

Non-Fatal Opioid Overdose and Abuse Visits to a University Hospital Emergency Department in Puerto Rico, 2009-2018

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Objective: The objective was to describe opioid-use trends (2009–2018) at a university hospital emergency department (ED) in metropolitan San Juan, Puerto Rico.

Methods: The ED database of the University of Puerto Rico - Dr. Federico Trilla Hospital provided the data for the study.

Results: Non-fatal opioid overdoses surged 7.5-fold, increasing from 12.1 (± 2.5) per 100,000 ED encounters for 2009 through 2016 to 91.2 (± 8.7) per 100,000 ED encounters for 2017 through 2018 ($P < .0001$). Starting in summer 2017, the surge reached its peak in October after two major hurricanes. The opioid-related ED cases comprised 15.8% from 2009 through 2016, increasing to 67% in 2017 through 2018. Prior to October 2015, multiple drugs were mentioned in 65% of the opioid-related cases, decreasing to 37% of the total cases, thereafter. Cocaine was reported in combination with opioids in 53% of all opioid-related cases from August 2009 through September 2015, decreasing to 21% from October 2015 through December 2018, cannabis in 15% and 10%, respectively, and alcohol in 10% and 6%, respectively. Amphetamines were mentioned once in combination with opioids. The overall male:female ratio for all opioid-related cases was 6.3 (rate: 8.8).

Conclusion: The data show an increase in opioid-toxicity cases in the area served by the above-named hospital beginning in mid-2017. Opioid-related cases overwhelmingly involved male patients. More work is needed to establish island-wide trends. [*PR Health Sci J* 2023;42(2):111-120]

Key words: Opioid overdose, Emergency department, ICD code

The US mainland is experiencing an epidemic of opioid-related overdose deaths (Supplementary material [S1]) that began with increased opioid prescribing in 1999, followed by increased heroin-associated deaths, and most recently fueled by illicitly manufactured fentanyl and other synthetic opioids (IMFs) (1–5). Fatal opioid overdoses are reported through the medical examiner's office. Individuals who survive opioid overdoses (S1), i.e., non-fatal opioid overdoses (NFOOs) (S1), have an increased risk of death in the following year, which risk is more than 20 times higher than found in age-, sex-, and race/ethnicity-matched controls (6). Illicit substance abuse (S1) is not actively monitored in Puerto Rico (7), so its serious health consequences are not known.

On the US mainland, the initial wave of the opioid crisis was associated with increasing rates of opioid prescribing for pain (1). In Puerto Rico, although opioid prescriptions increased from 1999 to 2013 (8,9), over 80% of the distribution was for methadone, an opioid used principally in narcotic treatment programs (9). Moreover, the mean opioid distribution per person (morphine milligram equivalents) from 2006 to 2017

was substantially lower in Puerto Rico (421.5) compared with Florida (1,507) and Hawaii (794.6) (9). Despite lower rates of opioid prescribing in Puerto Rico (9), relatively high rates of drug and substance abuse have been documented in detailed epidemiological surveys and interviews (7,10–12). An island-wide needs assessment conducted from 2014 through 2016 of adults aged 18 to 64 years old found that 3% of that population met DSM-IV criteria for illicit drug abuse (S1), and 1.2% for substance dependence (S1); both prevalences were higher than reported in 1998 for the San Juan metropolitan area, 0.8% and 0.5%, respectively (11). On the US mainland, the 2015 National Survey on Drug Use and Health found a similar prevalence of

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illicit drug-use disorder (2.8%) in adults 18 and older (13). During the years of the present study, the opioid overdose death rate on the US mainland increased from 11.9 to 20.7 (1), largely fueled by IMFs. The widespread penetration of IMFs into the illicit drug market in Puerto Rico (14) raises the possibility that Puerto Rico may also be experiencing a surge in opioid-related adverse events.

This study was inspired by the Drug Alert Warning Network (DAWN) (S1), a nationwide public health surveillance system that gathered data from hospital emergency department (ED) visits related to drug and substance-use in major US cities from 1973 through 2011 (15) but that never operated in Puerto Rico. While DAWN used medical chart reviews to identify cases, the present study employed the physician-assigned ICD (S1) diagnostic codes (16) to identify opioid-related ED cases. The ICD-based approach for identifying NFOO cases has been validated and provides a sensitivity of 97.2% and a specificity of 84.6% (17). All data were obtained from an acute general hospital associated with the University of Puerto Rico School of Medicine that serves a diverse population drawn from both metropolitan and adjoining rural communities. The study was exploratory in nature and not generalizable to population-based trends or those of other similar institutions; it was meant to gather data that generate a hypothesis regarding trends in opioid overdose mortality and morbidity in Puerto Rico.

Methods

Design, setting, and population

This is a time-series analysis of opioid-related cases from 2009 to 2018 presenting at the ED of the University of Puerto Rico - Dr. Federico Trilla Hospital in Carolina municipality located on the eastern edge of San Juan, Puerto Rico. The study was approved by the Institutional Review Board of the University of Puerto Rico Medical Sciences Campus in September 2018.

