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ORIGINAL ARTICLE | YOUTH MORTALITY

Monthly Trends in Drug Overdose Mortality among Youth Aged 15-34 Years in the United States, 2018-2021: Measuring the Impact of the COVID-19 Pandemic

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ABSTRACT

Background: Adolescents and young adults in the United States (US) have experienced a significant increase in drug overdose mortality rates in the last two decades. During the Coronavirus disease 2019 (COVID-19) pandemic, they experienced a lack of access to substance use disorder treatment, stay-home orders, school closure, social isolation, increased psychological distress, and financial strain. Few studies have examined the impact of the pandemic on monthly trends in drug-overdose mortality among youth by race/ethnicity. This study estimates differential changes in monthly drug overdose mortality among youth in the US by age, sex, and race/ethnicity.

Methods: Monthly deaths from the final 2018-2020 national mortality data and the 2021 provisional mortality data were used, and monthly population estimates were obtained from the Census Bureau. We calculated age-specific monthly drug overdose deaths per one million population and used log-linear regression models to estimate monthly percent increases in mortality rates from January 2018 through October 2021.

Results: Drug-overdose deaths among individuals aged 15-34 increased by 36.5% from 2019 (21,152 deaths) to 2020 (28,879 deaths). From February 2020 to May 2020, the drug-overdose mortality rate increased by 62% for males, 53% for females, 79% for Blacks, 62% for American Indians/Alaska Natives (AIANs), 57% for Hispanics, 56% for non-Hispanic Whites, and 47% for Asians. From January 2018 to October 2021, the average monthly drug-overdose mortality rate increased by 2.69% per month for Blacks, 2.54% for AIANs, 2.27% for Hispanics, 1.37% for Asians, and 0.81% for non-Hispanic Whites. Increases in drug-overdose mortality were more rapid among males than females and among youth aged 15-24 than youth aged 25-34.

Conclusion and Global Health Implications: During the peak months in 2020 and 2021, the COVID-19 pandemic had a disproportionate impact by race/ethnicity on trends in drug overdose mortality among the youth. Drug overdose mortality rates increased faster among Blacks, Hispanics, AIANs, and Asians compared to non-Hispanic Whites.

Keywords: • Drug Overdose Mortality • COVID-19 Pandemic • Monthly Trend • Race/Ethnicity • Adolescents and Young Adults • Youth • Log-linear

1. Introduction

In the last two decades, the youths in the United States have experienced a significant increase in drug overdose mortality rates.[1,2] Drug overdose mortality rates among young adults aged 20-24 increased four-fold from 1999 to 2017.[1] Suicide mortality from drug overdose among female teens aged 12-19 also increased three-fold from 1999 to 2017.[1] As a majority of drug-related deaths, opioid-related mortality among individuals aged 13-25 increased three-fold from 1999 to 2016.[2] During the COVID-19 pandemic, declared on March 11 2020,[3] the lack of access to substance use disorder treatment or mental health services, coupled with the stay-home-order, school closure, social isolation, psychological distress, unemployment, and financial strain may have increased the risk of drug overdose and related-mortality.[4–9] Previous studies have found significant increases in drug overdose[4,10] and opioid-related overdose deaths[11–13] during the pandemic. In 2020, the age-adjusted drug overdose mortality rate per 100,000 population in the United States was 28.27 (91,799 deaths), which was a marked increase from the rate of 21.65 (70,630 deaths) in 2019.[14] In particular, the drug overdose death rate among adolescents in 2020 increased by 94% from the 2019 rate.[15] Drug overdose or poisoning became the third leading cause of death among US children and adolescents in 2020.[16]

