

Changes in drug poisoning mortality before and after the COVID-19 pandemic by occupation in Massachusetts

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Abstract

Background: Incidence of drug poisoning deaths has increased during the coronavirus disease 2019 (COVID-19) pandemic. Previous research has established that risks differ for drug poisoning death according to occupation, and that workers also have a different risk for exposure to and death from COVID-19. This study sought to determine whether workers in certain occupations had drug poisoning mortality rates that increased in 2020 (the first year of the COVID-19 pandemic) compared to the average mortality rate for workers in those occupations during the previous 3 years.

Methods: Death certificates of Massachusetts residents who died from drug poisonings in 2017–2020 were obtained. Average mortality rates of drug poisoning according to occupation during the 2017–2019 period were compared to mortality rates in 2020.

Results: Between the 2017–2019 period and 2020, mortality rates of drug poisoning increased significantly for workers in three occupational groups: food preparation and serving; healthcare support; and transportation and material moving. In these occupations, most of the increases in 2020 compared to 2017–2019 occurred in months after COVID-19 pandemic cases and deaths increased in Massachusetts.

Conclusion: Mortality rates from drug poisonings increased substantially in several occupations in 2020 compared to previous years. Further research should examine the role of occupational factors in this increase in drug poisoning mortality rates during the COVID-19 pandemic. Particular attention should be given to determine the role that exposure to severe acute respiratory syndrome coronavirus 2, work stress, and financial stress due to job insecurity played in these increases.

KEYWORDS

COVID-19, mortality, occupation, opioids

1 | INTRODUCTION

Although overdose deaths have been increasing since the late 90s, in recent years the increasing trend had begun to plateau.¹ This plateauing reversed during the coronavirus disease 2019 (COVID-19) pandemic, when drug overdose mortality increased, primarily driven by opioid-related overdoses.² Overdose deaths increased most

drastically in the months following the implementation of nationwide lockdowns.³ The timing of the increase suggests that the pandemic itself, the effects of lockdowns, and the associated economic downturn may have been important causative factors in the increases in drug overdose deaths.

Workers in different occupations have a different risk for opioid and other drug-related deaths. This risk has been found to be

especially elevated among manual, blue-collar workers.^{4–11} Nationally, workers in six occupations were found to have significantly elevated proportional mortality ratios for opioid poisonings: construction; extraction; food preparation and serving; healthcare practitioners; healthcare support; and personal care and service.⁵ In Massachusetts, workers in nine occupations were found to have significantly elevated opioid-related mortality rates: construction and extraction; farming, fishing, and forestry; material moving; installation, maintenance, and repair; transportation; production; food preparation and serving related; building and grounds cleaning and maintenance; and healthcare support occupations.⁴ In the Massachusetts study, construction and extraction and farming, fishing, and forestry workers stood out as having opioid-related mortality rates over five times higher than the average for all workers.⁴ With respect to trends in opioid-related mortality, in Massachusetts workers in almost all occupations, were found to have increased rates. Some occupations had notably high trends. For example, farming, fishing, and forestry workers had an average annual percent change (AAPC) in mortality rates between 2000 and 2015 of 9.9%, and food preparation and serving workers had an AAPC of 8.2%.⁴ A variety of factors have been suggested to contribute to the differential risk for opioid and other drug poisoning deaths by occupation including work-related pain,^{12,13} occupational injuries,^{4,14–17} and job insecurity.¹⁸

During the pandemic, increases in drug overdose deaths may be different for workers in different occupations. Stress from exposure to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), seeing co-workers sick with the disease, and the risk of exposing family and friends to the disease may contribute to these increases. Workers in certain occupations including healthcare; transportation; services; cleaning; and public safety were shown to be at high risk for contracting COVID-19 in the early days of the pandemic.^{19,20} Additionally, certain occupations were shown to be at an elevated risk for exposure to infections like SARS-CoV-2 including healthcare, service, and transportation workers.²¹ Because workers of color, particularly Black and Hispanic workers are more likely to be employed in occupations with a high risk of exposure to infections like SARS-CoV-2, occupational exposures may be an important contributor to the disproportionate impact of COVID-19 on people of color.²² Furthermore, communities with more workers employed in occupations and industries with a high risk for infection tend to have higher rates of COVID-19.^{23–25} Studies from the United States and other countries suggest that many of these same occupations have had an elevated risk for COVID-19 mortality.^{26–29}