Data sources

The deidentified ED database provided birthdate, age, sex, admission date, and physician-assigned diagnostic codes (admission diagnosis, primary diagnosis, up to 4 secondary diagnoses, and E-codes); the “chief complaint” category was not used. Opioid abuse and NFOO cases were identified with International Classification of Diseases, Clinical Modification (ICD-CM) codes in the admission and primary diagnoses (Table 1): ICD-9 from August 31, 2009 to September 27, 2015, and ICD-10, thereafter (18–20).

Opioid overdose cases

Following the practice of the National Center for Health Statistics (1), opioid overdose deaths were sought by querying underlying cause-of-death codes X40–X44, X60–X64, X85, and Y10–Y14, in combination with T40 or 9650, codes for opioid poisoning; no qualifying deaths were found.

Drugs co-abused with opioids and polydrug abuse, ICD-9

Admission and primary diagnosis codes were screened for opioid and drug-induced disorders (Table 1). Secondary codes were subsequently examined for opioids and co-abused substances, i.e., alcohol, cannabis, cocaine, sedative-hypnotics, hallucinogens, amphetamines, and others. With ICD-9 codes, this strategy recovered many non-opioid cases that were subsequently eliminated.

Opioid abuse case, ICD-10

We identified opioid-related cases via admission and primary codes; co-abused drugs were identified through secondary codes.

Suicidal or intentional self-harm with opioids

In the ICD-9 system, both a suicide code and an opioid code were required to be present. ICD-10 codes include the concept of intent.

Population adjustment

Rates were adjusted per 100,000 ED encounters per month or year; a total of 399,348 visits were recorded during the study period.

Final data set

Duplicate cases were eliminated; cases potentially involving the same patient (same birthdate and sex) were counted individually if registered on different days. The final database included 810 cases with ICD-9 codes and 143 with ICD-10 codes.

Statistical analysis

Data were filtered in Excel

Statistical analysis and graphing were performed with GraphPad Prism version 8.0.0 for Windows, GraphPad Software, San Diego, California USA (www.graphpad.com). When applicable, data are presented as mean \pm standard error of the mean. Statistical support was provided by the Hispanic Alliance for Clinical and Translational Research (ALLIANCE).

Results

1. Demographics

The final data set of 954 drug abuse and drug overdose cases made up 0.24% of total ED encounters from August 2009 through December 2018. The patients consisted of 739 males, 214 females, and 1 unknown, and ranged in age from 1 to 89 years, with 96% being from the age of 20 through 65 years; the average age was 38 years (Fig. 1A). Only 8 cases (0.7%) were identified as teenagers. The male:female ratio for drug abuse and overdose cases was 3.5, contrasting with 0.7 for all patient encounters at the ED during this period.

Table 1. ICD Codes used in ED visits

ICD-9	ICD-10
1. Drug-induced disorders Drug-induced mood disorder (292.84) Other specified drug-induced mental disorders (292.89) Drug withdrawal (292.0) Drug-induced psychotic disorder with hallucinations (292.12) Pathological drug intoxication (292.2)	1. Opioid abuse Opioid abuse (F11.1) Opioid dependence (F11.2) Opioid use, unspecified (F11.9)
2. Substance abuse Alcohol (303.90–1, 305.00–1) Opioids (304.00–1, 304.70–72, 305.50–51) Sedative-hypnotics (304.10–1, 305.40–1) Cocaine (304.20–3, 305.60–3) Cannabis (304.30–1, 305.20–1) Hallucinogens (304.50, 305.30–1) Amphetamine or related sympathomimetic (304.40, 305.70).	2. Substance abuse Alcohol (F101.0–F101.4) Cannabis (F1210, F12259) Cocaine (F141.0–F142.4) Other stimulant (1514) Other psychoactive substance (F19.10–20)
3. Drug overdose, opiates and related narcotics Overdose by unspecified opium alkaloids (965.00) Overdose by heroin (965.01) Overdose by other opiates (965.09) Overdose by methadone (965.02) Overdose by analeptics (970.1) Overdose by unspecified drug or medicinal substance (977.9)	3. Drug overdose, opiates and related narcotics Overdose opium alkaloids (T40.0) Overdose by heroin (T40.1) Overdose by other opioids (T40.2) Overdose by synthetic narcotics (T40.4)
4. E-code: Drug overdose, other abused substances Accidental overdose by heroin (E850.0) Accidental overdose by other opiates and related narcotics (E850.2) Heroin causing adverse effects in therapeutic use (E935.0) Other opiates and related narcotics causing adverse effects in therapeutic use (E935.2) Assault by overdose (E962.0)	4. Drug overdose, other abused substances Overdose by cocaine, intentional self-harm, initial encounter (T40.5X2A) Overdose by cannabis (derivatives), intentional self-harm, initial encounter (T40.7X2A) Overdose, sedative-hypnotic (T42.6X2A) Overdose by, adverse effect of, and underdosing of analeptics and opioid receptor antagonists (T50.7X2A) Toxic effect of unspecified alcohol, undetermined (T51.94X2A)
5. Self-harm or suicidal intent Suicide and self-inflicted overdose by analgesics, antipyretics, and antirheumatics (E950.0) Suicide and self-inflicted overdose by other specified drugs and medicinal substances (E950.4)	5. Self-harm or suicidal intent Overdose by opioid, intentional self-harm, initial encounters Opium alkaloids (T40.0X2A) Heroin (T40.1X2A) Other opioids (T40.2X2A) Other synthetic narcotics (T40.4X2A) Overdose by opioid, intentional self-harm, subsequent encounter Opium alkaloids (T40.0X2D) Heroin (T40.1X2D) Other opioids (T40.2X2D) Other synthetic narcotics (T40.4X2D)

