

Article

The Rising Tide: Disparities in Fentanyl-Related Mortality Among Hispanic and Non-Hispanic Adolescents and Young Adults in the United States

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Abstract: Objectives: The United States has been greatly impacted by the opioid overdose epidemic, and fentanyl has largely contributed to the rise in overdose deaths in the past decade. We have analyzed trends in fentanyl-related mortality amongst adolescents and young adults (AYAs) to further describe emerging trends by ethnicity, gender, and age. Methods: We used mortality data from the U.S. Centers for Disease Control and Prevention Wide-Ranging Online Data for Epidemiologic Research (WONDER) Multiple Cause of Death file from 2009 to 2022. Drug overdose mortalities were identified using International Classification of Diseases, Tenth Revision (ICD-10) codes. Joinpoint regression was used to examine mortality rates involving fentanyl by ethnicity (Hispanic and non-Hispanic), gender, and age category. Results: The Average Annual Percent Change (AAPC) for fentanyl-involved mortality increased for all adolescents and young adults within the United States from 2009 to 2022. The greatest AAPCs for fentanyl-related mortalities occurred amongst, Hispanic AYAs, Male AYAs, and 13–18-year-olds. Conclusions: Significant increases in fentanyl-related mortalities have occurred in AYAs from 2009 to 2022. Disparities by ethnicity and emerging trends in gender and age category highlight the need for targeted approaches to help aid in reducing fentanyl-involved mortality amongst AYAs. There is an urgent need for harm reduction and public health efforts to address this escalating crisis.

Keywords: disparities; fentanyl; substance use; overdose; mortality; adolescents; Hispanic; United States



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1. Introduction

The United States (U.S.) is currently facing a severe opioid epidemic, a public health crisis characterized by a significant increase in opioid use (Althoff et al., 2020). This includes administration of prescription pain relievers, heroin, and synthetic opioids such as fentanyl (Althoff et al., 2020). The epidemic began with its first wave in the 1990s due to the over-prescription of opioid painkillers resulting from the increase in the rate of opioid prescriptions and the decrease in price and availability of opioid painkillers (Volkow & Blanco, 2021). A second wave emerged in the 2010s with a surge reported in heroin use, followed by a third and most deadly wave driven by synthetic opioids, particularly fentanyl (Volkow & Blanco, 2021). Fentanyl, a powerful synthetic opioid, is 50–100 times more potent than morphine (NIDA, 2024). It is used medically to treat severe pain, often

after surgery or for advanced cancer pain, but has more frequently been manufactured illegally and mixed with other drugs, leading to a spike in overdose deaths (Althoff et al., 2020). The comorbidities associated with fentanyl use include respiratory depression, heart failure, and a range of mental health disorders such as depression and anxiety (Slawek et al., 2018). Recently, there have been significant increases in both the incidence and prevalence of fentanyl-related overdose and fatal deaths across the country (Palamar et al., 2022). Evidence indicates a troubling trend of increasing fentanyl usage and fentanyl-laced opioids, particularly among U.S. adolescents due to increased accessibility (Althoff et al., 2020; Jashinsky, 2019). Moreover, national surveys and studies have documented rising trends in fentanyl exposure and overdose deaths among adolescents, highlighting the need for targeted interventions and preventive measures (O'Donnell et al., 2021).

The U.S. has been significantly impacted by the opioid epidemic, with fentanyl playing a central role in the rise of overdose deaths (NIDA, 2024). The U.S. has seen a sharp rise in the availability and use of fentanyl, contributing to a public health emergency (NIDA, 2024). Adolescents and young adults (AYAs) are particularly at risk, as this group often faces challenges related to mental health, substance abuse, and socio-economic factors that exacerbate this issue (Friedman et al., 2022). Adolescents are also at increased risk due to pill-form fentanyl, often distributed as counterfeit pills, rendering this vulnerable population at high-risk of overdose as they are not aware that the ingested pills may contain illicitly manufactured fentanyl (IMF). Major routes of administering IMF were also reported to be via inhalation (smoking) or intravenous use (injections), which further amplifies the risk of adolescent overdose due to lack of awareness and neglect of the type of deadly substances they were exposed to (Hermans et al., 2023). A steady rise in fentanyl-related deaths among AYA underscores the urgent need for effective public health strategies (Hermans et al., 2023).

The opioid epidemic, and specifically the fentanyl crisis, has disproportionately impacted ethnic minority groups and low-income communities (Althoff et al., 2020). Data indicate that certain populations, particularly non-Hispanic Whites, Blacks, and Hispanic/Latino communities are particularly affected by adverse outcomes resulting from fentanyl use (D'Orsogna et al., 2023). The impact of fentanyl on different race and ethnicity groups varies, with both Black and non-Hispanic White populations experiencing higher rates of overdose mortality (SAMSHA, 2020). This disparity can be attributed to a range of social determinants of health, including socio-economic status, access to healthcare, education, and community support systems (Britz et al., 2023). Such morbidity and mortality in these populations are influenced by factors including poverty, unemployment, lack of access to mental health and substance abuse treatment, and historical and systemic inequalities including unequal treatment and care (SAMSHA, 2020). Despite significant public health implications of opioid and fentanyl-specific overdoses in AYA population groups, only few studies have explored trends in reported mortalities that vary by certain demographic characteristics to guide culturally tailored evidence-based prevention interventions at state and national levels.

