of Medicine's Institutional Review Board determined the study was exempt from approval because it involved retrospective analyses of publicly available de-identified data.

Statistical analyses

Patient demographics, co-morbidities, and hospital characteristics were compared for the years 2010 to 2014 using Pearson's χ^2 test for categorical variables along with one-way analysis of variance for continuous variables. Yearly rates for studied outcomes were adjusted for the multiple confounders listed above using predictive margins.

All categorical data were presented as proportions/percentages. Logistic regression was used to calculate unadjusted and adjusted odds ratios comparing inpatient mortality, respiratory failure, cardiogenic shock, cardiac arrest, and mechanical ventilation/intubations. Adjusted/multivariate regression models included all variables that were found to be associated with the outcome on univariate analysis with a p-value cutoff of 0.2. We also included patient and hospital variables determined important for outcomes based on prior studies.

Stata 15.0 (StataCorp, College Station, TX) was used to perform all statistical analyses. These analyses accounted for survey design complexity (stratification, clustering, and weighting to produce nationally representative results) based on Healthcare Cost and Utilization Project NIS' analytic guidelines for incorporating sampling weights, primary sampling units, and strata.[12] All p values were two-sided and type I error was 0.05.

RESULTS

In-hospital visits involving opioid/opiate overdose with and without obesity, 2010–2014

Between 2010 and 2014, 302,862 adult patients age ≥18 years were hospitalized for opiate/opioid overdose. Of these, 30,726 were obese and 265,571 were not obese (Table 1). Those classified as obese were older (mean age: 53±0.2 vs. 48±0.1 years), more often female

(64.9% vs 50.1%), had higher Charlson comorbidity scores ≥ 3: 26.7% vs. 13.9%), greater burden of pulmonary circulatory disorders (5.2% vs. 1.8%) and chronic lung disease (38.9% vs. 24.5%), and more heart failure (17.0% vs. 6.8%).

In-hospital mortality and clinical outcomes

Compared to those without obesity, patients with obesity made up a greater proportion with respiratory failure (43.3% vs 31.9%). Obese patients also had lower prevalence of in-hospital mortality (2.2% vs. 2.9%) and cardiac arrest (2.0 vs 2.5%). There was no difference in prevalence of cardiogenic shock between patients with and without obesity (0.5% vs 0.47%). Following multivariate adjustment for demographic, clinical and hospital characteristics, patients with obesity had a non-significantly lower odds for in-hospital mortality (OR = 0.5, [(CI) 0.25–1.1]). Obese patients had higher odds for respiratory failure (OR = 1.7, [(CI) 1.6–1.8]) and mechanical ventilation/intubation (OR = 1.17, [(CI) 1.10–1.2]). Both non-obese and obese patients had similar odds for developing cardiac arrest (OR = 0.95, [(CI) 0.77–1.1]) and cardiogenic shock (OR = 1.2, [(CI) 0.81–1.9]).

Trend analysis of in-hospital mortality

The time trend from 2010 to 2014 for in-hospital mortality for patients presenting with opioid/opiate overdose comparing patients with and without obesity is noted in the Figure 2. Non-obese patients had higher mortality compared to those without obesity. There was a significant increase in in-hospital mortality for non-obese patients (2.4% in 2010 to 3.4% in 2014). For patients who were obese, there was a non-significant rise for in-hospital mortality over the studied time period (2.1% in 2010 to 2.4% in 2014).

Resource utilization

Patients with obesity had higher mean length of stay (4.8 vs. 3.8 days) and overall higher total hospitalization charges ($43,824 [CI: $42,173- $45,474] vs. $34,334 [CI: $33,556-$35,112]). Similarly, multivariate analyses indicated that patients with obesity had a longer length of stay (aMD = 0.4 days, [(CI) 0.25–0.58 days] and higher total hospital charges (aMD = $5,561, [(CI) $3,358-$7,483].