The pandemic has disproportionately worsened drug overdose and mortality rates in the United States.[11,17–19] Unintentional fatal and nonfatal emergency medical services-attended opioid overdoses increased among non-Hispanic Blacks but decreased for non-Hispanic Whites in Philadelphia.[17] In 2020, drug overdose mortality was highest for AIANs (41.4 per 100,000 population), compared with 36.8 for non-Hispanic Blacks, 31.6 for non-Hispanic Whites, and 17.3 for Hispanics.[18] The increase in drug overdose mortality rates from 2019 to 2020 was highest among non-Hispanic Blacks (48.8%), compared with non-Hispanic Whites (26.3%), and Hispanics (40.1%).[18] The proportion of opioid overdose deaths in 2020 for non-Hispanic Blacks and non-Hispanic Asians increased compared with 2019, while the proportion of opioid overdose deaths in 2020 for non-Hispanic Whites decreased in eleven states.[11] Cumulative excess mortality, which is the difference between the actual number of deaths and the projected number based on past data from January 2017 to February 2020, increased continuously for Blacks from March 2020 to 2021, while the other racial/ethnic group presented decreasing or a stable trend after October 2020 in Massachusetts.[19] Previous studies showed differences in drug overdose mortality before and after the pandemic by race and ethnicity or simply provided figures of increasing trends in drug overdose mortality. However, little is known about monthly percent changes in drug overdose mortality among non-Hispanic White, Black, Hispanic, AIAN, and Asian youth, showing how fast the rates have changed, using nationally representative US data.

To fill the gap in previous studies, this study will estimate monthly percent changes in drug overdose mortality rates per one million population for US youth aged 15-34 from January 2018 to October 2021 by age, sex, and race/ethnicity. We will also identify and analyze peak periods in monthly drug overdose mortality during the pandemic.

2. Methods

The 2018-2020 final and 2021 provisional monthly death data (N= 97,135) by age, sex, race/ethnicity, and cause of death were derived from the National Vital Statistics System (NVSS)'s mortality files. NVSS data are collected and disseminated by the Centers for Disease Control and Prevention (CDC)'s National Center for Health Statistics (NCHS) through the vital registration system. Individual states and independent registration areas, including the District of Columbia, New York City, and 5 territories are responsible for the official recording of live births, deaths, fetal deaths, marriages, divorces, and annulments.[20,21] Since final annual mortality data for a given year are typically released 11 months after the end of the calendar year,[22] we used provisional mortality data from January to October 2021, which were the latest data available from the NVSS. The 2018-2020 monthly population estimates by age, sex, and race/ethnicity were obtained from the Census Bureau.[23] Monthly population estimates for 2021

were derived by assuming the annual growth rate of the total population from 2020 to 2021.

We restricted death records for individuals aged 15-34, who are broadly referred to as youth,[24,25] by combining available data for two age groups, 15-24 and 25-34 years, to obtain sufficient records to analyze deaths and mortality rates for each racial and ethnic group by month. Deaths and corresponding population estimates were categorized by five racial and ethnic groups, including non-Hispanic Whites, Blacks, Asians, AIANs, and Hispanics. Due to small sample sizes, we did not distinguish ethnicity for Blacks, Asians, and AIANs. Drug overdose mortality rates were calculated by dividing the number of drug overdose deaths by the corresponding population and reported as deaths per 1,000,000 population. Drug overdose deaths were classified using the International Classification of Diseases, 10th Revision (ICD-10) underlying cause-of-death codes: X40-44, X60-64, X85, Y10-Y14, and included unintentional, suicide, homicide, and undetermined overdose deaths.[26]

For the trend analysis, we used log-linear regression models to estimate monthly percent increases in mortality rates from January 2018 through October 2021 by modeling the logarithm of the mortality rates as a linear function of time (month), which yielded monthly exponential rates of change in mortality rates. Statistical significance in group difference in monthly trend by sex, age group (15-24, 25-34), and race/ethnicity were tested using a Hausman test after the seemingly unrelated estimation, *suest*, the estimations from all subgroups to be pooled together.[27] All analyses were conducted by Stata 17.[28] No IRB approval was required for this study, as it is based on a secondary analysis of a public-use federal database. The study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline.[29]