The primary aim of our descriptive study is to explore trends in fentanyl-involved mortalities (including overdose deaths and fatal overdoses) among AYAs within the U.S. by ethnicity, age, and sex. Our findings, specifically mortality trends discovered in AYA U.S. groups, are aimed at improving our understanding of the opioid epidemic to further implement public health and harm reduction initiatives for AYA impacted by the opioid epidemic.

2. Methods

De-identified data were derived from the U.S. Centers for Disease Control and Prevention Wide-Ranging Online Data for Epidemiologic Research (WONDER) Multiple Cause of

Death file from 1999 through 2020 and the WONDER Multiple Cause of Death file from 2018 to 2022 (CDC, 2024a, 2024b). Since de-identified data were utilized, this study was exempt from the Institutional Review Board at Florida Atlantic University. Opioid and polysubstance opioid overdose deaths were identified using the International Classification of Diseases, Tenth Revision (ICD-10) codes. The following underlying cause of death codes were used: X40-44 (unintentional), X60-64 (intentional), X85 (homicide), and Y10-14 (undetermined intent). Deaths involving fentanyl were identified with the ICD-10 diagnosis code T40.4 (poisoning by synthetic opioids other than methadone). Such deaths were also related to predominantly illicitly manufactured fentanyl and fentanyl analogs (IMFs) (Tanz et al., 2024). Mortality rates are reported as crude rates per 100,000.

Data were restricted to AYA ages 13–25. All available data years, 1999–2022, were downloaded. Data were restricted to cases with reported Hispanic origin to ensure ethnicity trend analysis could be completed. Data for non-Hispanic Black and non-Hispanic others (American Indians, Alaska Natives, and Asian or Pacific Islanders) contained restricted data due to less than 10 deaths in a given year for 10 and 14 years, respectively, which would greatly restrict the trend analysis due to confined timelines that could be analyzed. Because of these suppressed death records, only ethnicity, Hispanic and non-Hispanic, and not race was analyzed. The downloaded 1999–2022 Hispanic dataset had suppressed death records due to low number of deaths for the years 1999–2005 and 2008. To ensure that all datasets were analyzed under the same parameters, the analysis was restricted to the years 2009–2022. The following categories were analyzed for mortality trends from 2009 to 2022: entire U.S. AYAs, ethnicity (Hispanic and non-Hispanic), gender (male and female), and age (13–18 and 19–25).

The National Cancer Institute's (NCI) Joinpoint Regression Program, Version 5.0.2, was used to fit weighted least-squares regression models to analyze mortality trends from 2009 to 2022, among U.S. AYAs by ethnicity (Hispanic and non-Hispanic), gender (male and female), and age (13–18 and 19–25) (Joinpoint Regression Program, 2023). The NCI Joinpoint program characterizes trends for aggregated vital statistics data by identifying observed time points for changes in trend, called Joinpoints (Ingram et al., 2018). This program obtains slope estimates and their variance, perform tests of trends, and is known to better accommodate abrupt changes in trends (Ingram et al., 2018). The Grid search algorithm was applied to ensure that Joinpoints only occurred at observed time points and not in between time points. A minimum number of time points from a Joinpoint to either end of the data and the minimum number of observations between two Joinpoints was set to the default of 2, as there must be at least two data points between two Joinpoints (Ingram et al., 2018). As the data used in this study contain 14 time points, the maximum number of Joinpoints was set to the default of 2. The program's conservative default setting for maximum number of Joinpoints helps avoid excessive multiple testing penalty and overfitting, while ensuring line segments will be of appropriate length to estimate standard error (Ingram et al., 2018). Model selection was completed with the Permutation test with an overall significance level of 0.05. A similar methodology was adopted in Brinzo and Martins' (2024) study exploring racial and ethnic trends in opioid and polysubstance opioid overdose mortality in adolescents and young adults using the CDC WONDER database.

3. Results

3.1. Study Characteristics

Table 1 displays characteristics of fentanyl-related mortalities in AYAs within the U.S. There were 36,473 deaths involving fentanyl from 2009 to 2022 among AYAs. In this time period, total death counts were highest amongst non-Hispanic AYAs. Fentanyl mortalities were also highest among males and among individuals aged 19–25.

Table 1. Reported Overdose Deaths due to Illicitly Manufactured Fentanyl Use or Exposure in Adolescents and Young Adults, 2009–2022.

Characteristic	Deaths (No.)
Total, No.	$n = 36,473$
Ethnicity	
Hispanic	6285
Non-Hispanic	30,188
Gender	
Female	10,408
Male	26,065
Age Category	
13–18	3357
19–25	33,116

3.2. Adolescent and Young Adult U.S. Population

Table 2 and Figure 1 display the trends in fentanyl-related mortality rates among AYA by ethnicity, gender, and age from 2009 to 2022. The absolute change in mortality rate among all adolescents and young adults was 11.35 deaths per 100,000 from 2009 to 2022. The Average Annual Percent Change (AAPC) for fentanyl mortality was 32.1% ($p < 0.001$). In this time period, AYAs living in the U.S. experienced two distinct changes in trend. Mortality rates from fentanyl increased significantly from 2009 to 2020 (Annual Percent Change (APC) = 39.0%, $p < 0.001$) amongst this population and then stabilized from 2020 to 2022 (APC = 0.0, $p = 0.998$).