2. Opioid abuse and overdose cases

Of all drug-related ED cases, 397 were identified as being related to opioid abuse or overdose (Fig. 1B). The average annual rate of all opioid-related cases did not change significantly from 2009 through 2015 (90 ± 7) to 2016 through 2018 (116 ± 23), while the rate of opioid-abuse-only cases declined from $79 (\pm 5)$ to $47 (\pm 2)$ ($P < .01$). The overall male:female ratio for all opioid-related cases from 2009 through 2018 was 6.3 (rate: 8.8).

Non-fatal opioid overdose cases

All cases at the ED that were coded as opioid overdoses were non-fatal, i.e., NFOOs. The annual NFOO rate increased 7.5-fold, going from $12.1 (\pm 2.5)$ for 2009 through 2016 to

$91.2 (\pm 8.7)$ for 2017 through 2018 ($P < .0001$) (Fig. 2A). The increase occurred principally under the ICD-10 system in 2017, and not during the transition from the ICD-9 to the ICD-10 coding system in 2015 (Fig. 2B). The highest rate of opioid overdose was registered in October 2017. Despite the increase in NFOO cases from 2016 through 2018, the monthly rate of opioid abuse cases (ICD-10-CM diagnosis code F11) remained steady at $47 (\pm 7)$ (Fig. 2C).

E-codes for opiates were considered separately

Two cases involving heroin overdose during therapeutic use (ICD-9-CM diagnosis code E935.0) were not otherwise listed as opioid cases and were added to the total of opioid overdose cases for 2010 and 2014. All 7 cases coded as opioid

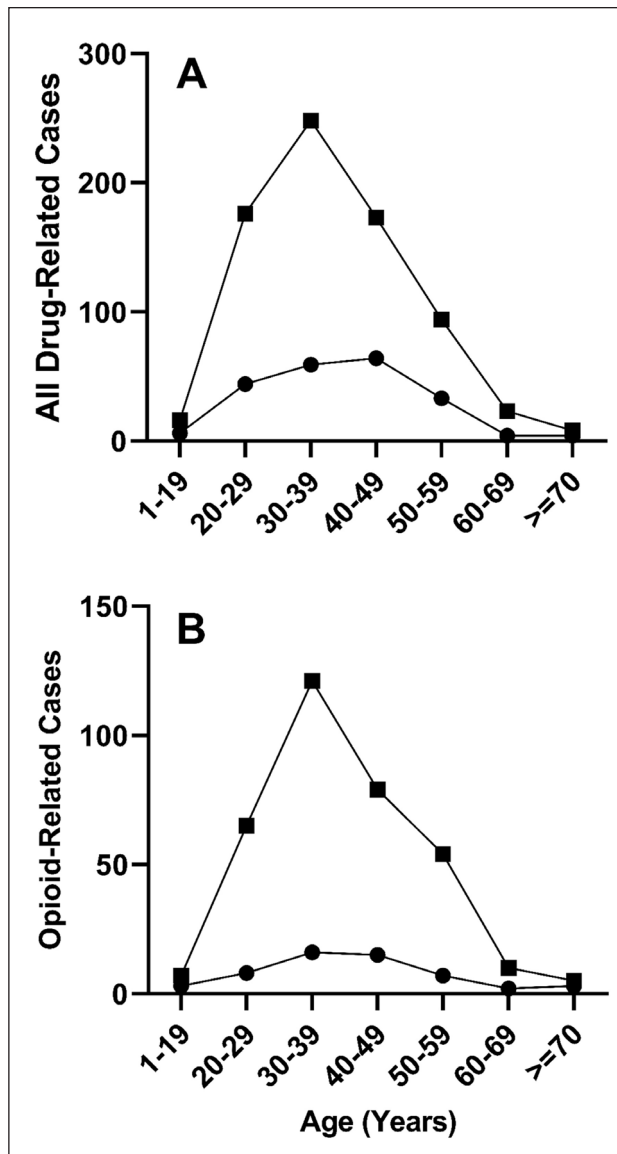


Figure 1. (A) Distribution of all cases related to drug abuse and overdose at the emergency department; cases that were selected for study based on ICD-9 codes for August 2009 through September 2015 and ICD-10 codes for October 2015–December 2018. Closed squares (■) are males and closed circles (●) are females. (B) The age and sex distribution of cases specifically related to opioids.

overdose in therapeutic use (ICD-9-CM diagnosis code E935.2) had primary and admission codes for pathological diagnoses and were not included in the total NFOO count. Four cases with diagnosis code E850.2 (accidental poisoning by other opiates and related narcotics) also had admission codes that identified them as opioid overdoses. One case with code E962.0 (assault by poisoning) was also coded as a heroin overdose in the admission code. Code E980.0 (undetermined poisoning with analgesics) was sometimes present in cases with additional opioid coding, which presence did not affect the total NFOO count.

Opioid poisoning in children

Four cases of such poisoning were identified in children under 4 years old, including 2 that were coded as poisoning with unidentified synthetic opioids. All were counted as NFOOs.