Differential risks for drug overdose death according to occupation during the pandemic may also be due to unemployment or the threat of unemployment. The fear of losing work during the economically precarious situation of the pandemic may have increased the risk of drug overdose death due to increases in job insecurity.¹⁸ Nationally, unemployment increased drastically in 2020, from less than 4% before the pandemic to over 14% at its peak in April, after which unemployment declined quickly, but did not return to its pre-pandemic levels.³⁰ In Massachusetts, unemployment

followed a similar pattern, however, the peak in Massachusetts in April was slightly higher at 16%.³¹ As previously mentioned, being unemployed or not in the labor force may be a risk factor for drug overdose death.^{32–34} Additionally, the risk of a drug overdose may have been impacted by changes in the risk of occupational injuries, a likely risk factor for opioid use,^{4,9,12–18} among essential workers due to working more hours and having heavier workloads.

This study sought to determine whether workers in certain occupations had drug poisoning mortality rates that increased during 2020 (the first year of the COVID-19 pandemic) compared to the average mortality rate for workers in those occupations during the previous 3 years (2017–2019). Among occupations with increases in drug poisoning deaths, we also examine the monthly trends in mortality to observe whether any increases occurred more during the months after widespread of COVID-19 in Massachusetts.

2 | METHODS

Death certificate data for all deaths occurring in Massachusetts from 2017 to 2020 were obtained from the Massachusetts Registry of Vital Records and Statistics. Deaths involving drug poisoning were identified by selecting deaths that had any of the following International Classification of Diseases (Tenth Revision) (ICD-10) codes as the underlying cause of death: X40–X45, Y10–Y15, Y45, Y47, and Y49. These ICD-10 codes correspond to unintentional poisonings. Table S1 provides details about the substances categorized by these codes. We have used a wide definition of poisonings to capture the deaths from a wide variety of substances. This same definition has been previously utilized especially in the literature examining “deaths of despair,” which have been contributing to increased mortality, of which drug poisonings are the cause of death with the highest number.^{7,9,10,35,36}

Specific variables obtained from death certificates included cause (s) of death, year of death, usual occupation, usual industry, age, sex, educational attainment, and race/ethnicity. Death certificate occupation and industry data refer to the “usual” occupation and industry of the decedent, meaning the occupation and industry that they tended to work during their life. They may not have necessarily been working in these industries and occupations at the time of death.³⁷ In this analysis, we assumed that this usual occupation represented the occupation they were working at the time of death. Deaths were restricted to those occurring to MA residents between the ages of 16 and 64. Anyone with usual occupation or industry information that indicated that they were unemployed or not in the labor force was excluded.

Information about usual occupation and industry from the death certificate was coded using the National Institute for Occupational Safety and Health (NIOSH) Industry and Occupation Computerized Coding System (NIOCCS). Occupations were categorized using the 2012 Major Occupation Census Codes. Data about the number of workers employed in Massachusetts according to occupation, age, sex, educational attainment, and race/ethnicity were obtained from

the 2017 to 2020 Massachusetts American Community Survey.³⁸ These numbers were matched with the death counts to compute mortality rates.

We computed numbers, percentage, and average annual mortality rates according to usual occupation, age, sex, race/ethnicity, and educational attainment stratified according to deaths that occurred in 2017–2019 and deaths occurring in 2020. To determine whether changes in rates between 2017–2019 and 2020 were significantly different according to occupation, we constructed Poisson regression models using SAS version 9.3. In these models, we computed the interaction between occupation and time period (2017–2019 vs. 2020). The number of workers was treated as an offset. In the model, for each usual occupation, the exponent of the interaction term (the rate ratio) represented how many times more or less the change in rates between the two time periods was for that particular usual occupation compared with the change for all other workers. No other variables were included in these models. Example SAS code is shown in Figure S1. We also examined mortality rates by month in 2020 compared with the average annual monthly mortality rates during the 2017–2019 period for all workers and for workers in occupations with a significant increase in mortality rates.

2.1 | Sensitivity analysis

Because of the rapid increases in unemployment in 2020 and the fact that in many cases this unemployment would not be reflected on death certificates, we examine whether there were significant differences in changes in mortality rates when 2019 employment data was used as the denominator to calculate mortality rates. We performed this analysis using the same parameters described above for calculating rate ratios by occupation.