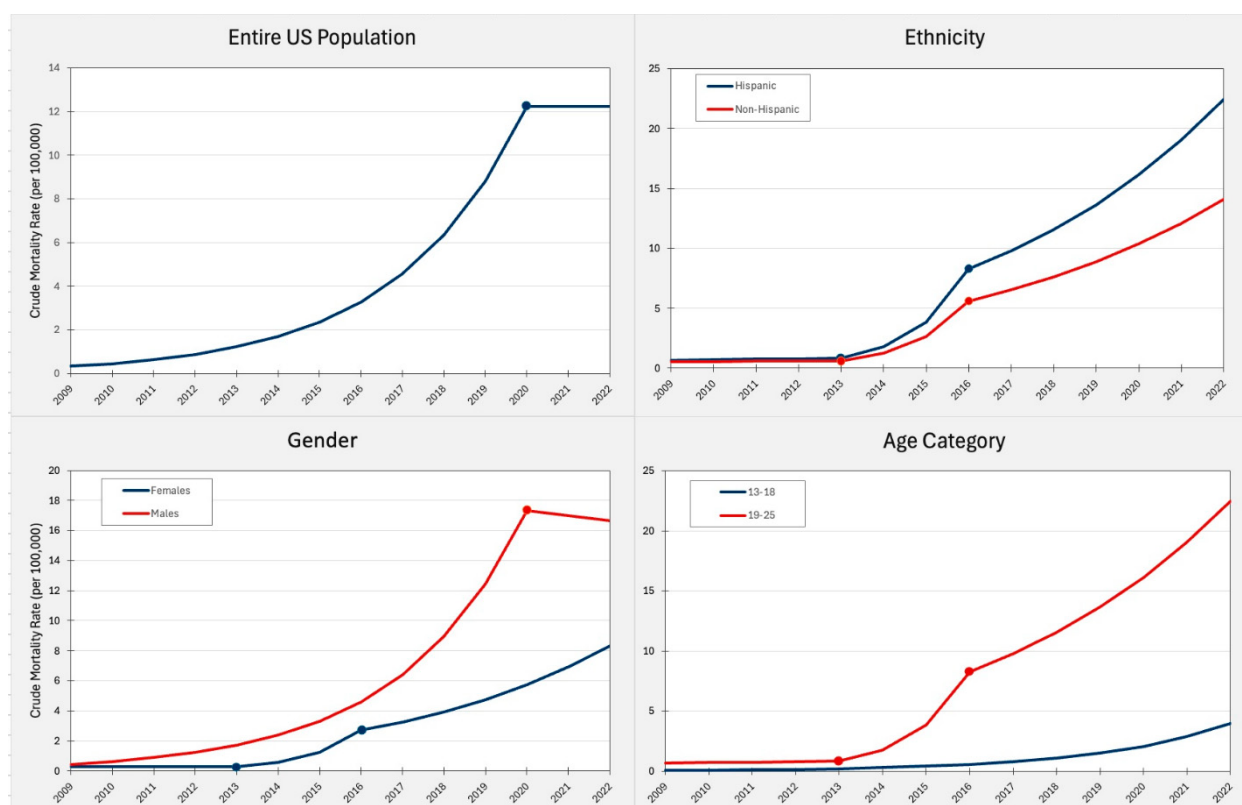
**Figure 1.** Jointpoint trend analyses of fentanyl-related mortality in adolescents and young adults in the US by ethnicity, gender, and age from 2009–2022.

Table 2. Joinpoint analyses of fentanyl-related mortality in adolescents and young adults by age, gender, and ethnicity from 2009–2022.

					Joinpoint Analyses (2009–2022)					
	2009	2022	2009–2022	2009–2022	Trend 1		Trend 2		Trend 3	
Variable	Crude Rate per 100,000	Crude Rate per 100,000	Absolute Rate Change	AAPC	Years	APC	Years	APC	Years	APC
Entire U.S. adolescents and young adults	0.43	11.78	11.35	32.1 **	2009–2020	39.0 *	2020–2022	0		
Ethnicity										
Hispanic	0.69	18.61	17.92	30.7	2009–2013	4.2	2013–2016	116.3	2016–2022	18.1 *
Non-Hispanic	0.52	11.93	11.41	28.5	2009–2013	2.3	2013–2016	111.6	2016–2022	16.6 *
Gender										
Female	0.25	7.36	7.11	30.2	2009–2013	−0.5	2013–2016	116.5	2016–2022	20.7 *
Male	0.61	15.99	15.38	31.9 **	2009–2020	39.3 *	2020–2022	−2.1		
Age Category										
13–18	0.13	3.44	3.31	38.5 **	2009–2022	38.5 *				
19–25	0.69	18.61	17.92	30.7	2009–2013	4.2	2013–2016	116.3	2016–2022	18.1 *

* Indicates that the Annual Percent Change (APC) is significantly different from zero at alpha = 0.05. ** Indicates that the Average Annual Percent Change (AAPC) is significantly different from zero at alpha = 0.05.

3.3. Ethnicity

Fentanyl-related mortality rates amongst AYAs from 2009 to 2022 were analyzed by ethnicity, Hispanic and non-Hispanic (Table 2). While non-Hispanic AYAs had the highest number of deaths due to fentanyl between 2009 and 2022, Hispanic AYAs faced the greatest absolute change in mortality rate, with an absolute change of 17.92 deaths per 100,000 from 2009 to 2022. In comparison, non-Hispanic AYAs had an absolute change in mortality rate of 11.41 deaths per 100,000. The AAPC for Hispanics was also higher than their non-Hispanic counterparts (AAPC 30.7% and 28.5%, respectively); however, neither of these AAPCs were significant ($p = 0.079$ and $p = 0.065$, respectively).

