ORIGINAL ARTICLE

Hospitalized patients co-diagnosed with infective endocarditis and opioid drug dependence in Florida, 2015-2018

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ABSTRACT

Objective: As the opioid addiction epidemic continues to grow, other serious health issues regarding drug use has also increased. This study examines the trends in admissions and population characteristics of those who experience infective endocarditis with opioid drug dependence.

Methods: We used ICD-9-CM and ICD-10-CM codes to identify patients admitted to a hospital with infective endocarditis and with a secondary diagnosis of opioid use related disorders using data released by the Florida Agency for Health Care Administration (AHCA). Data included age, gender, ethnicity, race, discharge disposition, admission type, payer status, total charges, and zip code of patients' residence.

Results: During the four-year period, the percent of patients diagnosed with infective endocarditis and a diagnosis code associated with opioid abuse or dependence doubled (4.48% to 8.52%). Of the patients dually diagnosed, the mean age was 37.47 and the majority were white (90.78%), non-Hispanic (91.96%), and female (58.55%). Nearly 47% of the patients did not have health insurance. The percentage of patients with both diagnosis codes living in urban counties was 91.37%. Median length of stay was 10 days and median total charges for patients was $101,604.

Conclusions: With the increasing incidence of opioid dependence and addiction within the United States, there is a rise in infective endocarditis, a costly and debilitating disease. Our analysis provides the framework for hospital systems to identify patients who may benefit from addiction services, which through downstream effects will cause less of a health and financial burden.

Key Words: Opioid dependence, Infective endocarditis, hospitalizations

1. INTRODUCTION

It is well established that there is a dangerous link between intravenous (IV) drug use and infective endocarditis.[1] Recent epidemiological numbers suggest that an estimated 8%-37.8% cases of infective endocarditis in the last few years involve an injection drug user (IDU), with one tertiary center citing an annual incidence as high as 56%.[2] With opioid dependence disorder on a surge, medical centers throughout

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the nation are faced with a flood of patients requiring treatment of their infection as well as their addiction. This leads to a new set of questions as burden and cost to healthcare systems increase. Florida is not spared from this epidemic and is cited as having overall higher reported drug overdose deaths compared to the national average.[3]

As a nationwide epidemic, the current opioid crisis presents a puzzling problem for U.S. healthcare systems. Current numbers show that 128 people die daily from an opioid overdose (either illegal or prescription) and national trends suggest that each year more people die from drug overdoses (the majority being opioid) than died in the entirety of the Vietnam War, the Korean War or any armed conflict since the end of World War II.[4,5] What is more troubling is the effect that the Coronavirus Disease 2019 (COVID-19) will have on the already inflated numbers of patients with opioid dependence. A recent analysis by Niles, Gudin, et al found that positive drug screens increased by 35% for non-prescribed fentanyl, 44% for heroin, and 39% for opiates during the pandemic among individuals.[6] Strengthening this argument, the American Medical Association released an issue brief which highlights the growing number of patients with opioid use disorder after the COVID pandemic with a state-by-state breakdown.[7]

Although the opioid epidemic shows an increasing slope, there lies a lack of knowledge on the medical and financial disparities as well as the geographical distribution of patients with opioid use disorder and the actions taken after admission and discharge from healthcare systems. Further, while the link between infective endocarditis and IV drug use has been established, patients are still being admitted into hospitals due to addiction and reinfection.[8,9] Although single center hospital systems have tracked IV drug use in Florida, this only examined the patients in a safety-net hospital in Miami.[10] To our knowledge, no survey of the entire state of Florida and its diverse patient population looking at the characteristics and distributions of opioid dependent patients and total hospital charges associated with infective endocarditis treatment on healthcare systems has yet to be examined. As part of state law, all Florida hospitals are required to report detailed hospital discharge data to the Florida Agency for Healthcare Administration (AHCA). What follows is a retrospective analysis of AHCA hospitalization data for the years 2015-2018 of patients with ICD co-diagnosis codes for opioid dependence/abuse and infective endocarditis.