3 | RESULTS

As shown in Table 1, between 2017–2019 and 2020 the mortality rate for drug poisonings increased slightly in Massachusetts from 48.8 deaths per 100,000 worker years (95% confidence interval [CI]: 47.4–50.1) to 50.0 (95% CI: 47.6–52.4). Mortality rates declined among workers aged 16–34 and 45–54. The decline for workers aged 25–34 was statistically significant. The mortality rate increased statistically significantly by 30% for those between the ages of 35–44. Mortality rates were also highest among workers in the 35–44 age group in 2020. There was a slight increase in drug poisoning mortality for those aged 55–64. Mortality rates were over three times higher among males compared to females in both time periods. Rates did not change dramatically between the two time periods for either males or females. During the 2017–2019 time period, mortality rates were highest among Hispanic and White, non-Hispanic workers. In 2020, mortality rates increased substantially for Black, non-Hispanic workers resulting in mortality rates higher than those of White, non-Hispanic workers and nearly as high

as rates among Hispanic workers. During both time periods, mortality rates were multiple times higher among those with a high school education or less compared to those with some college or more. Rates increased nonsignificantly among workers with a high school education or less and decreased non-significantly for those with some college education or more.

As shown in Table 2, during both time periods, workers in several occupations had mortality rates higher than the average for all workers including construction and extraction; farming, forestry, and fishing; installation, repair, and maintenance; building and grounds cleaning and maintenance; food preparation and serving related; transportation and material moving; production; and personal care and services. These occupations are consistent with occupations that have been documented to have elevated rates of drug poisoning or overdose deaths in Massachusetts in previous studies.^{4,7}

Between the 2017–2019 period and 2020, mortality rates increased significantly ($p < 0.05$) for workers in three occupation groups: food preparation and serving; healthcare support; and transportation and material moving. Workers in other occupations had notable, although not significant, increases in mortality including building and grounds cleaning and maintenance; protective service; and sales workers.

During 2020 in Massachusetts, cases of COVID-19 increased steadily through March and April, reaching a peak in late April. Cases remained relatively low through November when they began to increase dramatically reaching a new peak in late December.³⁹ In late March, a stay-at-home advisory was issued closing non-essential industries.⁴⁰ A phased re-opening of these industries began in mid-May⁴¹

With respect to monthly rates for all workers, noticeable increases in mortality (defined as a 10% or greater relative increase in mortality rates between 2017–2019 and 2020) were observed in February, April, May, and June 2020 compared with the average mortality rate for those months in the 2017–2019 period (Figure 1). Food preparation and serving workers had noticeable increases in mortality rates throughout 2020 except in August and November. Food preparation and serving workers' mortality rates were over 100% higher in February, April, and May (Figure 2). Healthcare support workers had noticeable increases in January through March, June through September, November, and December (Figure 3). Among transportation and material moving workers, there were noticeable mortality increases in February through June and August (Figure 4).

3.1 | Sensitivity analysis

As shown in Table S2, when using employment in 2019 as a denominator there were not any occupations identified as having a significant increase in mortality rates. Workers in transportation and material moving and healthcare support occupations did have increases in mortality and nearly significant p-values when the 2019 denominator was used. Workers in food preparation and

TABLE 1 Number and mortality rate of drug poisoning deaths according to age, sex, race/ethnicity, and educational attainment among Massachusetts working residents, 2017–2019 compared with 2020