Hispanic and non-Hispanic AYAs displayed similar trends in fentanyl-related mortality between 2009 and 2022 (Figure 1). Each displayed increases between 2009 and 2013, followed by an extreme increase between 2013 and 2016, and a continued gradual increase between 2016 and 2022. For Hispanics, the APC between 2009 and 2013 was 4.2% ($p = 0.9$), the APC between 2013 and 2016 was 116.3% ($p = 0.177$), and the APC between 2016 and 2022 was 18.1% ($p = 0.004$). For non-Hispanics, the APC between 2009 and 2013 was 2.3% ($p = 0.935$), the APC between 2013 and 2016 was 111.6% ($p = 0.152$), and the APC between 2016 and 2022 was 16.6% ($p = 0.005$).

3.4. Gender

Both females and males experienced increases in fentanyl-related mortality rates between 2009 and 2022. Males had an absolute change in mortality rate of 15.38 per 100,000 deaths and females had an absolute change in mortality rate of 7.11 per 100,000 deaths from 2009 to 2022. Males had an AAPC of 31.9% ($p < 0.001$), just slightly larger than that of females AAPC of 30.2% ($p = 0.054$).

While both males and females experienced an increase in mortality rates, the trends for each differed. Male AYAs experienced two distinct changes in trends: an increase in fentanyl-related mortality from 2009 to 2020, with an APC of 39.3% ($p < 0.001$), followed by a small non-significant decrease from 2020 to 2022, with an APC of -2.1% ($p = 0.920$). In comparison, females experienced three distinct trend changes: a decrease in trend between 2009 and 2013, with an APC of -0.5% ($p = 0.987$), followed by a high but non-significant increase in between 2013 and 2016, with an APC of 116.5% ($p = 0.140$), and a significant increase between 2016 and 2022, with an APC of 20.7% ($p = 0.001$).

3.5. Age Category

Fentanyl-related mortality in AYAs was also analyzed by age categories, 13–18 and 19–25. Young adults, aged 19–25, experienced nearly 10 times the number of fentanyl mortalities than adolescents, aged 13–18 (Table 1). While young adults had the greatest number of deaths from fentanyl of the two age categories from 2009 to 2022, it was the adolescents who had the highest AAPC of the entire analysis. Adolescents had an AAPC of 38.5% ($p < 0.001$) and young adults had an AAPC of 30.7% ($p = 0.079$) from 2009 to 2022.

Adolescents experienced no significant change in trend between 2009 and 2022 (APC = 38.5%, $p < 0.001$). In comparison, young adults experienced three distinct changes in trend between 2009 and 2022. The first trend for young adults was between 2009 and 2013, with an APC of 4.2% ($p = 0.9$). This was followed by a dramatic increase in trend between 2013 and 2016, with an APC of 116.3% ($p = 0.177$). Lastly, between 2016 and 2022, young adults experienced a significant increase in trend, with an APC of 18.1% ($p = 0.004$).

4. Discussion

This paper highlights persistent disparities in fentanyl-related mortality among AYAs (13–24 years old) in the U.S. Fentanyl overdose among adolescents has remained high, with

nearly 77% of fentanyl-related deaths in 2021 occurring in this age group (Friedman et al., 2022; NIDA, 2023a). Reports indicate fentanyl is the primary driver of the increase in total drug overdose deaths, with more than a 7.5-fold increase from 2015 to 2022 and the majority of cases occurring among males (NIDA, 2023a). Fentanyl is easy to manufacture and ship around the country at a low cost while providing 50–100 times more potency than many prescription opioids (MacMillan, 2024). Drug dealers can combine it with other substances, like oxycodone, heroin, cocaine, and methamphetamines, and individuals using these laced substances are unaware of its life-threatening consequences, leading to a peak in overdose deaths (MacMillan, 2024). However, in many cases, those who are aware of their fentanyl intake are unable to physically tolerate the drug's potency (MacMillan, 2024). The overall rate of drug use and overdose deaths remained stable between 2021 and 2022 (Spencer et al., 2019). Yet, fentanyl overdose among adolescents has remained high, with nearly 77% of fentanyl-related deaths in 2021 occurring in this age group (Friedman et al., 2022; NIDA, 2023b). Evidence suggests that while fentanyl may not be more prevalent among young individuals, as seen with its stability throughout the past few years, it may be becoming potentially more lethal (NIDA, 2023b). Additionally, factors such as suicidal ideation, mental illness, social isolation, and disruptions in the drug market during the COVID-19 pandemic may have influenced these statistics (Friedman et al., 2022). The substantial increase in fentanyl-related mortality among these age groups highlights the urgency of addressing this public health crisis with targeted interventions.

The data reveal that from 2009 to 2022, there were significant increases in fentanyl-related mortality among AYAs, with a particularly steep rise in mortality rates observed among Hispanic AYAs. Our findings indicate that this demographic experienced the greatest absolute change in mortality rates, supporting previous studies (Friedman et al., 2022; Gaur et al., 2020). This trend suggests that Hispanic AYAs may be facing unique or intensified risk factors compared to their non-Hispanic peers. While the APC in mortality rates for both Hispanic and non-Hispanic adolescents and young adults were not all statistically significant, the observed trends highlight a concerning escalation in fatalities that requires further investigation and intervention. Overall, there is a need for educational interventions targeting adolescents, especially those from underrepresented communities, to reduce fentanyl-related overdoses and increase access to naloxone and mental health services (Friedman et al., 2022).