Opioid drugs involved in opioid overdoses and abuse

Heroin overdose was diagnosed in 9 of 35 (35%) ICD-9–diagnosed cases from 2009 through 2015 and in 55 of 85 (65%) cases from 2016 through 2018. Overdose by synthetic narcotics was indicated in 10 of 85 (12%) cases from 2016 through 2018; the ICD-9 system did not have specific codes for synthetic opioids other than methadone. The code for adverse events related to analeptics and opioid receptor antagonists (T50.7x) appeared twice in early 2017, once as an admission code and once as a secondary code. Opioid receptor antagonists are used in opioid overdoses, and IMF-overdoses tend to be resistant to such antagonists and require higher doses (13). The T50.7 cases were not included in the count without a specific opioid-related ICD-10 code.

Opioid overdose with intentional self-harm

Five cases (rate: 1.8) were diagnosed from August 2009 through September 2015. Opioids were the only drug mentioned in 4 cases, and cocaine was co-present in the fifth. The surge in NFOO cases included 7 (rate: 18.6) in 2017 and 4 (rate: 10.3) in 2018.

3. Co-abused substances mentioned with opioids

From 2009 through 2015 (ICD-9), opioids alone were present in 35% of the opioid-related cases, and 65% also had co-abused substances. The presence of co-abused substances declined to 37%, thereafter (Table 2 and Fig. 3). Cocaine, the most common co-abused substance, was mentioned in 53.5% of the opioid-involved cases up to October 2015, declining to 21%, thereafter. Other substances mentioned in combination with opioids in the ICD-9 and ICD-10 codes were cannabis (15.4% and 9.8%, respectively), alcohol (9.8% and 6.3%, respectively), and sedative-hypnotics or benzodiazepines (10.2% and 2.1%, respectively).

Other substances in non-fatal opioid overdoses

Despite the common mention of multiple substances in opioid abuse cases, co-abused substances were mentioned only 4 times in 27 ICD-9-coded NFOO cases (14.8%) (1 alcohol, 1 cannabinoid, and 2 cocaine). From 2016 through 2018, additional abused substances were mentioned in 13 of 78 NFOOs (16.7%) (Fig. 3B). Cocaine was present with an opioid in 7.4% of the NFOO cases in 2009 through 2015 and in 6.4% of the cases in 2016 through 2018.

Opioids with sedative-hypnotic and anxiolytic drugs

Sedative-hypnotic and benzodiazepine drugs are prescription drugs that may be abused and can contribute to opioid toxicity if co-administered (16,17). Sedative-hypnotics were involved in 138 (rate: 50.0) ED drug-abuse cases from 2009 through

2015 but were mentioned in only 26 cases with opioids (rate: 9.5) in the same period, and only once in an NFOO case in 2017.

Cannabis and alcohol, 2009–2018

Cannabinoids were mentioned with an opioid in 56 abuse cases (rate: 14.0) and 4 NFOO cases (rate: 1). Alcohol was mentioned with opioids in 34 abuse cases (rate: 8.5) and in 4 overdose cases (rate: 1).

Other drug-related ED visits, by age group

Drug abuse cases retrieved with the general drug abuse ICD-9 codes from 2009 through 2015 were analyzed to gain insight into patterns of drug abuse with age (Fig. 4). The proportion of cases mentioning cannabinoids was highest among patients under 40, while the number of alcohol-related cases increased with age. In contrast, the small contribution of sedative-hypnotics was relatively evenly distributed among age groups.

Discussion

We found that the rate of NFOO cases at the Dr. Federico Trilla Hospital in Carolina, Puerto Rico, increased 7.5-fold from 2009 through 2016 to 2017 through 2018, while opioid-related abuse was relatively unchanged in the same period. The increase occurred principally during 2017 and remained high thereafter. Cocaine was the substance most commonly co-abused with opioids and was also the most abused substance. Opioid toxicity and overdose cases were found predominately among males from 20 to 49 years old. The near absence of amphetamine co-abuse was noteworthy, since methamphetamine has been found in 63% of the opioid deaths on the US mainland (21,22). Our findings lend support to a hypothesis of a recent surge in NFOO cases. Nonetheless, these data were obtained from only 1 hospital and cannot be considered representative of Puerto Rico without further investigation. The Carolina hospital in this study is located in a region with relatively low rates of substance use disorders. In 2016, the Puerto Rico Health Administration region that includes this hospital ranked next to lowest for substance use in the last 12-months (11).