Age group	2017–2019			2020			Rate ratio (95% CI) ¹	P value
	n (%)	Worker-years	Deaths per 100,000 worker-years (95% CI)	n (%)	Worker-years	Deaths per 100,000 worker-years (95% CI)		
16–24	268 (5.4)	1,416,490	18.9 (16.7–21.2)	60 (3.7)	406,299	14.8 (11.0–18.5)	0.76 (0.57–1.02)	0.0600
25–34	1504 (30.3)	2,444,062	61.5 (58.4–64.6)	428 (26.4)	816,311	52.4 (47.5–57.4)	0.78 (0.68–88)	<0.0001
35–44	1294 (26.1)	2,100,321	61.6 (58.3–65.0)	523 (32.2)	690,431	75.7 (69.3–82.2)	1.30 (1.15–1.47)	<0.0001
45–54	1144 (23.0)	2,247,506	50.9 (48–53.9)	343 (21.1)	687,129	49.9 (44.6–55.2)	0.94 (0.82–1.08)	0.4121
55–64	754 (15.2)	1,967,806	38.3 (35.6–41.1)	268 (16.5)	643,865	41.6 (36.6–46.6)	1.07 (0.92–1.25)	0.3841
Sex								
Female	1067 (21.5)	5,026,977	21.2 (20.0–22.5)	383 (23.6)	1,610,089	23.7 (21.3–26.1)	1.11 (0.98–1.27)	0.1100
Male	3897 (78.5)	5,149,208	75.7 (73.3–78.1)	1,240 (76.4)	1,633,946	75.9 (71.7–80.1)	0.90 (0.79–1.02)	0.1100
Race/ethnicity								
American Indian/Alaska Native/Other, non-Hispanic	64 (1.3)	281,396	22.7 (17.2–28.3)	26 (1.6)	139,662	18.6 (11.5–25.8)	0.79 (0.50–1.25)	0.3104
Asian, non-Hispanic	38 (0.8)	721,852	5.3 (3.6–6.9)	17 (1.0)	252,996	6.7 (3.5–9.9)	1.24 (0.70–2.20)	0.4642
Black, non-Hispanic	248 (5.0)	717,767	34.6 (30.3–38.9)	120 (7.4)	205,565	58.4 (47.9–68.8)	1.70 (1.36–2.14)	<0.0001
Hispanic	599 (12.1)	1,140,889	52.5 (48.3–56.7)	229 (14.1)	368,427	62.2 (54.1–70.2)	1.18 (1.00–1.39)	0.0469
White, non-Hispanic	4015 (80.9)	7,314,281	54.9 (53.2–56.6)	1,230 (75.8)	2,277,385	54.0 (51.0–57.0)	0.80 (0.70–0.92)	0.0015
Educational attainment								
High school or less	3599 (72.5)	2,820,673	127.6 (123.4–131.8)	1,159 (71.5)	802,831	144.4 (136.1–152.7)	1.11 (0.98–1.25)	0.1092
Some college or more	1365 (27.5)	7,355,512	18.6 (17.6–19.5)	463 (28.5)	2,441,204	19.0 (17.2–20.7)	0.90 (0.80–1.02)	0.1092
Total	4964	10,176,185	48.8 (47.4–50.1)	1,622	3,244,035	50.0 (47.6–52.4)		

Note: Bold indicates rate ratios with a p value less than 0.05.

Abbreviation: CI, confidence interval.

¹Reference group is all other workers.

TABLE 2 Drug poisoning mortality rates according to occupation among Massachusetts working residents 2017–2019 compared to 2020

Occupation	2017–2019			2020			Rate ratio (95% CI) ^{1,2}	p value
	n (%)	Worker-years	Deaths per 100,000 worker-years (95% CI)	n (%)	Worker-years	Deaths per 100,000 worker-years (95% CI)		
Architecture and engineering	44 (0.9)	246,605	17.8 (12.6–23.1)	9 (0.6)	88,304	10.2 (3.5–16.9)	0.55 (0.27–1.14)	0.1073
Arts, design, entertainment, sports, and media	75 (1.5)	241,911	31.0 (24.0–38.0)	26 (1.6)	79,140	32.9 (20.2–45.5)	1.03 (0.66–1.62)	0.8836
Building and grounds cleaning and maintenance	297 (6.0)	335,982	88.4 (78.3–98.5)	107 (6.6)	97,212	110.1 (89.2–130.9)	1.23 (0.98–1.54)	0.0797
Business and financial operations	69 (1.4)	664,448	10.4 (7.9–12.8)	26 (1.6)	237,745	10.9 (6.7–15.1)	1.02 (0.65–1.61)	0.9291
Community and social services	74 (1.5)	214,122	34.6 (26.7–42.4)	19 (1.2)	71,302	26.6 (14.7–38.6)	0.75 (0.45–1.24)	0.2643
Computer and mathematical	41 (0.8)	468,484	8.8 (6.1–11.4)	10 (0.6)	166,569	6.0 (2.3–9.7)	0.66 (0.33–1.33)	0.2474
Construction and extraction	1286 (25.9)	462,312	278.2 (263.0–293.44)	391 (24.1)	132,979	294.0 (264.9–323.2)	1.01 (0.89–1.15)	0.8637
Education, training, and library	49 (1.0)	722,244	6.8 (4.9–8.7)	12 (0.7)	252,789	4.7 (2.1–7.4)	0.68 (0.36–1.27)	0.2257
Farming, forestry, and fishing	71 (1.4)	22,855	310.7 (238.4–382.9)	17 (1.0)	8,401	202.4 (106.2–298.6)	0.63 (0.37–1.08)	0.0920
Food preparation and serving	517 (10.4)	565,887	91.4 (83.5–99.2)	177 (10.9)	133,304	132.8 (113.2–152.3)	1.45 (1.21–1.73)	<0.0001
Healthcare practitioners and technical	101 (2.0)	693,402	14.6 (11.7–17.4)	33 (2.0)	221,900	14.9 (9.8–19.9)	1.00 (0.67–1.48)	0.9835
Healthcare support	133 (2.7)	334,101	39.8 (33.0–46.6)	61 (3.8)	110,373	55.3 (41.4–69.1)	1.37 (1.01–1.86)	0.0464
Installation, repair, and maintenance	253 (5.1)	216,523	116.8 (102.4–131.2)	80 (4.9)	75,221	106.4 (83.0–129.7)	0.88 (0.68–1.14)	0.3520
Life, physical and social services	17 (0.3)	212,151	8.0 (4.2–11.8)	6 (0.4)	88,885	6.8 (1.3–12.2)	0.82 (0.32–2.07)	0.6702
Management	233 (4.7)	1,226,899	19.0 (16.6–21.4)	80 (4.9)	427,653	18.7 (14.6–22.8)	0.95 (0.73–1.23)	0.7059
Office and administrative support	328 (6.6)	1,046,032	31.4 (28.0–34.8)	102 (6.3)	315,830	32.3 (26.0–38.6)	1.01 (0.80–1.27)	0.9492
Personal care and services	224 (4.5)	343,965	65.1 (56.6–73.7)	60 (3.7)	83,985	71.4 (53.4–89.5)	1.07 (0.80–1.43)	0.6485
Production	284 (5.7)	352,654	80.5 (71.2–89.9)	75 (4.6)	95,552	78.5 (60.7–96.3)	0.95 (0.73–1.23)	0.6709
Protective service	45 (0.9)	211,310	21.3 (15.1–27.5)	19 (1.2)	60,815	31.2 (17.2–45.3)	1.44 (0.84–2.47)	0.1866
Sales and related	376 (7.6)	901,515	41.7 (37.5–45.9)	136 (8.4)	271,797	50.0 (41.6–58.4)	1.19 (0.97–1.46)	0.1006
Transportation and material moving	430 (8.7)	563,072	76.4 (69.1–83.6)	174 (10.7)	177,766	97.9 (83.3–112.4)	1.28 (1.06–1.54)	0.0092
All workers	4964	10,176,185	48.8 (47.4–50.1)	1622	3,244,035	50.0 (47.6–52.4)		