Gender disparities were also evident, with males experiencing a higher absolute change in mortality rates compared to females (15.38 vs. 7.11 per 100,000). The total number of deaths was higher among males ($n = 26,065$) compared to females ($n = 10,408$). This observation is consistent with existing literature. For instance, Brown et al. (2024) reported that during the COVID-19 pandemic in Pinellas County, FL, males were 2.27 times more likely to overdose than females. Similarly, since 2016, overdose rates among males have been approximately 2.5 times higher (Palamar et al., 2022; Spencer et al., 2019). However, females showed a significant increase in fentanyl-related mortality from 2016 to 2022, suggesting an emerging trend that requires targeted attention. Additionally, there has been a rise in overdose rates among pregnant and postpartum women since 2018, particularly those aged 10–34 (Patrick et al., 2020). Studies indicate that pregnant and non-pregnant women may be less inclined to seek addiction services, as many fear losing custody of their children, facing incarceration, or inability to access affordable opioid use treatment services, which deters them from seeking medical assistance (Patrick et al., 2020). Due to the social and economic issues involved with the use of fentanyl, there is a need to make large-scale strategies and educate policymakers and healthcare professionals about these disparities to reduce fentanyl-related deaths while creating accessible treatment for these vulnerable populations, including young adult pregnant women that might be overlooked with other

overwhelming data ([Han et al., 2019](#); [Patrick et al., 2020](#)). The data suggest that public health efforts should include gender-sensitive strategies to address the unique risk factors and social conditions contributing to increased fentanyl use and overdose among females.

Additionally, this study reveals an alarming increase in fentanyl-related mortality between age groups 13–18 and 19–25. While young adults (19–25) accounted for the majority of deaths, adolescents (13–18) exhibited the highest AAPC in mortality rates. This suggests a rapidly escalating crisis among younger populations, potentially linked to the increased availability of fentanyl-laced substances. The inclusion of fentanyl in illicit drugs, often unbeknownst to users, has exacerbated the overdose crisis despite overall declining drug use rates ([Friedman & Hadland, 2024](#)). This increase in overdose rates has occurred despite declining rates of drug use and the increased inclusion of fentanyl in illicit substances has become the suggested origin ([Friedman & Hadland, 2024](#)). Furthermore, one CDC study showed that 41% of reported fentanyl overdoses involve a history of mental health conditions, with young adults having the highest rates of untreated mental health conditions ([Tanz et al., 2022](#); [Merikangas et al., 2010](#)). As the conversation on adolescent fentanyl overdose continues, an improved understanding of the underlying reasons for these trends will be crucial to determining effective responses from clinicians and lawmakers.

The data also underscore significant disparities in fentanyl-related mortality among different ethnic groups. The rapid rise in overdose rates among Hispanic and Black adolescents, as well as in rural and lower-income communities, highlights the need for targeted public health strategies. These communities often face additional barriers, such as limited access to healthcare, addiction treatment, and harm reduction resources, exacerbating the impact of the opioid crisis. Over the past decade, the rate of fentanyl overdoses in Hispanic and Black adolescents has risen rapidly ([Saloner et al., 2018](#)). Additionally, rural and lower-income communities have been associated with higher rates of fentanyl overdoses, rendering harm-reduction strategies in these communities pivotal to reducing overall fentanyl mortality rates ([Whipple et al., 2023](#); [Victor et al., 2023](#); [Wu et al., 2022](#)). Possible harm reduction strategies at the community level include universal access to fentanyl test kits, naloxone, treatment facilities, and safe consumption facilities ([Saloner et al., 2018](#)). For example, during an increase in fentanyl overdoses in San Francisco in 2015, comprehensive harm reduction efforts, including naloxone distribution, prevented a significant rise in deaths ([Rowe et al., 2019](#)).

Drug testing, such as with test strips or spot test kits, is one way to help prevent potentially fatal overdoses and unintentional polysubstance use. Fentanyl test strips could be particularly impactful due to fentanyl's significantly lower median lethal dose (LD50) compared to most other opioids, as well as a high degree of willingness among people who use drugs to employ harm reduction behaviors such as the regular use of fentanyl test strips ([Drummer, 2019](#)). This is evidenced in a study by Krieger et al., which found that in a cohort of 93 participants who were current drug users, 70% reported concern that their drugs were adulterated, and 95% reported willingness and intention to use fentanyl test strips ([Krieger et al., 2018](#)). However, some states within the U.S. maintain that the possession and use of fentanyl test strips constitutes criminal possession of drug paraphernalia, despite the impacts these testing measures have on reducing overdose mortalities ([Domicolo, 2023](#)). A 2023 study performed by Tilhou et al. found a significant association between receiving a positive result from a fentanyl test strip and engaging in more risk-reducing behaviors, highlighting that drug testing can guide individuals toward safer practices of drug use especially when paired with community outreach and public health education. Thus, there is a need to raise awareness across the U.S. on the importance of increasing access to fentanyl test strips, as bringing the issue to a policy level could allow for a significant

impact on the nature of the opioid crisis. This also includes focus on disparities between Hispanic and non-Hispanic youths in accessing such critical resources, particularly those residing in rural and hard to reach communities (Markiewicz & Weis, 2018). Legislative and policy reforms are crucial to expanding the availability of life-saving resources like naloxone and fentanyl test strips. There is a pressing need for policies that support harm reduction and treatment access rather than punitive measures, which have been shown to be less effective in addressing the opioid crisis (Naumann et al., 2019). A study in North Carolina, a state with a standing order for naloxone, which allows for dispensation without individual-level prescription, found that within 3 years of enacting the standing order, 352 overdose deaths were avoided contributing to a benefit of \$2742 for every dollar spent on the naloxone distribution program (Naumann et al., 2019). These benefits have also been seen in policies targeted toward adolescents, such as youth-focused treatment programs or the implementation of drug education programs in schools (Markiewicz & Weis, 2018).