Increased rates of opioid overdose cases

The surge in NFOO cases began during the summer months of 2017 and peaked in October 2017, immediately after the

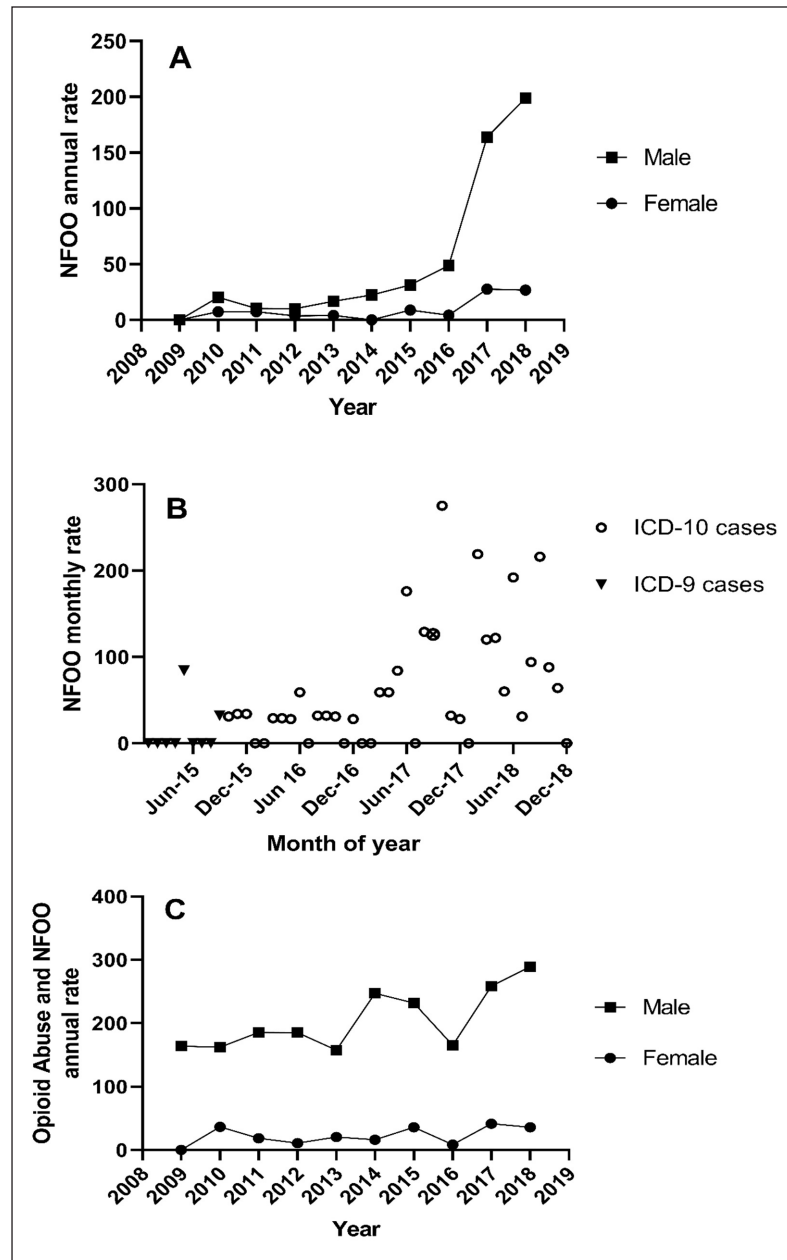


Figure 2. (A) The rates of non-fatal opioid overdoses per 100,000 emergency department encounters for 2009–2018, males and females separately. Cases were selected based on ICD codes for opioid overdose, not including opioid overdose in therapeutic use. (B) Monthly rates of all NFOO cases from January through September 2015, I D-9 (▼) and from October 2015 through December 2018, ICD-10 (○). September 2017 is marked with ⊗. (C) Rates of combined opioid overdose and abuse cases in males and females per year. Closed squares (■) are males and closed circles (●) are females.

passage of 2 hurricanes left most communities devastated and without electricity. The NFOO rates remained high through the end of the data collection period at the end of 2018. The increase in NFOO cases was not an artifact caused by changes to the ICD diagnostic criteria in the changeover from the ICD-9 to the ICD-10 system in October 2015. Additional data and study are needed to determine whether the high

Table 2. Co-Abused substances with Opioids in Emergency Department Opioid-Related cases

ICD-9 cases (n = 254) 2009–2015	M	F	All	%	ICD-10 cases (n = 143) 2015–2018	M	F	All	%
1. Opioid alone (n = 90)*	70	19	90		1. Opioid alone (n = 90)	78	12	90	
Percent total cases	28	7	35		Percent total cases	55	8	63	
2. Opioid with 1 CAS (n = 115)	102	13	115	45	2. Opioid with 1 CAS (n = 38)	31	7	38	27
Cocaine	84	10	94		Cocaine	15	4	19	
Cannabis	6	2	8		Cannabis	4	1	5	
Alcohol	9	0	9		Alcohol	4	0	4	
Sedative-hypnotic	3	1	4		Sedative-hypnotic	1	0	1	
3. Opioid with 2 CASs (n = 35)	33	2	35	14	Opioid antagonist	1	0	1	
Cocaine + sedative-hypnotic	6	2	8		Other	5	2	9	
Cocaine + alcohol	7	0	7		3. Opioid with 2 CASs (n = 13)	13	0	13	9
Cocaine + cannabis	16	0	16		Cocaine + sedative-hypnotic	0	0	0	
Sedative-hypnotic + cannabis	4	0	4		Cocaine + alcohol	2	0	2	
4. Opioid with 3 CASs (n = 14)	14	0	14	6	Cocaine + cannabis	6	0	6	
Cocaine + cannabis + sedative-hypnotic	5	0	5		Cocaine + other	1	0	1	
Cocaine + alcohol + sedative-hypnotic	2	0	2		Cannabis + other	1	0	1	
Cocaine + cannabis + alcohol	3	0	3		Alcohol + other	2	0	2	
Cocaine + alcohol + other	1	0	1		Sedative-hypnotic + cannabis	0	0	0	
Cannabis + alcohol + sedative-hypnotic	3	0	3		Sedative-hypnotic + benzodiazepine	1	0	1	
					4. Opioid with 3–4 CASs (n = 2)	1	1	2	1
					Cocaine + cannabis + alcohol	1	0	1	
					Cocaine + cannabis + benzodiazepine or others	0	1	1	