Note: Bold indicates rate ratios with a p-value less than 0.05. Workers in legal occupations are not shown because deaths among these workers were less than 5 in at least one of the time periods. Deaths and worker-years do not sum to 100%.

Abbreviation: CI, confidence interval

¹Reference group is workers in all other occupations.

²No covariates were included in models to calculate rate ratio.

serving occupations did not have increases in mortality when the 2019 denominator was used.

4 | DISCUSSION

The findings from this study suggest that increases in drug poisoning deaths during the COVID-19 pandemic may have been higher among certain occupations. In particular, these deaths increased substantially among food preparation and serving; healthcare support; and transportation and material moving workers. Among these occupations, increases were mostly higher in months that coincided with the pandemic, compared to the average mortality rates during those same months during the preceding three years. In some instances, mortality was elevated in the pre-pandemic months. These increases could have been due to chance or other factors that changed in 2020.

These increases in mortality could be due to the stress from the pandemic, both due to the potential of being exposed to SARS-CoV-2 and the financial and social effects of the pandemic. Previous research suggests that workers in the occupation groups with significant increases in drug poisoning mortality face more exposure to SARS-CoV-2 and/or high mortality rates from COVID-19 than workers in other occupations.^{21,22,26,27,42} Most of these workers are also likely employed in essential industries, thus increasing the risk of exposure.⁴³ A recent study found that frontline workers were more likely to report symptoms of anxiety and depression compared to other workers.⁴⁴ Particularly among healthcare workers, there is emerging evidence that infection with COVID-19 can have negative mental health consequences.^{45,46} Further potential mechanisms that may link the pandemic to stress among workers include long work hours for many essential workers and increased demands for delivery workers due to more people working from home.⁴⁷

The fact that workers in occupations with increases in drug poisoning deaths also likely had disproportionate exposure to SARS-CoV-2 is supported by the fact that each occupation had significantly elevated mortality rates from COVID-19 in Massachusetts in 2020.²⁶ Healthcare support workers had the highest rate, followed by transportation and material moving; and food preparation and service workers.²⁶ However, workers in these occupations may also have exposure to different risk factors that increased their risk for severe illness when contracting COVID-19. Most healthcare support and transportation workers are employed in essential industries. Previous research has suggested that workers in essential industries may be at a higher risk for severe COVID-19 due to having a higher prevalence of underlying risk factors compared to workers in other industries.⁴⁷ Work environment factors may increase the prevalence of these underlying risk factors among workers.⁴⁸ Additionally, workers seeing co-workers sick with COVID-19 and dying from the disease may have increased stress. Especially in the case of healthcare support workers, the exposure to patients infected with SARS-CoV-2 may have further exacerbated stress.