3. Results

Drug overdose deaths among individuals aged 15-34 in the US increased by 36.5% from 2019 (21,152 deaths) to 2020 (28,879 deaths). Figure 1 shows the monthly trend in drug overdose mortality per million population by age, sex, and race/ethnicity from January 2018 to October 2021. Average monthly drug overdose mortality among youth aged 25-34 was higher than the rate among youth aged 15-24 (Figure 1A). Average monthly drug mortality rates were higher for males than for females (Figure 1B). As shown in the figures, the first peak of the drug-overdose mortality was in May 2020 and the second peak of the drug-overdose mortality was in March 2021. From February 2020 to May 2020, the drug overdose mortality rate increased by 59% overall, 62% for males, and 53% for females, while from October 2020 to March 2021, the increase in the drug overdose mortality rate was higher for females (29%) than for males (25%).

Average monthly drug overdose mortality rates were generally highest for non-Hispanic Whites between 2018 and 2019, followed by Blacks, AIANs, Hispanics, and Asians (Figure 1C). During the pandemic, racial/ethnic minorities showed a marked increase in drug overdose mortality. From February 2020 to May 2020, the drug-overdose mortality rate increased by 79% for Blacks, 62% for AIANs, and 57% for Hispanics, compared with 56% for non-Hispanic Whites and 47% for Asians. From October 2020 to March 2021, AIANs had the highest increase in mortality (78%), while other racial/ethnic groups had a 16% to 35% increase in drug overdose mortality.

Table 1 shows descriptive statistics and estimated monthly percent changes (EMPC) in drug overdose mortality rates per one million population for US youth aged 15-34 using log-linear regression analysis. From January 2018 to October 2021, the average monthly rate of increase in drug overdose mortality was 1.26% for youth aged 15-34, 1.55% for youth aged 15-24, and 1.15% for youth aged 25-34. Males had a faster average monthly increase in drug overdose mortality than females (1.31% vs. 1.12%). We found marked racial/ethnic disparities in the pace of monthly increases in drug overdose mortality. The monthly drug-overdose mortality rate increased by 2.69% per month for Blacks, 2.54% for AIANs, 2.27% for Hispanics, 1.37% for Asians, and 0.81% for non-Hispanic Whites. Group differences were statistically significant at $p < 0.05$.