Abbreviations: CAS, co-abused substance; M, male; F, female. *ICD-9 cases include 1 individual of unknown sex

NFOO rates are transitory or more permanent. Nonetheless, disaster researchers agree that psychological disorders and substance abuse increase in the aftermath of both man-made and natural disasters—such as Hurricane Katrina, which has been extensively studied—and may be evident for several years after a given disaster (23,24).

Polysubstance abuse

Polysubstance use has been associated with a 3-fold higher mortality rate compared to mono-substance use (25). Only 4 NFOO cases with co-abused psychoactive substances were noted from August 2009 through December 2015, 2 with cocaine and 1 each with alcohol and a cannabinoid, totaling 14.8% of the NFOO cases. The number of NFOO cases with co-abused substances was higher from January 2016 through January 2018, but the proportion of total NFOO cases with co-abused drugs was similar, 15.4%. The surge of NFOO cases was not due to increased use of the dangerous cocaine–opioid (“speedball”) combination (26), which comprised the same proportion of

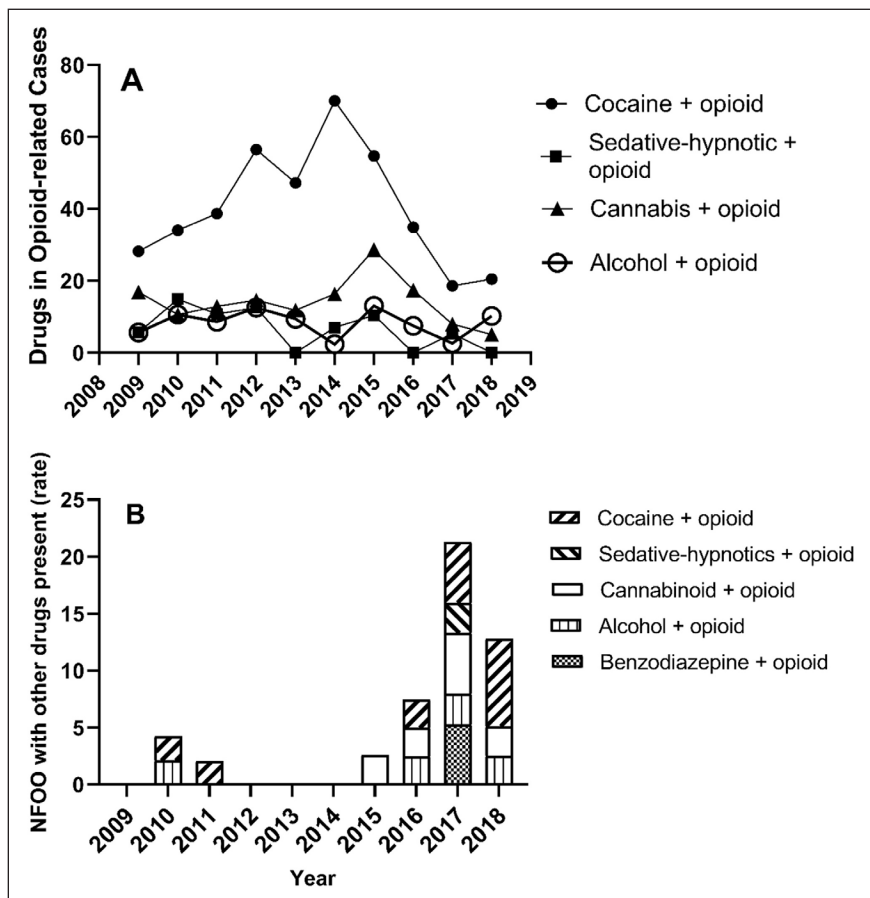


Figure 3. Rates of drugs or substances co-abused with opioids in emergency department cases, per ICD codes. (A) Additional drugs/substances mentioned in all opioid-related cases. (B) Additional drugs in non-fatal opioid overdose cases.

NFOO cases before and after 2015. The combination of benzodiazepines with opioids is particularly dangerous since both are potent respiratory depressants, and physicians are warned to avoid prescribing the combination (27); approximately 85% of the benzodiazepine-overdose deaths in the United States in 2017 involved the combination of both drugs. Nonetheless, this combination was not responsible for the observed increased in NFOO cases: Only 2 cases were recorded in 2017 and 2018, although they may have contributed to toxicity in those particular cases. Cannabinoids appeared in combination with opioids in 3 cases during the 2016 through 2018 period, an increase from the rate of that combination in 2009 through 2015 that may be related to the increased toxicity of synthetic cannabinoids (28), but not responsible for the surge. Alcohol-related cases increased similarly.