DISCUSSION

As the crises of both the opioid and obesity epidemics continue to prevail, hospitalizations of this patient population are also expected to increase. Our study found that obesity is a significant risk factor for respiratory failure and higher use of hospital resources in patients hospitalized with opioid/opiate overdose. Despite these findings, however, we did not estimate higher odds for in-hospital mortality, cardiac arrest or cardiogenic shock in patients hospitalized with opioid/opiate overdose who were obese compared to non-obese patients. Our findings suggest that patients with obesity and opioid/opiate overdose require longer and much more intensive care during hospitalizations, which may be necessary to achieve similar odds of mortality in patients who are not obese. To our knowledge, this is one of the largest studies that has investigated the effects of obesity on opioid/opiate overdose in hospitalized patients on a national level.

Research has found increased severity of preexisting lung disease in patients with obesity which may be exacerbated in the setting of opioid/opiate overdose.[13–15] Our study also indicated that patients with obesity had higher pulmonary comorbidities, which might explain why they had higher rates of respiratory failure and intubations. Another large database study conducted by Izrailtyan and colleagues found that obesity increased the risk for in-hospital cardiopulmonary and respiratory arrest in medical/surgical patients who presented with respiratory failure after being prescribed opioids.[16] Our study was similar in that patients with obesity had higher odds for respiratory failure. However, unlike Izrailtyan and his colleagues, we did not see higher odds or prevalence for cardiac arrest. Additionally, the impact of obesity on mortality was not described by Izrailtyan and his colleagues. In another study, Burton and colleagues found an increasing trend in hospital mortality in the general population from 2010–2014 in the U.S. for patients with opioid overdose, but also did not investigate obesity.[17] We found a similar increasing trend in hospital mortality over the same time period for non-obese patients with opioid/opiate overdose, but we did not see a significant increase in mortality for those with obesity.

The current study supports previous research indicating that patients with obesity have longer stays in the hospital and utilize more hospital resources.[18,19] Our study is unique in that it identified obesity as a risk factor for these outcomes in patients presenting with opioid/opiate overdose. Patients in our study with obesity and opioid/opiate overdose had prolonged hospitalizations and higher hospital charges. Though observational studies cannot determine the causes of such findings, several factors should be considered, which may possibly explain higher hospital resource utilizations. First, patients with obesity and opioid/opiate overdose were sicker compared to those without obesity — suggested by higher respiratory failure and need for mechanical ventilation/intubation which requires critical care and prolonged hospitalizations. Additionally, obese patients hospitalized with opioid/opiate overdose had more comorbidities contributing and not contributing to their hospitalization that required management.

Researchers have increasingly found that there is an over-grading severity of preexisting lung disease in patients with obesity coupled with the fact that the respiratory system is highly affected during an opioid overdose — which may account for these results.[9,13,15] Interestingly, despite no difference being found in the odds of in-hospital mortality when comparing obese to non-obese patients with opioid/opiate overdose, the prevalence and trend of in-hospital mortality was lower in individuals who were diagnosed with obesity. This might possibly be explained by the obesity *paradox* which refers to the protective effect on clinical outcomes in patients with obesity compared to those without obesity — and recent studies show the effect of an ‘obesity paradox’ on chronic disease mortality.[20,21] Some studies have alluded to the obesity paradox in COPD patients as well.[22,23] Additional studies will need to be conducted to further assess survival outcomes in hospitalized patients with obesity and opioid/opiate overdose. Many public health interventions geared towards reducing the impact of obesity on opioid use have centered on chronic pain. Our results underscore the importance of recognizing patients admitted to the hospital for opioid overdose. Even further, our study indicates the need to address hospitalization outcomes of obese patients who are admitted for opioid overdose.

Strengths and Limitations

This study has several strengths that should be acknowledged: 1) the study is among the first and one of the largest national studies that has investigated the effects of obesity on opioid/opiate overdose in hospitalized patients; 2) the study was able to use a very large database that could capture much of the United States, and results should be a good representative of the obesity and opioid/opiate crisis on patients and the national healthcare system.