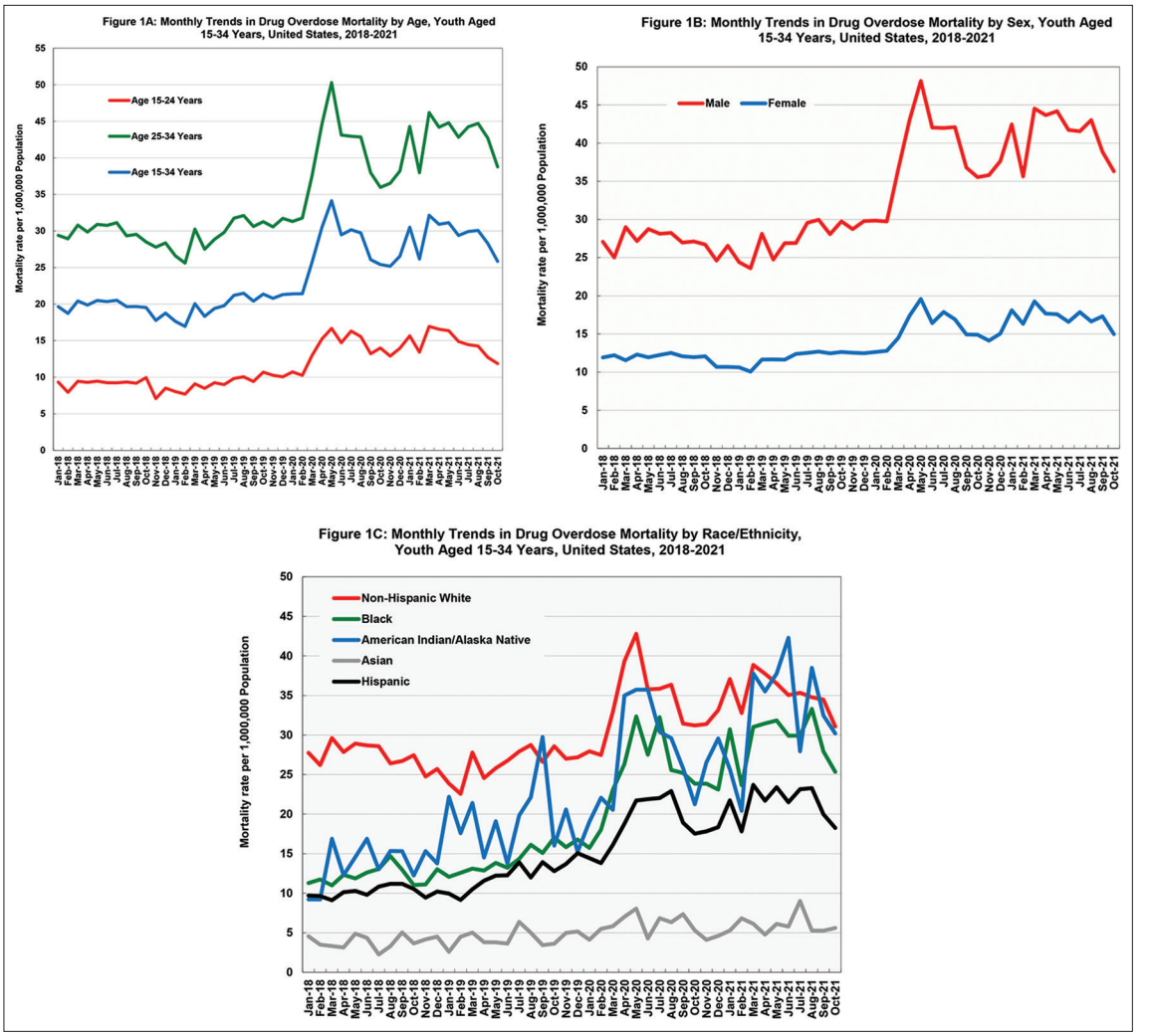

Figure 1: (A-C) Monthly Drug Overdose Mortality Rates per 1 Million Population Among Youth Aged 15-34 years by Age, Sex, and Race/Ethnicity, United States, January 2018 through October 2021

4. Discussion

This study estimated monthly percent changes in drug overdose mortality rates per one million population for the US youth aged 15-34 from January 2018 through October 2021 by race and ethnicity. We found that monthly drug overdose deaths among racial/ethnic minority youth disproportionately increased during the COVID-19 pandemic. Our findings are consistent with previous studies in terms of the fact that non-Hispanic Blacks and AIANs experienced a significant increase in drug overdose mortality.[11,18,19] Our study makes a unique contribution to the existing literature by providing new evidence that Black, Hispanic, AIAN, and Asian youth experienced substantially higher rates of increase in drug overdose mortality.

The existing socioeconomic and health disparities experienced by racial/ethnic minority groups and structural racism might have contributed to the racial/ethnic disparities in drug overdose mortality, in conjunction with COVID-19. Moreover, Blacks and Hispanics are less likely to receive substance use

Table 1: Estimated Monthly Percent Changes (EMPC) in drug overdose mortality rates per one million population for US youth aged 15-34 from January 2018 through October 2021