Our data suggest that there are 2 groups of opioid users: individuals who use multiple substances, including opioids, and seek medical help for less severe adverse reactions or withdrawal, and individuals who use opioids principally or only and in a manner that increases their risk for serious toxicity and/or overdose. Polysubstance use is complex, with individual users preferring different usage frequencies and combinations of substances (29). Although the total number of ED cases with co-abused opioids and other psychoactive substances increased after 2016, the proportion of cases with co-abused substances did not increase, suggesting that the increase in NFOO cases was related principally to the opioid component.

Illicitly manufactured fentanyl

The ICD codes for “synthetic opioids,” which include methadone as well as IMFs, were assigned by admitting physicians in 10 of 83 opioid cases, about 12%, from 2016 through 2018. This number may be an underestimate since IMFs are increasingly substituted for heroin on the illicit drug black market (14), are frequently detected in individuals who inject drugs (30) and increase the risk for NFOO (31). The marked increase of NFOOs in 2017 resembles the surge of opioid deaths on the US mainland that occurred at the same time and which has been attributed to the increased availability of IMFs (1). This suggests that IMFs may have contributed to the surge of NFOO cases in Puerto Rico.

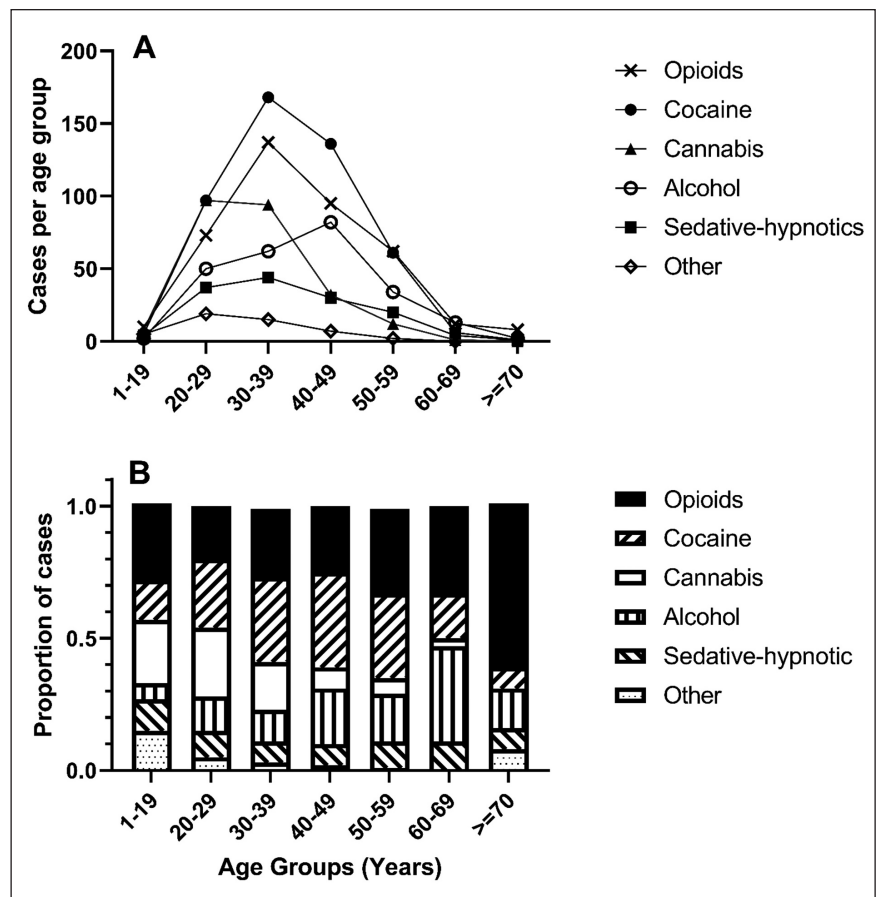


Figure 4. Distribution by age group of all cases with ICD-9 codes associated with drug-induced disorders, 2009-2015. (A) Distribution by number of cases and age group. (B) Distribution by proportion of cases per age group.

Amphetamines

Amphetamines were mentioned only once in combination with opioids, although the prevalence of amphetamine (7) and stimulant (11) use in Puerto Rico is very similar to the overall usage levels on the US mainland (7). Nonetheless, the rate of stimulant-involved overdoses on the US mainland varies geographically from 5.3 in the west to 1.2 in the east (22); hence, the pattern and rate of dangerous use in Puerto Rico may be more similar to that observed in the eastern US.

Male:female ratio

We found an overall male:female ratio of 3.5 for all substance abuse-related cases, with a ratio of 6.3 for opioid-related cases. Caetano et al (7) reported that the 12-month prevalence of illegal or non-prescribed drug use in metropolitan San Juan in 2013 through 2014 was 20.7% in men and 12.9% in women, very similar to rates reported on the US mainland for 2016 (24). The higher male:female ratio in ED cases compared with results of the household survey suggests that female users may employ a less dangerous pattern of use. On the US mainland, the age-adjusted male:female ratio for opioid overdose deaths

in 2018 was 2.05 (1), and the gender gap has been narrowing as heroin use among women increases (32).

Self-harm

We found intentional self-harm or suicidal intent in 9.8% of the NFOO cases. Oquendo and Volkow (33) have categorized suicide as a silent contributor to the overwhelming overdose epidemic on the US mainland, where the estimated proportion of suicides in opioid overdose deaths was lower, at nearly 5%.

