



Deaths in Four Opioid Categories among the Older Population during the COVID-19 Pandemic in Florida

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ABSTRACT

Background: Opioid overdose deaths remain a global health problem. Over half a million died from drug use, and 70% were attributable to opioids. The problem is more severe in the United States, where opioid overdose deaths had a 44.18% increase from 47,600 deaths in 2017 to 68,630 deaths in 2020 alone. While public attention is focused on younger adults, the consistent increase in opioid overdose deaths in the older population warrants careful attention.

Objective: Our study aims to report the descriptive results of older adults who died from four opioid categories during the COVID-19 pandemic in Florida.

Methods: We conducted a retrospective study of older decedents or people ≥ 65 years who died from opioids during the COVID-19 pandemic 2020.

Results: Three hundred forty-eight older adults died from opioids as a cause of death in Florida in 2020. Eighty percent of these deaths resulted from accidents, and suicides accounted for 18.15%. Among those who died from accidents, one hundred percent were due to opioid intoxication. More older men died from accidents than older women, while more older women died from suicides than older men; over 160 cases of opioid deaths involved benzodiazepines, followed by cocaine with 104 cases, ethanol-81 cases, and psycho-stimulants with 47 cases.

Conclusion: Our study results provide critical evidence of the adverse outcome of opioid use and overdoses among older adults. The co-presence of other substances in Opioid Overdose Deaths (OOD) suggests unsafe illicit drug use, even in old age. Opioid deaths resulting from accidents and suicides underscore the need for sustainable harm reduction strategies tailored to the needs of this vulnerable age group.

Keywords: Opioids; Older population; Opioid-related death; COVID-19 pandemic; Drug

INTRODUCTION

Opioid Overdose Deaths (OOD) remain a significant public health issue. Globally, more than half a million deaths are associated with drug use, of which 70% were caused by opioids [1]. In Europe, more than 8,200 drug overdose deaths occurred in 2017, where opioids accounted for eight to nine deaths out of ten drug-induced deaths that same year [2]. In Australia, 61% of the 1,842 drug overdose deaths in 2020 were due to opioids [3]. National Drug and Alcohol Research Center, 2022. In the United States, overdose deaths involving any opioids recorded a dramatic increase, from 47,600 deaths in 2017 to 68,630 in 2020 [4]. The economic costs of addressing the opioid epidemic in just four years reached \$2.5 trillion in the U.S. alone from 2015 to 2018 [5]. However, reports

of OOD focused primarily on people under age 50 or younger adults [6]. Opioid deaths in the aging population received less attention [7].

The older population was considered unfortunate victims of opioid overdose deaths, not only during the COVID-19 pandemic but consistently throughout the opioid epidemic in the U.S. Nearly 80,000 people in the older population died from opioid overdose deaths from 1999 to 2019 [8]. There was a 1,960% increase in opioid overdose deaths in people 55 years and over from 500 deaths in 1999 to 10,300 deaths in 2019 in the U.S [9]. About 125,000 older adults were admitted to hospitals in the U.S. due to opioid-related diagnoses from 2010 to 2015 [10]. Hospital inpatient stays related to opioid use among older adults increased

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Received: 02-Sep-2023, Manuscript No. JPMME-23-22843; **Editor assigned:** 04-Sep-2023, PreQC No. JPMME-23-22843 (PQ); **Reviewed:** 18-Sep-2023, QC No. JPMME-23-22843; **Revised:** 25-Sep-2023, Manuscript No. JPMME-23-22843 (R); **Published:** 05-Oct-2023, DOI: 10.35248/2684-1320.23.9.230.

Citation: Suriaga A, Tappen R, Hain D (2023) Deaths in Four Opioid Categories among the Older Population during the COVID-19 Pandemic in Florida. J Pain Manage Med. 9:230.

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by 85%, while emergency room visits related to opioid intoxication increased by 112% among this age group in the U.S in 2017 [10]. Older adults are seven times more likely to be hospitalized after an emergency visit than younger adults, mainly due to a drug overdose, including opioids [11]. Further, people >50 years old with Opioid Use Disorder (OUD) had two times the risk of death than their younger counterparts who also had OUD [12]. Thus, opioid overdose deaths in this age group warrant careful attention. Research on which specific opioids cause more deaths in the older population is limited. Also, there is a dearth of research on the manner of death, the characteristics of older adults who died from opioid intoxications, and the involvement of other substances in opioid deaths in older adults.