2. METHODS

Within AHCA, the Office of Data Collection and Quality Assurance (DCQA) collects patient discharge data from all licensed acute care hospitals, comprehensive rehabilitation hospitals, ambulatory surgical centers, and emergency departments.[11] Administrative data includes diagnosis and procedure codes, charges, and other patient characteristics as reported on the uniform billing form at the time of discharge. Our analysis included data from 214 acute care hospitals throughout Florida's 67 counties and included over 2.8 million hospital discharges per year. Data was analyzed from the years 2015 to 2018 and included age, gender, ethnicity, race, discharge disposition, admission type, payer status, total charges, and zip code of patients' residence.

We used International Classification of Diseases, 9th and 10th Revisions, Clinical Modification codes (ICD-9-CM, ICD-10-CM) to identify and filter patients in Florida hospitals using deidentified data released by AHCA. The infective endocarditis ICD-9 codes included 421, 4211, 4219, 11281, 3642, 9884, 11504, 11514, 11594, 4249, 42491, 42499 and for ICD-10, we included A3951, A5483, B376, B394, B395, B399, I330, I38, I39, I339. For opioid dependence, we used the codes outlined in the Appendix from the Agency for Healthcare Research and Quality Case Study: Exploring How Opioid-Related Diagnosis Codes Translate from ICD-9-CM to ICD-10-CM.[12]

This study was reviewed by the UF IRB Board (#201902977) and was provided with the IRB exempt status, due to its retrospective nature and the utilization of deidentified patient information. No patients were contacted, coerced, or solicited by the research team. No consent was required for participation in the study as all information was deidentified and readily available through AHCA for research.

Categorical data were summarized using counts (percentages) and the continuous data were summarized using medians (and quartiles). All statistical analyses were performed using the SAS statistical software, version 9.4. ArcGIS Desktop Release 10.8.1 was also used for the creation of thematic map.

3. RESULTS

3.1 Patient demographics

Of the over 11 million patients admitted to Florida hospitals between 2015 and 2018, there were 36,660 patients who were diagnosed with infective endocarditis. Of these patients, 2,463 were also diagnosed with opioid dependence. The number of patients with both diagnoses almost doubled from 2015 to 2018 (386 to 750 cases) as well as the percent of endocarditis patients who were diagnosed with opioid use disorder (see Table 1).

Table 1. Number of patients hospitalized with both opioid dependence diagnosis and infective endocarditis diagnosis – Florida, 2015-2018

Year	Patients with Opioid Dependence & Infective Endocarditis Diagnoses	Patients with Infective Endocarditis Diagnosis Only	Percent of Infective Endocarditis Patients Diagnosed with Opioid Dependence
2015	386	8,614	4.48
2016	613	9,895	6.20
2017	714	9,347	7.64
2018	750	8,804	8.52

Table 2. Characteristics of patients hospitalized with opioid use disorder and infective endocarditis– Florida, 2015-2018 (N = 2,463)

Characteristic No. (%)	
Age at Hospital Admission (Years)	
< 18	2 (0.08%)
18–25	266 (10.80%)
26–40	1,448 (58.79%)
41–60	611 (24.81%)
> 60	136 (5.52%)
Gender	
Male	1,021 (41.45%)
Female	1,442 (58.55%)
Ethnicity	
Non-Hispanic	2,265 (91.96%)
Hispanic	165 (6.70%)
Unknown	33 (1.34%)
Race	
African-American	111 (4.51%)
White	2,236 (90.78%)
Asian	8 (0.33%)
American Indian or Alaska Native	3 (0.12%)
Other	83 (3.37%)
Unknown	22 (0.89%)
Geographic Classification	
Rural	78 (3.17%)
Urban	2,204 (89.48%)
Unknown or Non-Florida Patient	181 (7.35%)
Insurance Payer	
Medicaid	677 (27.48%)
Medicare	244 (9.91%)
Commercial	267 (10.84%)
Tricare, VA or other federal government	21 (0.85%)
Self-pay/non-payment	1,157 (46.98%)
Other	97 (3.94%)

A descriptive analysis of patient data for all four years combined includes age, gender, race, ethnicity, payer status and whether the patient came from a rural or urban county (see Table 2). The mean age of patients was 37.47 years with a standard deviation of 12.22 years. The majority of patients were in the 26-40 age group (58.79%). Of the 2,463 admissions, 1,442 (58.55%) were females.