Educational programs targeting adolescents, such as “This Is (Not) About Drugs” (TINAD), have shown some success in increasing knowledge about the dangers of opioid misuse (This is not about drugs, 2024; Moore et al., 2019). However, these programs need to be part of a broader strategy that includes access to treatment and support services. Legislative initiatives, such as the SUPPORT Act and community-based policies like the Opioid Affected Youth Initiative (OAYI), also play a crucial role in addressing this crisis among young people. Public policy needs to accommodate strategies for harm reduction in active opioid users, as further stigmatizing drug use is unlikely to reduce the risk of overdose in opioid use disorder (Latkin et al., 2019).

4.1. Public Health Implications

Opioid use, including IMF exposure and abuse, represent a significant public health problem of high urgency in the U.S., particularly when it comes to AYA groups (Danielson et al., 2023). Although the epidemic has motivated advances in the effective treatment of opioid use disorder (OUD), with a particular focus on medications for OUD (MOUD), such efforts remain insufficient to combat the burden induced by the current opioid epidemic (Danielson et al., 2023). Hence, there is a call to shift attention earlier in the etiological process of the onset of substance use behaviors in youth for a more comprehensive and tailored approach to address reported opioid-related morbidities and mortalities (Calihan et al., 2024). The use of universal screening and prevention strategies for teens, with an enhanced focus on addressing underlying mental health issues (anxiety, trauma, depression) and environmental barriers (low caregiver monitoring, affiliating with substance using peers), can inform the restructuring of resource allocation to more effectively and equitably address youth substance use and mental health problems (Danielson et al., 2023). This in turn contributes to the de-stigmatization of the disease of SUDs, while raising awareness of illicit drugs that are now more accessible among those highly susceptible to the risk of long-term morbidities and death (Calihan et al., 2024).

4.2. Limitations

Limitations of this study include potential misclassification of deaths and the exclusion of nonresident data, which may limit the generalizability of the findings. Results from this study should be considered descriptive and exploratory in nature. Nonetheless, this analysis contributes to the understanding of the third wave of the opioid epidemic, particularly the trends in fentanyl-related mortality among adolescents and young adults by ethnicity, gender, and age.

5. Conclusions

In conclusion, the results underscore the urgent need for comprehensive, multi-faceted public health interventions to address this escalating crisis, particularly among vulnerable youth populations. Effective strategies should prioritize education, accessible treatment, and policy reforms to mitigate the disproportionate impact of fentanyl on minority groups and address the complex socio-economic and mental health factors driving this epidemic. Continued surveillance and evidence-based, community-oriented, and culturally tailored research studies are crucial to monitor trends and evaluate the effectiveness of intervention programs, ensuring that they are responsive to the evolving dynamics of the opioid crisis.

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References

- Althoff, K. N., Leifheit, K. M., Park, J. N., Chandran, A., & Sherman, S. G. (2020). Opioid-related overdose mortality in the era of fentanyl: Monitoring a shifting epidemic by person, place, and time. *Drug and Alcohol Dependence*, 216, 108321. [CrossRef]
- Brinzo, P. N., & Martins, S. S. (2024). Racial/ethnic trends in opioid and polysubstance opioid overdose mortality in adolescents and young adults, 1999–2020. *Addictive Behaviors*, 156, 108065. [CrossRef] [PubMed]
- Britz, J. B., O’Loughlin, K. M., Henry, T. L., Richards, A., Sabo, R. T., Saunders, H. G., Tong, S. T., Brooks, E. M., Lowe, J., Harrell, A., Bethune, C., Moeller, F. G., & Krist, A. H. (2023). Rising racial disparities in opioid mortality and undertreatment of opioid use disorder and mental health comorbidities in Virginia. *AJPM Focus*, 2(3), 100102. [CrossRef] [PubMed]
- Brown, C. H., Johnson, K. A., Hills, H. A., Vermeer, W., Clarke, D. L., Barnett, J. T., Newman, R. T., Burns, T. L., & Pellan, W. A. (2024). Overdose deaths before and during the COVID-19 pandemic in a US county. *Frontiers in Public Health*, 12, 1366161. [CrossRef]
- Calihan, J. B., Carney, B. L., Schmill, D. M., & Bagley, S. M. (2024). The call for a school-based approach to opioid overdose prevention. *American Journal of Public Health*, 114(12), 1305–1308. [CrossRef] [PubMed]
- CDC. (2024a). *National vital statistics system, mortality 1999–2020 on CDC WONDER online database, released in 2021. Data are from the multiple cause of death files, 1999–2020, as compiled from data provided by the 57 vital statistics jurisdictions through the vital statistics cooperative program*; Centers for Disease Control and Prevention, National Center for Health Statistics. Available online: <http://wonder.cdc.gov/mcd-icd10.html> (accessed on 12 June 2024).
- CDC. (2024b). *National vital statistics system, mortality 2018–2022 on CDC WONDER online database, released in 2024. Data are from the multiple cause of death files, 2018–2022, as compiled from data provided by the 57 vital statistics jurisdictions through the vital statistics cooperative program*; Centers for Disease Control and Prevention, National Center for Health Statistics. Available online: <http://wonder.cdc.gov/mcd-icd10-expanded.html> (accessed on 12 June 2024).
- Danielson, C. K., McCauley, J., Hinkley, J., Hahn, A., Moreland, A., López, C., Goodyear, M., Adams, Z., & McCart, M. (2023). Prevention and intervention with young people as a critical public health strategy to curtail the opioid epidemic: A call to action. *Journal of Addiction Research & Therapy*, 14(4), 521.
- Domicolo, C. (2023, February 28). White House loosens funding restrictions on fentanyl test strips to curb overdose epidemic. *Chicago Policy Review*. Available online: <https://chicagopolicyreview.org/2023/02/28/white-house-loosens-funding-restrictions-on-fentanyl-test-strips-to-curb-overdose-epidemic/> (accessed on 27 September 2024).