In this article, we aimed to report the number of people ≥ 65 years, known as older adults, who died from opioids in 2020 in four categories categorized as natural opioids (morphine, codeine), semi-synthetic opioids (oxycodone, hydrocodone, hydromorphone, and oxymorphone), synthetic opioids (fentanyl, fentanyl analog, methadone, and tramadol), and an illicit opioid, heroin. Additionally, we report opioid-related accidents and suicides in the aging population. We aim to add evidence to the existing knowledge about opioid-related adverse outcomes in older adults. Knowing what specific opioids contributed to these preventable deaths is critical in maintaining patient safety, particularly for those at risk for opioid-related harmful effects, including death. The four opioid categories were adapted from the Centers for Disease Control and Prevention [13]. We added fentanyl analog to the synthetic opioid category in the data analysis since it was not initially included in the CDC list. There are at least 37 fentanyl analogs identified, and they are part of the new psychoactive substances called synthetic opioids designed to mimic the effects of fentanyl, such as 3-Methylfentanyl and Fentanyl citrate [14,15].

This study has healthcare implications as 14.1 million out of 45.2 million (31%) Medicare Part D beneficiaries received at least an opioid in 2017 [16]. Medicare recipients, primarily older adults, are at greater risk for experiencing adverse effects from opioid use, including respiratory depression, confusion, drug dependence, tolerance, falls, and fractures due to slowed drug metabolism and excretion [7,16,17]. Opioids are justifiably prescribed for acute and chronic pain, particularly for conditions such as fibromyalgia, arthritis, neuropathies, organ failures, cancer, cerebrovascular accidents, and fractures [9,18,19]. Opioids also treat pain from surgery and other injuries [16]. Approximately 18.7 million older Americans experience pain or discomfort [20]. As the US aging population increases from 54.1 million in 2019 to nearly 95 million by 2060, the number of older adults who use opioids is expected to increase in the coming years [21].

Notably, Florida was second in the nation with the highest number of overdose deaths (the first was California) [22,23]. Florida also ranks second in the country with the most significant number of older people (21.3%), second only to Maine with 21.8% [24]. Nearly 8% of U.S opioid deaths happened in Florida in 2021 [25]. The Florida opioid death rate was 35 deaths per 100,000 populations [23].

MATERIAL AND METHODS

Design

This retrospective study used de-identified data from the Florida Department of Law Enforcement in 2020. The Florida Atlantic

University Institutional Review Board approved this study as non-human subject research.

Setting

The study included all Florida counties (n=67). Forty-four counties are classified as urban, and 23 counties as rural.

Data source

We obtained de-identified reports of Drugs Identified on Deceased Persons from the Florida Department of Law Enforcement (FDLE). The FDLE reports are public records of decedents or persons who died from a substance or combination of drugs. There were 49 drugs included in the reports, ranging from opioids, stimulants, ethanol, cocaine, benzodiazepines, and psychedelics. The FDLE started collecting data from deceased persons with identified drugs or substances in their system at the time of death in 1987. As a government data source, FDLE aims to provide important information on people who died from drugs for local and state governments for service planning purposes and allocation of resources.

Decedents included

For this study, we purposely focused on the 2020 data to examine the characteristics of older decedents with opioids as a Cause of Death (COD) during the COVID-19 pandemic. Only the 2020 data was available for analysis when this study was conducted. There were 14,322 cases of persons (all age groups) who died with any opioids in their system, of which 9,163 were cases of opioids as a cause of death in all age groups.

We extracted data for older adults, i.e., those 65 years and above. Out of 1059 older decedents who died with any opioid found in their system, three hundred forty-eight decedents met our eligibility criterion of having an opioid as a cause of death as determined by the FDLE medical examiners based on autopsy, urine, and toxicology results. All decedents included in the data analysis were tested for the presence of any opioid in their system and opioids as a cause of death. An opioid is considered a cause of death if it played a causal role in the death of a person through autopsy, urine, and toxicology results as determined by the medical examiners [26].

Statistical analysis

We used descriptive statistics to report opioid deaths among the older population in Florida. We analyzed all data using SPSS 28 [27]. For the co-presence of other substances or drugs in opioid deaths, we quantified and repeatedly examined the occurrences of these substances in opioids as a cause of death among older decedents. Although multiple drugs were listed on the FDLE reports in 2020 under various causes of death, only drugs classified as opioids and cause of death were included in the analysis.