	Age 15-34								Age 15-24	Age25-34
	Total	Male	Female	NHW	Black	AIAN	Asian	Hispanic	Total	Total
Deaths	97,135	69,073	28,062	67,061	12,300	1,389	1,327	13,844	22,817	74,318
%	100	71.11	28.89	69.04	12.66	1.43	1.37	14.25	23.49	76.51
EMPC	1.255	1.308	1.124	0.812	2.686	2.540	1.366	2.273	1.549	1.150
95% LCL	1.009	1.052	0.890	0.578	2.346	2.066	0.870	1.994	1.233	0.916
95% UCL	1.501	1.566	1.359	1.047	3.027	3.017	1.865	2.553	1.866	1.384
Intercept	2.856	3.175	2.361	3.218	2.290	2.469	1.242	2.154	2.059	3.273
Slope*	0.012	0.013	0.011	0.008	0.027	0.025	0.014	0.022	0.015	0.011
SE (slope)	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.001	0.002	0.001
R-Square	0.697	0.696	0.671	0.513	0.848	0.719	0.400	0.855	0.680	0.681

EMPC=EXP (slope)*100-100, LCL=lower confidence limit, UCL=upper confidence limit, SE=standard error, NHW=Non-Hispanic White, AIAN=American Indian and Alaska Native. *All slopes were statistically significant at $P<0.001$ using log-linear regression

disorder treatment than Whites, even after adjusting for demographics and health status.[30] It is important to address underlying causes of racial and ethnic health disparities and to stem the rising tide of drug overdose deaths among the American youth through appropriate policy interventions. For example, during the COVID-19 public health emergency, barriers to the delivery of medication for substance use disorder treatment were temporarily removed through telehealth payment parity or less privacy and licensing regulations.[31] Future research should also examine the differential effects of social capital, lack of economic opportunities, neighborhood poverty rate, racial/ethnic composition, and working environment on racial/ethnic disparities in drug overdose mortality.[1]

4.1. Limitations

This study has limitations. First, provisional death counts might be underestimated relative to final counts since provisional counts are often incomplete and causes of death may be pending investigation.[22,32] Second, the national distribution of deaths might be affected by the distribution of deaths reported from jurisdictions reporting later.[22] Third, there might be misclassification of AIAN, Asian, and Hispanic ethnicity on the death certificate.[22] We recommend that future studies might consider adopting the predicted provisional death counts, adjusted for delayed reporting.[32] However, we decided to use provisional death estimates, giving researchers and policymakers an early indication of shifts in mortality trends and providing actionable information sooner than the final mortality data.[22]

5. Conclusion and Global Health Implications

Trends in drug-overdose mortality among minority youth disproportionately increased during the peak months of the pandemic in 2020 and 2021. Higher rates of increase in drug-overdose mortality among racial and ethnic minorities compared to non-Hispanic Whites shed light on the need to reduce increasing inequalities in overdose mortality rates among racial/ethnic groups. Given rising trends in drug overdose mortality globally, including high-income countries such as Canada, United Kingdom, and Sweden,[33] our findings on age, sex, and racial/ethnic trends in US drug overdose mortality during the pandemic will be useful for international comparisons.

Compliance with Ethical Standards

Conflict of Interest: *The authors have no conflicts of interest to disclose.* ***Financial Disclosure:*** *None to report.* ***Funding/Support:*** *None.* ***Ethics Approval:*** *No IRB approval was required for this study, as it is based on a secondary analysis of a public-use federal database.* ***Acknowledgments:*** *None.* ***Disclaimer:*** *None.*

Key Messages

- During the first year of the COVID-19 pandemic, the drug overdose mortality rate among youth aged 15-34 increased by 36.5% between 2019 (21,152 deaths) and 2020 (28,879 deaths).
- Between February 2020 and May 2020, the drug overdose mortality rate increased by 62% for males and 53% for females.
- The drug overdose mortality rate increased by 79% for Blacks, 62% for American Indians/Alaska Natives, 57% for Hispanics, 56% for non-Hispanic Whites, and 47% for Asians during the first peak of the pandemic.
- From January 2018 through October 2018, the monthly drug overdose mortality rate increased faster for Blacks, American Indians/Alaska Natives, Hispanics, and Asians than for non-Hispanic Whites.

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