Although there are some identified strengths, there are several limitations to our study that should be considered. First, our data was obtained from an administrative database. In so doing, the heavy reliance on personnel to accurately incorporate ICD-9-CM codes may have led to missed codes or codes being documented inaccurately.[24] Second, this could have led to the under-coding of obesity as well as opioid overdose; third, our study used a sample database that does not have emergency department (ED) visits. A recent article confirmed that the ED is an underutilized venue for identification and treatment of patients with substance abuse.[25] Given our large sample size in addition to most patients requiring hospitalizations in the setting of overdose, we suspect our data accurately reflects the national population. Fourth, NIS does not capture detailed histories, and we could not determine if opioid overdose was in the setting of recently prescribed opioids. Fifth, given under-coding, we could not determine if many of the patients had chronic pain vs acute pain vs opioid abuse condition leading up to the hospitalization. Additionally, we were not able to determine opioid type, dosage, route, or frequency of administration prior to hospitalization. Finally, though we took benzodiazepines into account in our models, we could not account for all potential sedatives that might have impacted outcomes.

CONCLUSIONS

In conclusion, the data suggest that obesity does have some impact on hospitalization outcomes of patients hospitalized for opioid/opiate overdose. Patients with obesity presenting with opioid/opiate overdose are more likely to develop respiratory failure, require higher hospital resource use, but lower prevalence and rates of in-hospital mortality. Future studies should examine the effect of ‘obesity paradox’ on opioid/opiate overdose so that innovative interventions might be developed and implemented to increase the survival rate of patients with opioid/opiate overdose. Our results underscore the importance of documenting the obesity status of patients admitted to the hospital for opioid/opiate overdose; which may provide us with another area of focus in the fight to reduce the public health burden of opioid/opiate overdose.

Availability of data and materials

Researchers should readily be able to purchase the same databases we did to conduct research here: https://www.distributor.hcup-us.ahrq.gov/Databases.aspx. The authors did not have special access privileges to the NIS databases. Contact information for further guidance on purchase and download at vog.qrha@rotubirtsiDPUCH.