- D'Orsogna, M. R., Böttcher, L., & Chou, T. (2023). Fentanyl-driven acceleration of racial, gender and geographical disparities in drug overdose deaths in the United States. *PLoS Global Public Health*, 3(3), e0000769. [CrossRef]
- Drummer, O. H. (2019). Fatalities caused by novel opioids: A review. *Forensic Sciences Research*, 4(2), 95–110. [CrossRef]
- Friedman, J., Godvin, M., Shover, C. L., Gone, J. P., Hansen, H., & Schriger, D. L. (2022). Trends in drug overdose deaths among US adolescents, January 2010 to June 2021. *JAMA*, 327(14), 1398–1400. [CrossRef]
- Friedman, J., & Hadland, S. E. (2024). The overdose crisis among U.S. adolescents. *The New England Journal of Medicine*, 390(2), 97–100. [CrossRef]
- Gaur, D. S., Jacka, B. P., Green, T. C., Samuels, E. A., Hadland, S. E., Krieger, M. S., Yedinak, J. L., & Marshall, B. D. L. (2020). US drug overdose mortality: 2009–2018 increases affect young people who use drugs. *The International Journal on Drug Policy*, 85, 102906. [CrossRef]
- Han, Y., Yan, W., Zheng, Y., Khan, M. Z., Yuan, K., & Lu, L. (2019). The rising crisis of illicit fentanyl use, overdose, and potential therapeutic strategies. *Translational Psychiatry*, 9(1), 282. [CrossRef]
- Hermans, S. P., Samiec, J., Golec, A., Trimble, C., Teater, J., & Hall, O. T. (2023). Years of life lost to unintentional drug overdose rapidly rising in the adolescent population, 2016–2020. *The Journal of Adolescent Health: Official Publication of the Society for Adolescent Medicine*, 72(3), 397–403. [CrossRef] [PubMed]
- Ingram, D. D., Malec, D. J., Makuc, D. M., Kruszon-Moran, D., Gindi, R. M., Albert, M., Beresovsky, V., Hamilton, B. E., Holmes, J., Schiller, J., & Sengupta, M. (2018). National center for health statistics guidelines for analysis of trends. *Vital and Health Statistics. Series 2, Data evaluation and Methods Research*, 179, 1–71.
- Jashinsky, J. (2019). *Non-fatal opioid and all drug overdose surveillance report, Florida, Q1-2019*. Available online: https://www.floridahealth.gov/statistics-and-data/fl-dose/_documents/non-fatal-od-2019-q1.pdf (accessed on 27 September 2024).
- Joinpoint Regression Program. (2023). *Statistical methodology and applications branch, surveillance research program* (Version 5.0.2); National Cancer Institute.
- Krieger, M. S., Yedinak, J. L., Buxton, J. A., Lysyshyn, M., Bernstein, E., Rich, J. D., Green, T. C., Hadland, S. E., & Marshall, B. D. L. (2018). High willingness to use rapid fentanyl test strips among young adults who use drugs. *Harm Reduction Journal*, 15(1), 7. [CrossRef]
- Latkin, C. A., Gicquelais, R. E., Clyde, C., Dayton, L., Davey-Rothwell, M., German, D., Falade-Nwulia, S., Saleem, H., Fingerhood, M., & Tobin, K. (2019). Stigma and drug use settings as correlates of self-reported, non-fatal overdose among people who use drugs in Baltimore, Maryland. *The International Journal on Drug Policy*, 68, 86–92. [CrossRef] [PubMed]
- MacMillan, C. (2024, March 18). Why is fentanyl driving overdose deaths? *Yale Medicine*. Available online: <https://www.yalemedicine.org/news/fentanyl-driving-overdoses> (accessed on 27 September 2024).
- Markiewicz, J., & Weis, M. (2018). *Awareness, education, and collaboration: Promising school-based opioid prevention approaches*; Substance Abuse and Mental Health Resources Administration.
- Merikangas, K. R., He, J. P., Burstein, M., Swanson, S. A., Avenevoli, S., Cui, L., Benjet, C., Georgiades, K., & Swendsen, J. (2010). Lifetime prevalence of mental disorders in U.S. adolescents: Results from the National Comorbidity Survey Replication–Adolescent Supplement (NCS-A). *Journal of the American Academy of Child and Adolescent Psychiatry*, 49(10), 980–989. [CrossRef]
- Moore, S. K., Grabinski, M., Bessen, S., Borodovsky, J. T., & Marsch, L. A. (2019). Web-based prescription opioid abuse prevention for adolescents: Program development and formative evaluation. *JMIR Formative Research*, 3(3), e12389. [CrossRef]
- Naumann, R. B., Durrance, C. P., Ranapurwala, S. I., Austin, A. E., Proescholdbell, S., Childs, R., Marshall, S. W., Kansagra, S., & Shanahan, M. E. (2019). Impact of a community-based naloxone distribution program on opioid overdose death rates. *Drug and Alcohol Dependence*, 204, 107536. [CrossRef]
- NIDA. (2023a) December 13. *Reported drug use among adolescents continued to hold below pre-pandemic levels in 2023*. Available online: <https://nida.nih.gov/news-events/news-releases/2023/12/reported-drug-use-among-adolescents-continued-to-hold-below-pre-pandemic-levels-in-2023> (accessed on 14 July 2024).
- NIDA. (2023b) December 13. *Unintentional drug overdose death rates among US youth aged 15–19*. Available online: <https://nida.nih.gov/research-topics/trends-statistics/infographics/unintentional-drug-overdose-death-rates-among-us-youth-aged-15-19> (accessed on 13 July 2024).
- NIDA. (2024) August 21. *Drug overdose deaths: Facts and figures*. Available online: <https://nida.nih.gov/research-topics/trends-statistics/overdose-death-rates> (accessed on 5 June 2024).
- O'Donnell, J., Tanz, L. J., Gladden, R. M., Davis, N. L., & Bitting, J. (2021). Trends in and characteristics of drug overdose deaths involving illicitly manufactured fentanyls—United States, 2019–2020. *MMWR Morbidity and Mortality Weekly Report*, 70, 1740–1746. [CrossRef]
- Palamar, J. J., Ciccarone, D., Rutherford, C., Keyes, K. M., Carr, T. H., & Cottler, L. B. (2022). Trends in seizures of powders and pills containing illicit fentanyl in the United States, 2018 through 2021. *Drug and Alcohol Dependence*, 234, 109398. [CrossRef] [PubMed]