Limitations

The data provide a view of the medical impact of substance abuse. Nonetheless, interpretation of the data is limited by its origin in a single hospital, rather than from several hospitals throughout Puerto Rico; in addition, the small total number of NFOO cases is also a limitation. We have not examined more recent data to address the possibility that the surge in the opioid overdose rate was temporary. The use of ICD codes to infer co-abused drugs has not been independently verified by chart review.

Conclusions

The data present preliminary evidence that there was a surge in opioid-related NFOOs at a metropolitan area hospital, possibly related to (1) the increased presence of potent IMFs on the illicit drug market and/or (2) the psychological impact of the hurricanes in 2017. Data from hospital ED cases serve as a supplement to detailed epidemiological data and may facilitate the understanding of drug abuse in Puerto Rico.

Resumen

Objetivos: El objetivo fue describir las tendencias en el uso de opioides (2009-2018) del departamento de emergencias (DE) en un hospital universitario en el área metropolitana de San Juan, Puerto Rico. **Metodología:** La base de datos del DE del Hospital Dr. Federico Trilla-Universidad de Puerto Rico proporcionó los datos para el estudio. **Resultados:** Las sobredosis de opioides no mortales aumentaron 7.5 veces, de 12.1 (\pm 2.5) por 100,000 encuentros en DE para el 2009-2016 a 91.2 (\pm 8.7) en el 2017-2018 ($P < .0001$). A partir del verano 2017, llegó al pico en octubre después de dos huracanes fuertes. Los casos relacionados a opioides del DE comprendió 15.8% para el 2009-2016, y aumentaron a 67% en 2017-2018. Previo a octubre 2015, múltiples drogas están presentes en 65% de los casos relacionados a opioides, disminuyendo al 37%. La cocaína fue reportada en combinación con opioides en 53% de todos los casos relacionados a opioides desde agosto 2009 hasta septiembre 2015, disminuyendo al 21% desde octubre 2015 hasta diciembre 2018, el cannabis de 15% al 10%, y el alcohol de 10% al 6%, respectivamente. Las anfetaminas se reportaron una vez en combinación con opioides. La proporción hombre:mujer para todos los casos relacionadas a

opioides fue de 6.3 (tasa: 8.8). **Conclusión:** Los datos muestran un aumento en los casos de toxicidad relacionado a opioides en el hospital arriba nombrado comenzando en mediados del 2017. Los casos relacionados a opioides involucran pacientes masculinos. Es necesario más trabajo para establecer tendencias en toda la isla.

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Glossary (alphabetical order)

DAWN: Legacy DAWN (data collection 1992 through 2011) was a public health surveillance system that monitored emerging drug trends in both (1) emergency department visits in hospitals and (2) deaths reported by medical examiners and coroners (ME/C) across the nation. The program was administered by the Substance Abuse and Mental Health Administration (SAMHSA). In addition, Legacy DAWN was a longitudinal probability sample of hospitals located throughout the United States, including Alaska and Hawaii. Non-Federal, short-stay, general surgical, and medical hospitals located in the United States, with at least 1 24-hour emergency department (ED) were eligible to participate. Drug-related ED visits were identified through a retrospective review of ED visits in participating hospitals and decedent case files in each participating death investigation jurisdictions for ME/Cs (2).

DSM-IV: The Diagnostic and Statistical Manual is the standard classification of mental disorders used by mental health professionals in the United States. The DSM-IV was developed with the collaboration of mental health professionals, the World Health Organization, and the American Psychiatric Association, its publisher. It was in use from 1994 to 2000, at which point it was replaced by the DSM-IV-TR (3).

Drug/substance abuse: An outdated term based on the DSM-IV. Briefly, drug or substance abuse was defined as a pattern of clinically significant impairment or distress, with 1 or more criteria, including failure to fulfill major role obligations, use in physically hazardous situations, use causing legal problems, and social or interpersonal problems related to substance use (3).

Drug dependence: The DSM-IV defined dependence as a pattern of clinically significant impairment or distress, with 3 or more of the following: tolerance, withdrawal, taking the substance in larger amounts or for a longer period than was intended, unsuccessful efforts to cut down, spending a great deal of time in substance-related activities, giving up social, occupational, or recreational activities because of drug or substance use, and continuing use despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by the substance (3).

ICD codes: The International Statistical Classification of Diseases and Related Health Problems (ICD), is a medical classification list by the World Health Organization (WHO). The ICD has been the basis for comparable statistics on causes of mortality and morbidity between places and over time. At the UPR Carolina Hospital, the transition from ICD-9, the previous version, to the ICD-10 was accomplished in October 2015 (4).

Opioid: Opioids are a class of psychoactive substances (including opium, morphine, and codeine) derived from the poppy plant, as well as semi-synthetic forms (including heroin) and synthetic compounds (including methadone and fentanyl) with similar properties (1). “Opiates” refers specifically to derivatives of the poppy plant.

Opioid overdose, non-fatal: An opioid overdose that is survived by the individual. The opioid antagonist naloxone can prevent death from an opioid overdose if administered in time (5).

Opioid poisoning or overdose: An opioid overdose can be identified by a combination of 3 signs and symptoms: pinpoint pupils; unconsciousness; and difficulty breathing. It has been estimated that 1 in 30 opioid overdoses has a fatal outcome (5).

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