REFERENCES

1. Centers for Disease Control and Prevention. https://www.cdc.gov/drugoverdose/index.html. Accessed December 7, 2019.
2. Gomes T, Tadrous M, Mamdani MM, Paterson JM, Juurlink DN. The burden of opioid-related mortality in the United States. JAMA Netw Open. 2018;1(2).
3. Rudd RA, Seth P, David F, Scholl L. Increases in drug and opioid-involved overdose deaths - United States, 2010–2015. MMWR Morb Mortal Wkly Rep. 2016 Dec 30;65(50–51):1445–1452. [PubMed: 28033313]
4. Weiss AJ, Elixhauser A. Obesity-Related Hospitalizations, 2004 versus 2009: Statistical Brief #137. In: Healthcare Cost and Utilization Project (HCUP) Statistical Briefs [Internet]. Rockville, MD: Agency for Healthcare Research and Quality; 2006–2012.
5. Volkow ND & Wise RA. How can drug addiction help us understand obesity? Nature Neuroscience. 2005;8(5):555–560. [PubMed: 15856062]
6. Mysels DJ, Sullivan MA. The relationship between opioid and sugar intake: review of evidence and clinical applications. J Opioid Manag. 2010;6(6):445–452. doi:10.5055/jom.2010.0043 [PubMed: 21269006]
7. Zuckerman M, Greller HA, Babu KM. A review of the toxicologic implications of obesity. J Med Toxicol. 2015;11(3):342–354. doi:10.1007/s13181-015-0488-6 [PubMed: 26108709]
8. Stokes A, Berry KM, Collins JM, Hsiao CW, Waggoner JR, Johnston SS, … Manson JE The contribution of obesity to prescription opioid use in the United States. Pain. 2019;160(10):2255–2262. doi:10.1097/j.pain.0000000000001612 [PubMed: 31149978]
9. Dahan A, Aarts L, Smith TW.; Incidence, reversal, and prevention of opioid-induced respiratory depression. Anesthesiology. 2010;112(1):226–238. doi: 10.1097/ALN.0b013e3181c38c25. [PubMed: 20010421]
10. Mandal S, Hart N. Respiratory complications of obesity. Clin Med (Lond). 2012;12(1):75–78. doi:10.7861/clinmedicine.12-1-75 [PubMed: 22372230]
11. El-Solh A, Sikka P, Bozkanat E, Jaafar W, Davies J. Morbid obesity in the medical ICU. Chest. 2001;120(6):1989–1997. [PubMed: 11742933]
12. National Inpatient Sample. https://www.hcup-us.ahrq.gov/nisoverview.jsp. Accessed November 3, 2019.
13. Barbarito N, De Mattia E. Grading the severity of obstruction in patients with chronic obstructive pulmonary disease and morbid obesity. Monaldi Arch. Chest Dis. 2013;79(3–4). 10.4081/monaldi.2013.11
14. Dahan A, Overdyk F, Smith T, Aarts L, Niesters M. Pharmacovigilance: A review of opioid-induced respiratory depression in chronic pain patients. Pain Physician. 2013;16(2):E85–E94. [PubMed: 23511694]
15. Kuo A, Wyse BD, Meutermans W, Smith MT. In vivo profiling of seven common opioids for antinociception, constipation and respiratory depression: no two opioids have the same profile. Br J Pharmacol. 2015;172(2):532–548. doi:10.1111/bph.12696 [PubMed: 24641546]
16. Izrailtyan I, Qiu J, Overdyk FJ, Erslon M, Gan TJ. Risk factors for cardiopulmonary and respiratory arrest in medical and surgical hospital patients on opioid analgesics and sedatives. PLoS One. 2018;13(3):e0194553. Published 2018 Mar 22. doi:10.1371/journal.pone.0194553 [PubMed: 29566020]
17. Burton BN, Lin TC, Said ET, Gabriel A. National trends and factors associated with inpatient mortality with opiod overdose. Anesth Analg. 2019;128(1):152–160. [PubMed: 30198926]
18. Nguyen AT, Tsai CL, Hwang LY, Lai D, Markham C, Patel B. Obesity and mortality, length of stay and hospital cost among patients with sepsis: A nationwide inpatient retrospective cohort study. PLoS One. 2016;11(4):e0154599. [PubMed: 27124716]
19. Mallow PJ, Belk KW, Topmiller M, Strassels SA. Geographic variation in hospital costs, payments, and length of stay for opioid-related hospital visits in the USA. J Pain Res. 2018;11:3079–3088. doi:10.2147/JPR.S184724 [PubMed: 30584350]
20. Pokharel Y, Sun W, Virani SS, et al. Myocardial Injury, Obesity, and the Obesity Paradox: The ARIC Study. JACC Heart Fail. 2017;5:56–63. [PubMed: 28017350]

21. Spartalis M, Tzatzaki E, Moris D, Athanasiou A, Spartalis E. Morbidity, mortality, and obesity paradox. Ann Transl Med. 2017;5(21):440. doi:10.21037/atm.2017.08.31 [PubMed: 29201891]

22. Yamauchi Y, Hasegawa W, Yasunaga H, Sunohara M, Jo T, Takami K., … Nagase T. Paradoxical association between body mass index and in-hospital mortality in elderly patients with chronic obstructive pulmonary disease in Japan. Int J Chron Obstruct Pulmon Dis. 2014;9:1337–1346. Published 2014 Dec 9. doi:10.2147/COPD.S75175 [PubMed: 25525351]

23. Iyer AS, Dransfield MT. The "Obesity Paradox" in Chronic Obstructive Pulmonary Disease: Can It Be Resolved?. Ann Am Thorac Soc. 2018;15(2):158–159. doi:10.1513/AnnalsATS.201711-901ED [PubMed: 29388820]

24. Hashimoto RE, Brodt ED, Skelly AC, Dettori JR. Administrative database studies: goldmine or goose chase? Evid Based Spine Care J. 2014;5:74–6. [PubMed: 25278880]