With regards to ethnicity, 165 (6.70%) were Hispanic/Latino and 2,265 (91.96%) were non-Hispanic with 33 patients with unknown ethnicity. The most common race was White which accounted for 2,236 (90.78%) patients then Black or African American, accounting for 111 patients (4.51%).

Regarding patient insurance status, 1,157 (46.98%) patients did not have health insurance (i.e., self-pay/non-payment) for their hospital admission, followed by patients with Medicaid coverage (27.48%). Only 266 (10.84%) patients paid using commercial health insurance.

According to 2010 census data of the state of Florida, there are 30 counties classified as being rural and 37 being classified as urban.[13] The percentage of patients with both diagnosis codes living in urban counties was 89.48%, whereas those living in rural counties was 3.17%. There was a total of 181 (7.35%) patients who lived in unknown Florida counties or lived outside the state of Florida based on the provided zip code of patient's residence.

3.2 County distribution

Pinellas County, an urban county located on the west central coast of Florida (includes St. Petersburg), with a populous of under 1,000,000 residents, had the highest incidence of patients with endocarditis and opioid dependence having 241 residents (9.78%). Notable counties with 5% or more of the co-diagnoses include: Brevard, Broward, Hillsborough, Palm Beach, Pasco, and Volusia counties. Figure 1 provides a heat map which shows the distribution of cases throughout Florida.

3.3 Admission status, discharge directions & length of stay

Of the 2,463 patients, 2,052 (83.31%) were admitted via emergency status as a result of severe, life threatening or potentially disabling conditions. The next common admission status was urgent because the patient required attention for the care and treatment of a physical or mental disorder

(11.57%). The remainder of admission status types that were used less often were elective, newborn and trauma (5.11%). Newborn status was most likely assigned to neonatal patients born after maternal overdose from opioid addiction. Most commonly, patients who had both of these diagnoses were split between being discharged to home/self-care (30.45%) or left against medical advice (28.66%). The median length of hospital stay was 10.00 days (lower quartile: 4, upper quartile: 25). The maximum amount of time that a patient stayed in the hospital was 182 days.