The fact that healthcare support workers had an increase in drug poisoning mortality, but healthcare practitioners did not have such an

increase may be due to several factors. In this study, healthcare support workers had a higher drug poisoning rate in the pre-pandemic period compared with other workers consistent with other studies.^{7,9} Occupational factors including injuries may contribute to higher pain and use of opioids among healthcare support workers.⁹ Therefore, the effects of the pandemic may have had more of an impact on healthcare support workers because there was a higher proportion of workers at risk due to these factors. Another potential contributing factor is that a higher proportion of healthcare practitioners were able to work from home during the pandemic (such as through telemedicine) compared to healthcare support workers. While previous research finds that a low proportion of both healthcare practitioners and support jobs were likely to be able to work from home, the share was higher among healthcare practitioners.⁴⁹

Several occupation groups that would be expected to have higher exposure to SARS-CoV-2 were not found to have significant increases in drug poisoning death. Baker et al.²¹ identified seven occupation groups with frequent exposure to infections greater than the average for all workers. Of those seven occupations, only one (healthcare support) had significant increases in drug poisoning deaths in this study. Of the other five occupations, only two had a substantial but not significant increase (building and grounds cleaning and maintenance; protective services) and four did not increase substantially or declined (healthcare practitioners and technical; personal care and service; community and social services; and education, training, and library). Additionally, while all three of the occupations with significant increases in drug poisoning deaths during the pandemic had among the highest mortality rates from COVID-19 in Massachusetts,²⁶ there were seven other occupations with elevated mortality rates that did not have significant increases in drug poisoning mortality. Of these seven occupations, only one had a substantial but not significant increase (protective services) and six did not increase substantially or declined (production; construction and extraction; installation, maintenance, and repair; personal care and service; arts, design, entertainment, sports, and media; and community and social service).²⁶ These findings suggest that while the effects of the pandemic, especially in occupations with higher exposure to SARS-CoV-2 may be an important contributor to increases in drug poisoning mortality, other factors are relevant as well.

Another factor that may contribute to differential occupational increases in drug poisoning deaths is unemployment and financial strain. Unemployment increased dramatically during the early days of the COVID-19 pandemic.³⁰ Unemployment and not being in the labor force are likely to risk factors for drug poisoning death.³²⁻³⁴ The potential impact of unemployment is different depending on the occupation being considered. In particular, nationally the unemployment rate increased over three times among food preparation and serving workers during the pandemic.³⁰ Unemployment for transportation and material moving and building and grounds cleaning workers did increase in 2020, but this increase was smaller than for many other occupations.⁵⁰ Although directions for filling out

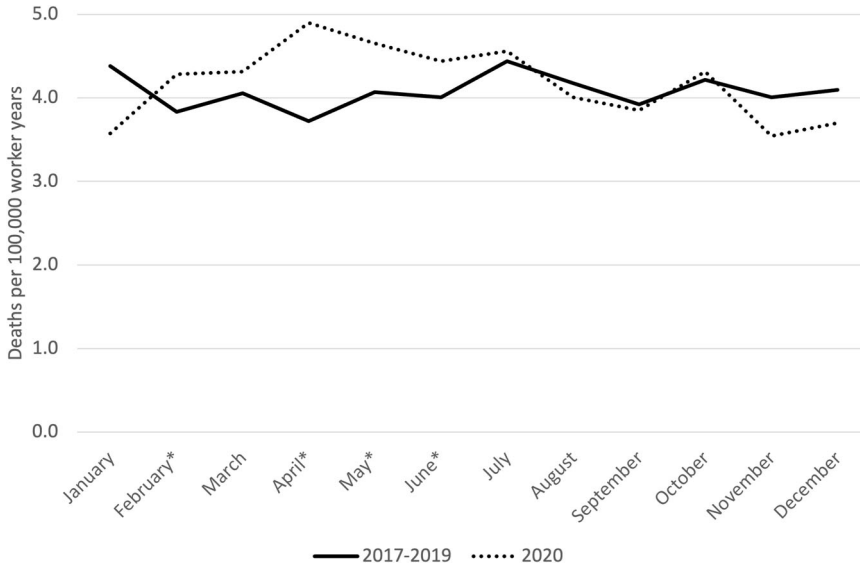


FIGURE 1 Drug poisonings mortality rates among all workers by Month, Massachusetts residents, 2017–2019 average compared with 2020. *Months with a 10% or greater relative increase in mortality rates between 2017–2019 and 2020.