RESULTS

Characteristics

The summary statistics of older adults who died from opioids during the COVID-19 pandemic in Florida in 2020 are presented in Table 1. Three hundred forty-eight older decedents died from opioids as a cause of death this year. One case had missing data so we removed it from the analysis (N=347). The opioids (n=11) included in the analysis were morphine, codeine, hydrocodone, hydromorphone, oxycodone, oxymorphone, fentanyl, fentanyl analog, methadone, tramadol, and an illicit opioid, and heroin.

No older decedents died from Buprenorphine in Florida in 2020. The age of decedents ranged from 65 to 93 years old. The mean age was 69.99 (SD=5.332). Two-thirds of the older decedents were male (67.9%). There was no difference in the type of opioids by sex. Older non-Hispanic whites were more affected than members of any other races/ethnicities combined. More older men died from fentanyl (n=106), morphine (n=32), oxycodone (n=22), hydrocodone (n=13), heroin (n=19), and fentanyl analog (n=12) than did women. Older women experienced the largest number of deaths from fentanyl (n=29), oxycodone (n=20), hydrocodone (n=16), morphine (n=15), and tramadol (n=8).

Table 1: Characteristics of older decedents who died from opioids in 2020.

Characteristics			
Age (mean=69.49)		n	%
(SD=5.332)			
Sex	Male	235	67.5
	Female	113	32.5
Race/ethnicity	Non-Hispanic White	302	86.5
	Black	43	12.3
	Hispanic	2	0.6
	Asian	1	0.3

Table 2: Manner of death of older decedents across opioid categories, 2020.

Opioid Categories		Manner of Death				Total Number of Death
		Accident	Homicide	Suicide	Undetermined Cause	
		n (%)	n(%)	n(%)	n(%)	
Natural Opioids	Morphine	40 (11.52)	0	8 (2.31)	0	48
	Codeine	3 (0.86)	0	3 (0.86)	0	6
Semi-synthetic Opioids	Hydrocodone	16 (4.61)	0	12 (3.46)	1 (0.29)	29
	Hydromorphone	7 (2.02)	0	8 (2.31)	0	15
	Oxycodone	24 (6.92)	0	18 (5.19)	0	42
	Oxymorphone	4 (1.15)	0	5 (1.44)	0	9
Synthetic Opioids	Fentanyl	130 (37.46)	1 (.29)	1 (0.29)	3 (0.86)	135
	Fentanyl analog	15 (4.32)	0	1 (0.29)	0	16
	Methadone	9 (2.59)	0	1 (0.29)	0	10
	Tramadol	9 (2.59)	0	6 (1.73)	1 (0.29)	16
Illicit Opioid	Heroin	21 (6.05)	0	0	0	21
Total		278 (80.11%)	1 (.29%)	63 (18.16%)	5 (1.44%)	347

Urban Counties	Large Central Metro	113	32.47
	Large Fringe Metro	101	29.02
	Medium Metro	115	33.05
	Small Metro	15	4.31
Rural Counties	Metropolitan	1	0.29
	Noncore	2	0.57
	Missing	1	0.29

Manner of death

Table 2 summarizes the manner of opioid-related death in older decedents. More than 80% of these older decedents died from accidents (n=278), followed by suicide at 18.15%. Synthetic opioids such as fentanyl contributed most to these deaths at 46.96%, morphine at 11.52%, and oxycodone at 6.92%. Oxycodone also contributed to 18 deaths resulting from suicide (5.19%) in the older population, followed by Hydrocodone with 12 fatalities and Morphine with six deaths that resulted in suicide. Although more older men died from accidents than women (124 vs. 50), more older women died from suicide than older men (24 vs. 15).

For those opioid deaths that resulted from accidents, all of them were due to drug intoxications, either from a single opioid (n=21), two opioids (n=17), or an opioid and another drug (n=31), and multiple drug combination at least three or more drugs combined such as one or two opioids plus two or more non-opioid drugs (n=150).

Involvement of other substances

The co-presence of other drugs in opioids as a COD is reported in Table 3. Cocaine was present 104 times in the overall opioid deaths. Among the individual opioid categories, particularly in Fentanyl deaths, cocaine was present in 64 cases. Ethanol use was present in 81 cases of opioid deaths, with nearly half of them occurring in Fentanyl deaths. It is noteworthy to mention that

benzodiazepines/hypnotics such as Alprazolam (n=54), Clonazepam (n=23), Diazepam (n=23), Lorazepam (n=9), Nordiazepam (n=16), Oxazepam (n=4), Temazepam (n=15), and Zolpidem (n=16) were also involved in 160 cases of opioid deaths altogether in older decedents. Stimulants were also present in 37 cases, specifically amphetamine (n=18) and methamphetamine (n=19).