25. Ellison J, Walley AY, Feldman JA, Bernstein E, Mitchell PM, Koppelman EA, Drainoni ML. Identifying Patients for Overdose Prevention with ICD-9 Classification in the Emergency Department, Massachusetts, 2013–2014. Public Health Rep. 2016;131(5): 671–675. [PubMed: 28123207]

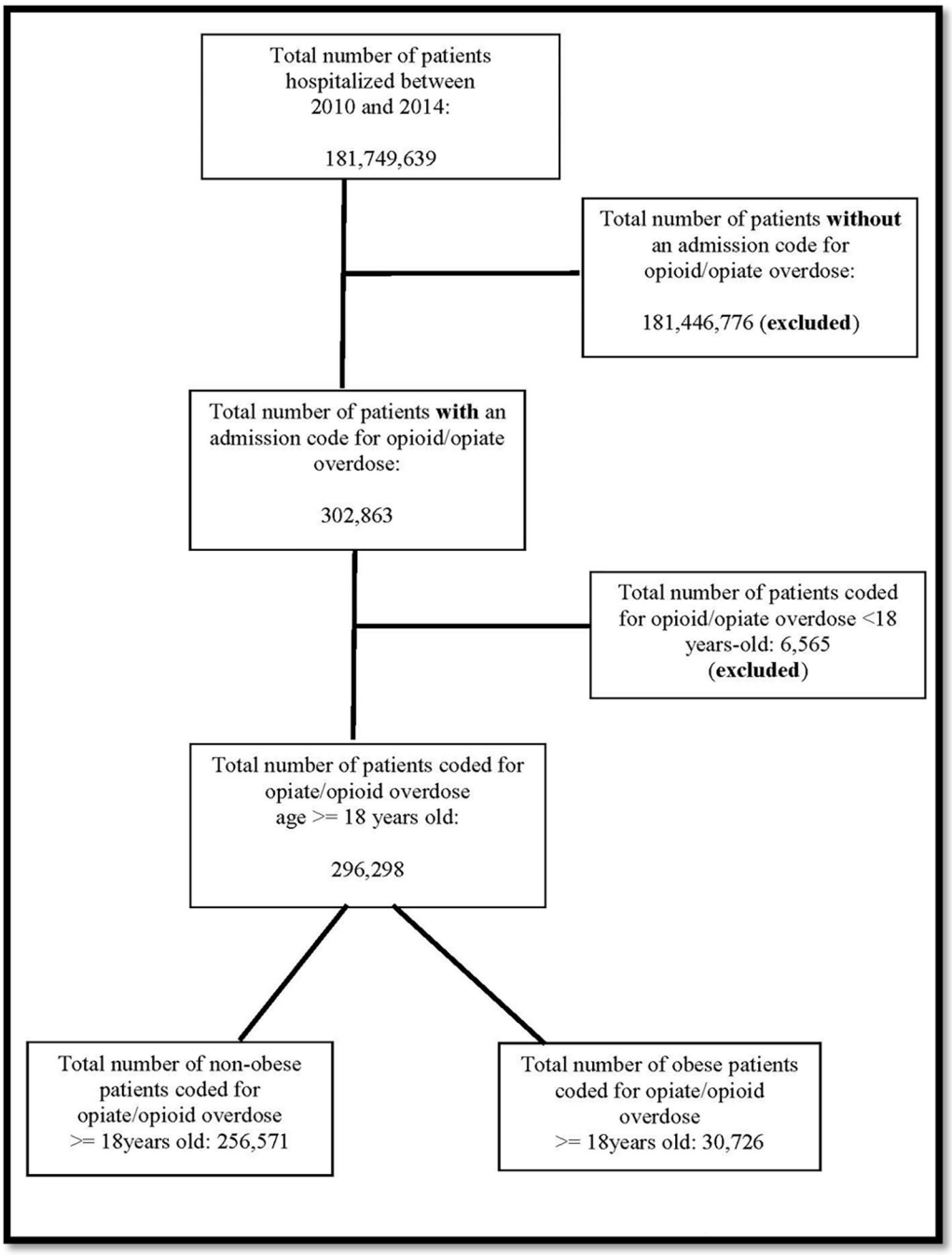

Figure 1.
Patient identification flow diagram, 2010–2014

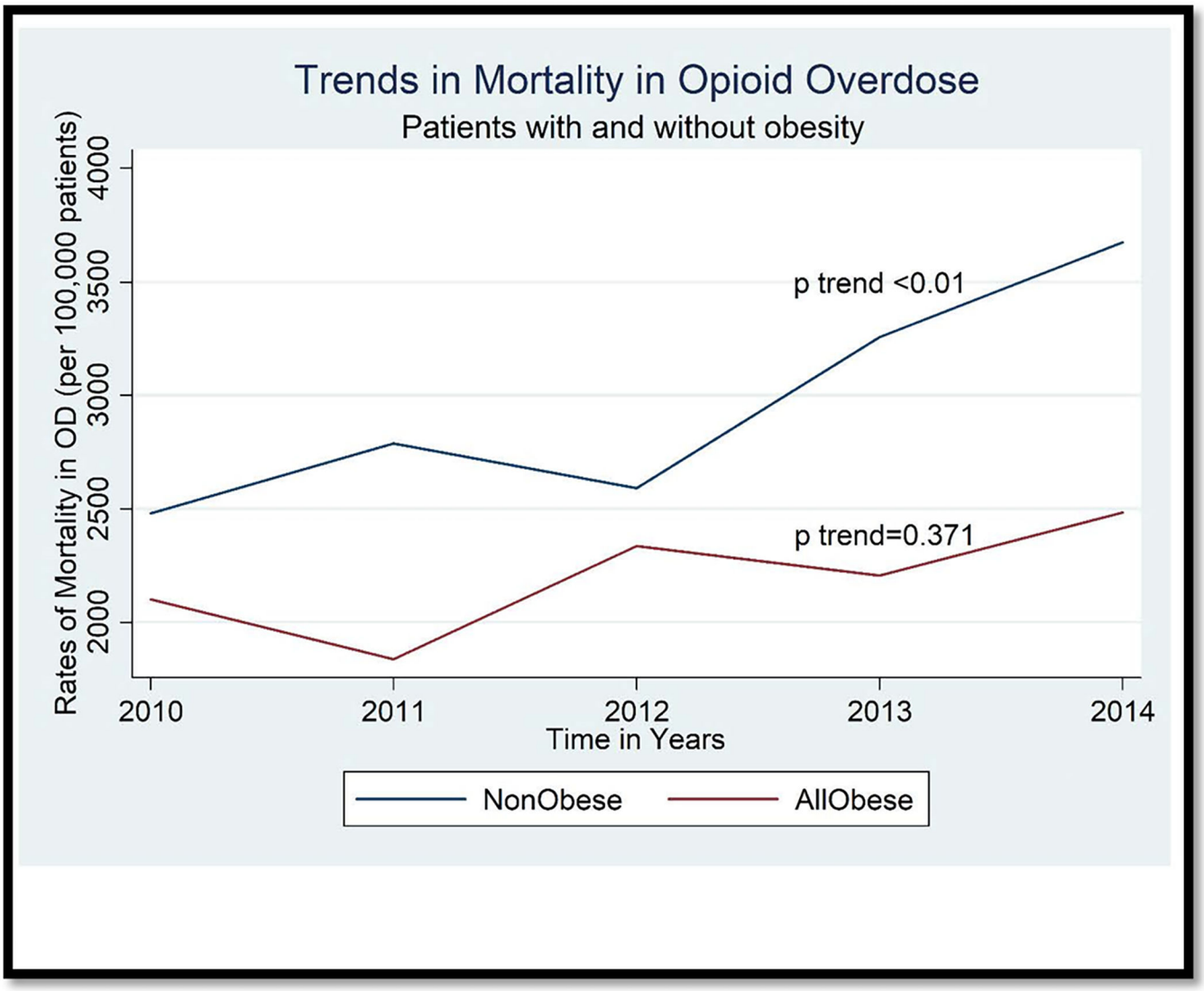

Figure 2.
Trends of in-hospital mortality in patients who opioid/opiate overdose (obese vs non-obese)