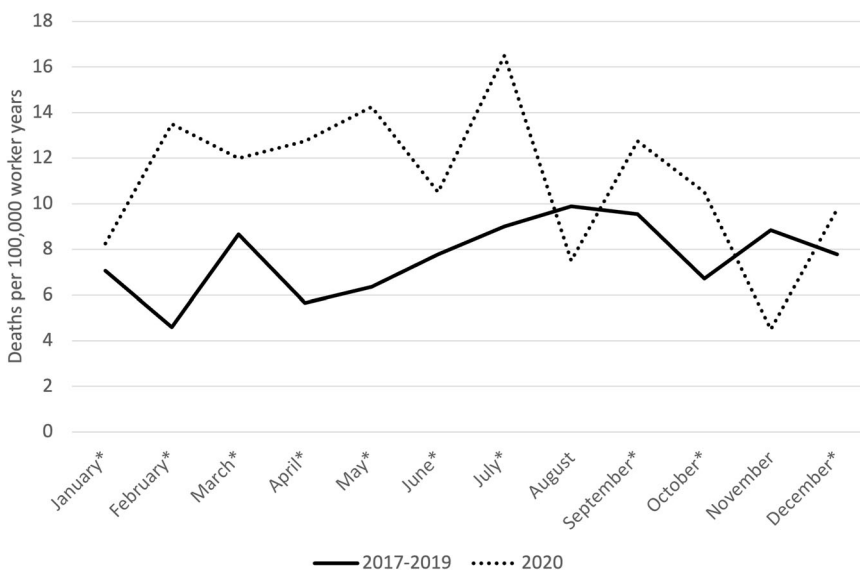


FIGURE 2 Drug poisonings mortality rates among food preparation and serving workers by month, Massachusetts residents, 2017–2019 average compared to 2020, *Months with a 10% or greater relative increase in mortality rates between 2017–2019 and 2020

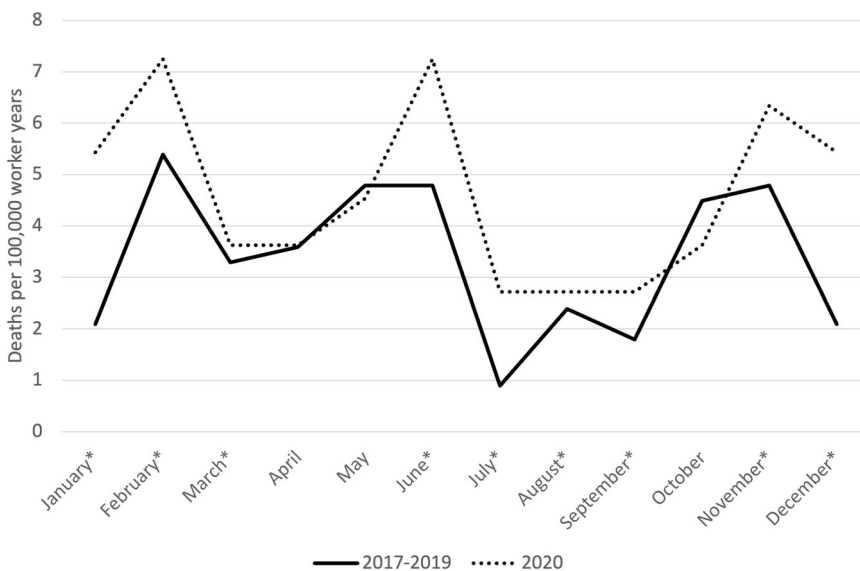
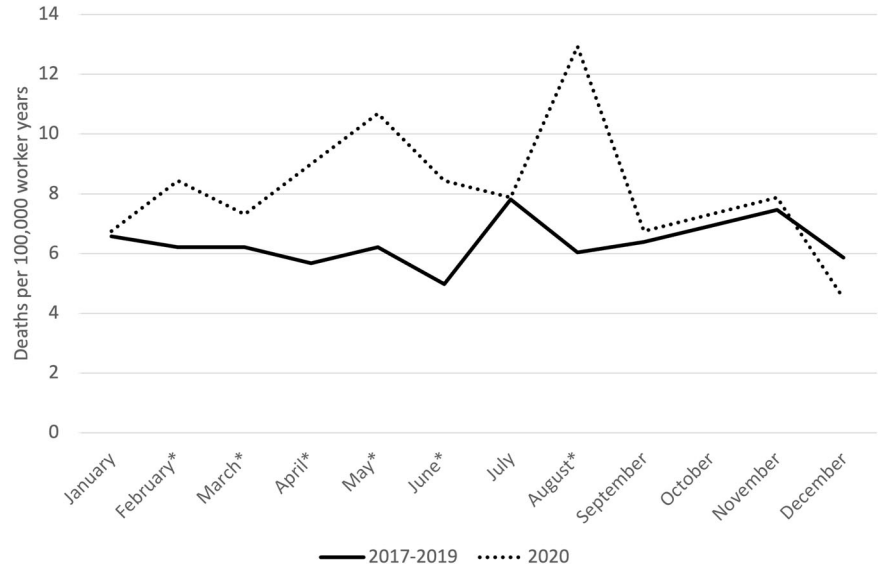