Table 3: Other drugs identified in opioid deaths among older population in florida, 2020.

Other Drugs	Natural Opioids			Semi-Synthetic Opioids			Synthetic Opioids			Illicit Opioid		Total
	Morphine n(%)	Codeine n(%)	Hydrocodone n(%)	Hydromorphone n(%)	Oxycodone n(%)	Oxymorphone n(%)	Fentanyl n(%)	Fentanyl Analogs n(%)	Methadone n(%)	Tramadol n(%)	Heroin n(%)	
Alprazolam	3 (0.6)	1 (0.2)	11 (2.4)	3 (0.6)	11 (2.4)	3 (0.6)	16 (3.5)	3 (0.6)	0	1 (0.2)	2 (0.4)	54 (11.84)
Amphetamine	3 (0.6)	0	2 (0.4)	0	3 (0.6)	0	8 (1.7)	2 (0.4)	0	0	0	18 (3.95)
Cannabinoid	2 (0.4)	0	0	0	0	0	7 (1.5)	1 (0.2)	0	0	1 (0.2)	11 (2.41)
Carisoprodol Meprobamate	1 (0.2)	0	0	1 (0.2)	0	0	2 (0.4)	0	1 (0.2)	0	1 (0.2)	6 (1.32)
Cathinone	2 (0.4)	0	0	0	0	0	4 (0.8)	0	0	0	2 (0.4)	8 (1.8)
Chlordiazepoxide	0	0	0	0	0	0	1 (0.2)	0	0	0	0	1 (0.2)
Clonazepam	3 (0.6)	0	3 (0.6)	1 (0.2)	4 (0.8)	1 (0.2)	7 (1.5)	1 (0.2)	0	2 (0.4)	1 (0.2)	23 (5.04)
Cocaine	12 (2.6)	1 (0.2)	3 (0.6)	0	3 (0.6)	0	64 (14.0)	5 (1.0)	5 (1.0)	2 (0.4)	9 (1.9)	104 (22.81)
Diazepam	3 (0.6)	1 (0.2)	2 (0.4)	0	5 (1.0)	1 (0.2)	8 (1.7)	1 (0.2)	1 (0.2)	1 (0.2)	0	23 (5.04)
Ethanol	10 (2.2)	1 (0.2)	5 (1.09)	2 (0.4)	9 (1.9)	3 (0.6)	39 (8.5)	1 (0.2)	2 (0.4)	4 (0.9)	5 (1.0)	81 (17.76)
Gabapentin	4 (0.9)	1 (0.2)	3 (0.6)	2 (0.4)	1 (0.2)	4 (0.9)	16 (3.5)	2 (0.4)	1 (0.2)	4 (0.9)	1 (0.2)	48 (10.53)
Lorazepam	1 (0.2)	0	2 (0.4)	0	2 (0.4)	0	3 (0.6)	0	0	1 (0.2)	0	9 (1.97)
Methamphetamine	3 (0.6)	0	2 (0.4)	0	2 (0.4)	0	10 (2.2)	1 (0.2)	0	0	1 (0.2)	19 (4.16)
Nordiazepam	1 (0.2)	0	1 (0.2)	0	5 (1.0)	0	7 (1.5)	0	1 (0.2)	1 (0.2)	0	16 (3.51)
Oxazepam	0	0	1 (0.2)	0	0	0	2 (0.4)	0	0	1 (0.2)	0	4 (0.9)
Temazepam	2 (0.4)	1 (0.2)	3 (0.6)	3 (0.6)	1 (0.2)	1 (0.2)	3 (0.6)	0	0	1 (0.2)	0	15 (3.29)
Zolpidem	3 (0.6)	0	4 (0.9)	2 (0.4)	5 (1.0)	1 (0.2)	1 (0.2)	0	0	0	0	16 (3.51)
Total	53 (11.62)	6 (1.3)	42 (9.21)	14 (3.0)	60 (13.15)	14 (3.0)	198 (43.42)	17 (3.7)	11 (2.41)	18 (3.9)	23 (5.0)	456 (100%)

Clinical characteristics

The occurrence of disease conditions associated with opioid deaths in the older population is presented as clinical characteristics in Table 4. The atherosclerotic cardiovascular disease had the greatest number of occurrences (n=18), followed by hypertensive heart disease (n=16) and chronic obstructive pulmonary disease (n=6). Diabetes mellitus and arteriosclerotic heart disease were associated with five deaths each. Several clinical characteristics listed on the FDLE dataset occurred only once (n=21), such as cardiac arrhythmia, coronary artery disease, steatosis, post-traumatic stress disorder, schizophrenia, and major depressive disorder.