Table 1:

Demographics comparing patients with and without obesity who presented with opioid/opiate overdose, National Inpatient Sample (2010–2014)

Patient characteristics and outcomes	Non-obese patients N = 265,571	Obese patients N = 30,726
Characteristics		
Age (years) (mean ± SE)	48.0 ± 0.1	53.0 ± 0.2
Female, n (%)	133,051 (50.1)	19,941 (64.9)
Race, (%)		
White	214,846 (81.0)	24,058 (78.3)
Black	23,370 (8.8)	3,410 (11.1)
Hispanic	17,262 (6.5)	2,212 (7.2)
Asian or Pacific Islander	1,593 (0.6)	153 (0.5)
Native American		
Charlson comorbidity score, n (%)		
0	136,769 (51.5)	8,265 (26.9)
1	61,612 (23.2)	8,357 (27.2)
2	29,743 (11.2)	5,868 (19.1)
3 or more	36,914 (13.9)	8,203 (26.7)
Comorbidities, (n%)		
Acquired Immunodeficiency Syndrome	1,699 (0.64)	61 (0.2)
Alcohol misuse	43,288 (16.3)	2,673 (8.7)
Heart failure	18,058 (6.8)	5,223 (17.0)
Chronic lung disease	65,064 (24.5)	11,952 (38.9)
Depression	67,720 (25.5)	8,695 (28.3)
Uncomplicated Diabetes Mellitus	32,930 (12.4)	9,463 (30.8)
Complications of Diabetes Mellitus	9,294 (3.5)	3,226 (10.5)
Pulmonary Circulation disorders	4,780 (1.8)	1,597 (5.2)
Renal failure	18,855 (7.1)	4,485 (14.6)
Median income in patient's zip code, n (%)		
$1–$38,999	86,576 (32.6)	9,863 (32.1)
$39,000–$47,999	70,376 (26.5)	8,603 (28.0)
$48,000–$62,999	62,143 (23.4)	7,189 (23.4)
$63,000 or more	45,943 (17.3)	5,008 (16.3)
Insurance type, n (%)		
Medicare	100,120 (37.7)	15,485 (50.4)
Medicaid	66,923 (25.2)	7,189 (23.4)
Private	54,442 (20.5)	5,899 (19.2)
Uninsured	43,288 (16.3)	2,089 (6.8)
Hospital volume, n (%)		
Small	37,976 (14.3)	4,178 (13.6)
Medium	73,563 (27.7)	8,357 (27.2)

Patient characteristics and outcomes	Non-obese patients N = 265,571	Obese patients N = 30,726
Large	153,500 (57.8)	18,159 (59.1)
Hospital region, n (%)		
Northeast	47,537 (17.9)	4,455 (14.5)
Midwest	58,160 (21.9)	6,575 (21.4)
South	101,979 (38.4)	11,798 (38.4)
West	57,363 (21.6)	7,835(25.5)
Teaching hospital, n (%)		
Non-teaching	151,375 (57.0)	18,066 (58.8)
Teaching	113,929 (42.9)	12,628 (41.1)

Table 2:

Inpatient outcomes in patients with and without obesity who presented with opiate/opioid overdose 2010–2014

In-hospital outcomes	Non-obese patients N=265,571	Obese patients N=30,726
Clinical outcomes		
Cardiogenic Shock, n (%)	1,248 (0.47)	153 (0.5)
Respiratory failure, n (%)	84,717 (31.9)	13,304 (43.3)
Mechanical vent/intubation, n (%)	57,894 (21.8)	6,944 (22.6)
In-hospital mortality n (%)	7,701 (2.9)	676 (2.2)
Cardiac Arrest, n (%)	6,639 (2.5)	614 (2.0)
Resource utilization outcomes		
Mean Length of stay, mean (95% CI)	3.88 (3.83–3.94 days)	4.8 (4.7–4.9 days)
Mean total hospital charges, mean (95%)	$34,334 ($33,556–$35,112)	$43,824 ($42,173–$45,474)