- Patrick, S. W., Richards, M. R., Dupont, W. D., McNeer, E., Buntin, M. B., Martin, P. R., Davis, M. M., Davis, C. S., Hartmann, K. E., Leech, A. A., Lovell, K. S., Stein, B. D., & Cooper, W. O. (2020). Association of pregnancy and insurance status with treatment access for opioid use disorder. *JAMA Network Open*, 3(8), e2013456. [CrossRef]
- Rowe, C., Wheeler, E., Stephen Jones, T., Yeh, C., & Coffin, P. O. (2019). Community-based response to fentanyl overdose outbreak, San Francisco, 2015. *Journal of Urban Health: Bulletin of the New York Academy of Medicine*, 96(1), 6–11. [CrossRef] [PubMed]
- Saloner, B., McGinty, E. E., Beletsky, L., Bluthenthal, R., Beyrer, C., Botticelli, M., & Sherman, S. G. (2018). A Public Health Strategy for the Opioid Crisis. *Public Health Reports*, 133(1_suppl.), 24S–34S. [CrossRef]
- Slawek, D. E., Lu, T. Y., Hayes, B., & Fox, A. D. (2018). Caring for patients with opioid use disorder: What clinicians should know about comorbid medical conditions. *Psychiatric Research and Clinical Practice*, 1(1), 16–26. [CrossRef]
- Spencer, M. R., Warner, M., Bastian, B. A., Trinidad, J. P., & Hedegaard, H. (2019). Drug overdose deaths involving fentanyl, 2011–2016. *National Vital Statistics Reports: From the Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System*, 68(3), 1–19. [PubMed]
- Substance Abuse and Mental Health Services Administration. (2020). *The opioid crisis and the Black/African American Population: An urgent Issue*. Publication No. PEP20-05-02-001; Office of Behavioral Health Equity, Substance Abuse and Mental Health Services Administration.
- Tanz, L. J., Dinwiddie, A. T., Mattson, C. L., O'Donnell, J., & Davis, N. L. (2022). Drug overdose deaths among persons aged 10–19 years—United States, July 2019–December 2021. *MMWR. Morbidity and Mortality Weekly Report*, 71, 1576–1582. [CrossRef]
- Tanz, L. J., Stewart, A., Gladden, R. M., Ko, J. Y., Owens, L., & O'Donnell, J. (2024). Detection of illegally manufactured fentanyls and carfentanil in drug overdose deaths—United States, 2021–2024. *MMWR. Morbidity and Mortality Weekly Report*, 73(48), 1099–1105. [CrossRef]
- (2024, September 10). This is not about drugs. *Youth opioid education program*. Overdose Lifeline. Available online: <https://www.overdoselifeline.org/opioid-heroin-prevention-education-program/> (accessed on 22 September 2024).
- Victor, G., Hedden-Clayton, B. J., Lister, J., Lee, G., Huynh, P., & Ray, B. (2023). Community overdose surveillance: Fentanyl involvement in overdose deaths in rural Michigan. *Drug and Alcohol Dependence Reports*, 7, 100150. [CrossRef]
- Volkow, N. D., & Blanco, C. (2021). The changing opioid crisis: Development, challenges and opportunities. *Molecular Psychiatry*, 26(1), 218–233. [CrossRef]
- Whipple, C. R., Kaynak, Ö., Kruis, N. E., Saylor, E., Bonnevie, E., & Kensinger, W. S. (2023). Opioid use disorder stigma and support for harm reduction in rural counties. *Substance Use & Misuse*, 58(14), 1818–1828. [CrossRef]
- Wu, Z. H., Yong, Q., Walker, J. M., Grady, J. J., & Laurencin, C. T. (2022). Fentanyl, Heroin, and Cocaine overdose fatalities are shifting to the Black Community: An analysis of the state of Connecticut. *Journal of Racial and Ethnic Health Disparities*, 9(2), 722–730. [CrossRef] [PubMed]

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