Table 4: Clinical characteristics of older adults with opioids as a cause of death.

	Cause of Death	n	%
Cardiovascular	Atherosclerotic cardiovascular Disease	18	19.8
	Arteriosclerotic heart disease	5	5.5
	Cardiomegaly	2	2.2
	Valvular heart disease	4	4.4
	Hypertensive heart disease	16	17.5
	Cardiac arrest	2	2.2
	Cardiomegaly	2	2.2
	Cardiac arrhythmia	1	1.1
	Coronary artery disease	1	1.1
	Hyperlipidemia	1	1.1
Respiratory	Hemopericardium	1	1.1
	Hemorrhagic pericarditis	1	1.1
	Anoxic Encephalopathy	2	2.2
	COPD	6	6.6
	Hypoxic ischemic encephalopathy	2	2.2
	Left lung abscess	1	1.1
	Pulmonary abscess	1	1.1
	Pulmonary emphysema	2	2.2
	Pulmonary thromboemboli	1	1.1
	Diabetes mellitus	5	5.5
Digestive/ Endocrine	Cirrhosis of the liver	2	2.2
	Adrenal hyperplasia	1	1.1
	Hepatocellular carcinoma	1	1.1
	Hyperglycemia	1	1.1
	Steatosis	1	1.1
Neuro	Syndrome of Inappropriate Antidiuretic Hormone	1	1.1
	Epilepsy	1	1.1
	Acute ischemic cerebral infarction	1	1.1
Mental	Major depressive disorder	1	1.1
	Post-Traumatic Stress Disorder	1	1.1
	Schizophrenia	1	1.1

Others	Drowning	2	2.2
	Protein Calorie Malnutrition	1	1.1
	Obesity	1	1.1
	Sharp force injuries of the antecubital fossa	1	1.1
	Total	91	100%

DISCUSSION

This study reported the socio-demographic characteristics of older decedents who died from opioids as a cause of death during the 2020 COVID-19 pandemic in Florida. We reported 9,163 cases of decedents with any opioids as a cause of death across age groups, and we primarily focused on 348 older adults who died with any opioids as a cause of death in 2020. Overall, these opioid-related death counts might differ from what the Centers for Disease Control and Prevention reported for opioid deaths in Florida in 2020 (N=7231) [28]. Peppin and Coleman reported issues with reporting drug overdose deaths by the CDC, particularly opioids; for instance, the CDC used death certificates to classify drug overdose deaths where death certificates were issued even though the postmortem toxicology results were not yet completed [29]. Another possible explanation for this difference in opioid-related death counts would be that opioid overdose deaths were not always captured in the CDC report since death certificates only have a single cause of death. In contrast, opioid overdose deaths could involve multiple drugs or substances [29].

The results of this study indicated that more older men died from opioids than did older women (67.5% vs. 32.5%), which corresponds to the results of other studies on opioid overdose deaths in terms of gender disparity [30]. Eeckhaut et al., reported increased trends in opioid overdose deaths in four age groups: Women 15-44, women 45-64, men 15-44, and men 45-64, but did not include older adults in their study [30]. While our study results showed that more older men died from opioid intoxication than older women Mason et al., post reported that between 1999 and 2019, 58.98% of those 55 years and older who died from opioid overdose deaths in the U.S were men [29]. It should be noted that our study focused on decedents 65 years and older for one year only (2020), while Mason et al., focused on 55 years and above and included 20 data years [31]. Thus, the difference in opioid overdose deaths by sex could be attributed to a specific age group and the data years.