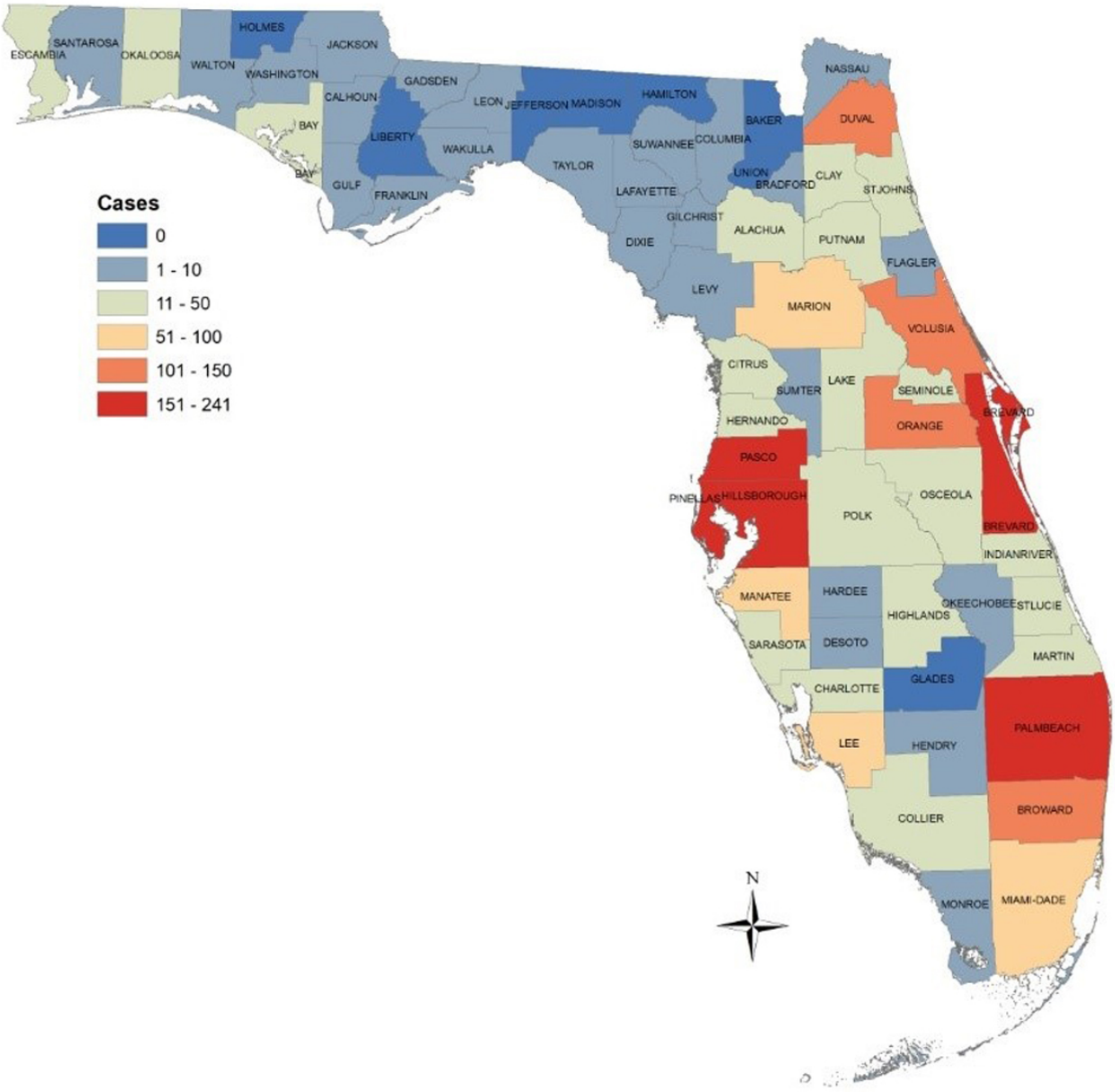

Figure 1. Hospitalizations with endocarditis and drug dependence in Florida hospitals 2015-2018

3.4 Hospital charges

The median total charges for these patients who were admitted into Florida hospitals during 2015-2018 was $101,604 (lower quartile: $47,060, upper quartile: $232,793). To note, this was the total charges billed and is not reflective of the actual amount paid by insurance or the patient. The minimum charge reported for a patient hospital stay was $1,323 while the maximum amount was $2,158,664.

4. Discussion

Regarding distribution of age frequency, to our knowledge, no age stratification of opioid dependence and endocarditis has been conducted previously looking specifically at the diverse patient population throughout the state of Florida.

Although a mean age of 37.47 was noted in our patient population, all age groups have seen a large spike in opioid overdoses and deaths nationally.[14] Our data aligned with what was uncovered in 2016 by Weiss and colleagues who examined national statistics in regard to age stratification of both diagnoses. An interesting finding was that females were more likely to have both diagnoses, even though it is well known that men are more likely to use illicit drugs and illicit drug use resulting in more emergency room visits.[15] However, this finding falls in line with other descriptors of disparities in health where women are more likely to have medical insurance and seek medical attention[16] and with other research done in the area of opioid use disorder and endocarditis coinfection.[10,17] Race distribution is noted to be consistent with opioid overdose deaths found in the state of Florida, where non-Hispanic whites are the most commonly affected followed by Hispanics, then Blacks.[18] Payer status showed that the majority of patients were self-pay followed closely by Medicaid coverage. This could be due to financial disparity, where individuals with a lower socioeconomic status feel pressure to engage in risky behaviors, resulting in unsafe needle practices which leads to a greater chance of contracting infective endocarditis.