Results indicating that older non-Hispanic whites were more affected by opioid deaths than members of any other races or ethnicity combined followed a similar pattern from a five-year analysis (2014-2018) previously reported [32]. Kolodny, a co-director of the Opioid Policy Research Collaborative, suggested that doctors have been cautious in prescribing opioids to non-white patients due to fear of addiction and abuse, which could explain the lower incidence of opioid deaths among non-whites [33]. Chacon et al., reported that African Americans and Hispanics were more likely to start or abuse opioids and other substances to cope with the pandemic's stresses [34]. However, this was not the case among the aging population in Florida, where most deaths happened in non-Hispanic older white decedents in 2020.

Among the four opioid categories, fentanyl contributed substantially to opioid mortality, consistent with previous studies [4,30]. The involvement in opioid deaths of other substances, such as cocaine

and methamphetamine, is not new. However, most previous studies in OOD reported all ages without providing specific details of the co-presence of other drugs and their clinical characteristics, particularly in the aging population [4]. In our study, the authors reported the involvement of eight benzodiazepines/hypnotics and psycho-stimulants such as methamphetamine and amphetamine. Our results reflected that of Cano and Huang, who reported an increasing trend of these substances in opioid overdose mortality in 42 of 47 states in the United States, mainly in the Western regions [33]. However, Cano and Huang's study did not focus on older adults [35]. In contrast, Mason et al., reported that the burden of opioid overdose deaths in the U.S was among non-Hispanic Black men from 1999 to 2019, where they recorded an alarming rate from 2.24 deaths per 100,000 in 1999 to 40.3 deaths per 100,000 in 2019 [8]. However, we did not see that in our study, where most opioid deaths in four categories were concentrated among non-Hispanic whites. Again, our study focused on older adults ≥ 65 years in this state-wide analysis, while Mason et al., focused on people 55 years and older in the U.S [8].

The clinical characteristics of older decedents with opioid deaths mirrored what Ornell et al., reported regarding individuals with substance use disorder being at higher risks of developing cardiovascular disease and respiratory complications [36]. This may explain the presence of atherosclerotic and arteriosclerotic heart diseases, hypertensive heart disease, and COPD experienced in 45 cases reported in our study.

The National Institute on Drug Abuse reported that suicide in opioid-overdose deaths evidenced a quadruple increase from 1999 to 2014, particularly in people aged 55-64 [37]. Our study results indicated that a little over 18% of older decedents died from suicide while using opioids, with the majority dying from drug intoxication. While it is challenging to rule out the exact cause of this phenomenon, more so with the absence of a suicide note, the reasons could be multifactorial. People with OUD may also have comorbid conditions such as depression, anxiety, and chronic pain that may lead them to end their lives [35]. Our study found three cases of older decedents with a major depressive disorder, post-traumatic stress disorder, and schizophrenia [38].

CONCLUSION

Drug overdose deaths, particularly from opioid intoxication, are a serious public health problem in younger adults and the aging population. The result of this study has direct patient safety implications since the total opioid prescriptions for Medicare Part D recipients in the U.S reached 803,549 in 2019. Additionally, older decedents who died from opioid intoxication resulting in accidents or suicide warrant strategic interventions. There were no gender differences in the type of opioids used by older decedents. For instance, among the four opioid categories, fentanyl deaths topped the list, followed by morphine, oxycodone, and hydrocodone for both men and women. Older men, however, are disproportionately affected by opioid misuse. The presence of cocaine, heroin, and methamphetamine in opioid deaths suggests unsafe illicit drug use behavior, even in old age.

We recommend caution in interpreting the results of this study as a basis to withhold opioid prescription where its use is medically necessary. Monitoring older adults who take opioids more than the prescribed dosage and duration and those who use multiple drugs with opioids should be a continuous endeavor. The type of opioids involved in opioid mortality should guide healthcare

providers when prescribing any opioid to the aging population aimed toward both relieving pain and maintaining public safety. Our results highlight the need for a sustainable opioid preventive and harm reduction approach tailored for older adults.

Limitations

We do not infer causality in opioid mortality among the older population, particularly those deaths that resulted from accidents and suicide. We did report the clinical diagnosis associated with opioid death, but the severity of these conditions was not indicated in the dataset. We do not know whether opioid use by older decedents may have exacerbated the occurrence of this diagnosis, such as atherosclerotic heart disease. Another limitation was the lack of information regarding the type of residence these older decedents lived in before their demises, such as nursing homes, assisted living, or community dwellings. Finally, the results of this study may not be representative of the general older population who died from opioids in the U.S. since the demographic characteristics of opioid overdose deaths differ from state to state.

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