Although it has been noted that rural counties have a higher prevalence of opioid overdose,[19] our findings indicate that the opposite holds true at least when considering a co-diagnosis of infective endocarditis. Nearly 30% of patients discharged from the hospital Left Against Medical Advice (LAMA). This is a large difference compared to all hospital diagnoses, in which LAMA is typically around 1%-2%.[20] This could be due to the social stigma of opioid drug use, the need to satisfy drug urges quickly, and fear of incarceration.

Length of stay was higher than the average length of stay for hospitalized patients. For these patients, the average length of stay was 17.16 days, where the national average has been found to be around 4.6 days.[21] Length of stay correlates with increasing healthcare costs, explaining our finding that median hospital charges were over $100,000.

Weiss and colleagues found that nationally between 2005 and 2014 the number of inpatient stays related to both opioid use disorder and endocarditis more than doubled. We found similar statistics in Florida, where the number of patients with coinfection between 2015 and 2018 essentially doubled (386 to 750 patients). Although initial strides have been made in addiction counseling services, there is still a pressing need to expand funding in this area.

Our intent by analyzing data of Florida's co-diagnosis of opioid use and endocarditis was to bring to the attention of healthcare administration the disparities in health of patients suffering from opioid use disorder and infective endocarditis. By providing a framework of the prototypical patient characteristics and the charges associated with care, we hope to illustrate the need to provide these patients with addiction counseling services and reduce hospital costs. Initiatives, such as Project Save Lives in Duval County implemented locally, have already shown to be effective in providing care to patients while decreasing costs;[22] it is our hope that a similar program can be passed state-wide to cover this gap in care. Addiction counseling services would allow not only a better quality of life for the patient, but also a lower financial burden to the patient and the healthcare system.

Our study is not without its limitations. Although the use of ICD diagnosis codes is common practice in surveillance of data, it is not a fool-proof method and depends on the codes assigned to the patient by the hospital for reimbursement purposes and is prone to subjective error by the coder and selective bias in maximizing reimbursement. Also, although both infective endocarditis diagnosis and opioid use disorder diagnosis were required for inclusion into the data set, IV opioid use may not have been the cause of infective endocarditis, as other contributors such as invasive heart procedures or dental manipulation have been known to cause the infection. However, since the link is so strongly suggested in past literature[1,2] the assumption is that opioid use disorder, at least in part, contributed to infective endocarditis. Further, in an observational study, Chen and colleagues concluded that dental manipulation does not increase the risk of infective endocarditis.[23] In addition, some patients who had opioid dependence issues may not have had the diagnosis included in their care plan to avoid social stigma and reporting of opioid dependence to insurance companies.

5. CONCLUSIONS

This retrospective analysis was intended to highlight some of the commonalities of patients who present to Florida hospital systems with a diagnosis of both opioid dependance and infective endocarditis to emphasize the need for addiction counseling for these patients. The typical patient with co-diagnosis in the state of Florida was found to be an urban living, young adult, white female who was either insured with Medicaid or who self-paid for care. Our analysis may provide the framework for hospital systems to identify potential patients who may benefit from addiction counseling services, which through downstream effects will cause less of a financial burden on Florida health systems. However, future research should validate the financial savings associated with this finding, as a cost benefit analysis is warranted to confirm feasibility. Further research and analysis should be conducted on the effect of the COVID-19 pandemic as

opioid overdoses have been on the rise, which may lead to an increase in infective endocarditis diagnosis and healthcare costs.

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CONFLICTS OF INTEREST DISCLOSURE

The authors declare they have no conflicts of interest.

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