FIGURE 3 Drug poisonings mortality rates among healthcare support workers by month, Massachusetts residents, 2017–2019 average compared to 2020. *Months with a 10% or greater relative increase in mortality rates between 2017–2019 and 2020.

FIGURE 4 Drug poisonings mortality rates among **transportation and material moving workers** by month, Massachusetts residents, 2017–2019 average compared with 2020. *Months with a 10% or greater relative increase in mortality rates between 2017–2019 and 2020.



death certificates instruct to never enter unemployed as part of the occupation or industry information, in some cases, a decedent will be listed as unemployed on their death certificate. If workers in some occupations are less likely to be coded as unemployed than others even if that is their current work status, this could bias the findings towards overestimating mortality among those occupations. Such misclassification may explain some of the increases in mortality among food preparation and serving workers. Because of the large increase in the unemployment rate among this occupation in 2020, the denominator for the number of workers in 2020 was much lower than in previous years. If unemployment among these workers was not being represented on their death certificates (as would be correct with respect to the guidance for filling out death certificates), the rate will be elevated. When using 2019 workers as a denominator, there was not a significant increase in poisoning mortality rates among food preparation and serving workers, suggesting that the decrease in the denominator in 2020 may have contributed to the rate increase (Table S2). Additionally, in some cases industry and occupation will not be reported on the death certificate at all, even if the worker was employed at any point during their life. This rate of underreporting may differ with respect to age, gender, and race/ethnicity. Such underreporting could contribute to the underestimation of mortality rates in this study because workers without occupation information will be excluded.⁵¹

Previous research has demonstrated that occupational injuries are a likely risk factor for drug overdose deaths.^{4,9,12–18} In Massachusetts, among the four occupations with significant increases in drug overdose deaths, two (healthcare support and building and grounds cleaning) had increases in the rate of occupational injuries and illnesses in 2020 compared with previous years.⁵² It should be noted that some of these increases may be driven by increases in occupational illnesses (primarily COVID-19), which contributed to increases in occupational injuries and illnesses rates in 2020.⁵³ However, when specific injuries that are connected to pain and opioid use are considered using data from the Bureau of Labor Statistics Survey of Occupational Injuries

and Illnesses increases among some of these occupations are noted. For example, in Massachusetts, healthcare support workers had a 17% increase in the rate musculoskeletal disorders (MSDs) in 2020 compared with 2019, while food preparation and serving workers in Massachusetts had a 22% increase in MSDs. Although transportation and material moving workers overall did not have increases in MSDs, workers in several detailed transportations and material moving occupations nationwide (Massachusetts specific data is not available for detailed occupations) did have increases in MSDs in 2020 including ambulance drivers and attendants.⁵² These increases in MSDs injuries and associated pain may have increased the risk for drug overdoses.⁵⁴

There are a variety of other factors that may have contributed to increases in the risk of drug poisoning deaths during the pandemic. The pandemic interrupted the availability of treatment for substance use disorders,⁵⁵ workers in certain occupations may have been more vulnerable to these disruptions due to the nature of their employer-provided healthcare. Additionally, it is possible that the pandemic resulted in changes in the potency of drugs being taken or even the types of drugs being consumed. For example, it is possible that workers may have transitioned from taking prescription opioids to more potent fentanyl. A recent report from the Massachusetts Department of Public Health documented increases in poisoning deaths involving fentanyl among workers in the pre-pandemic years, paralleling similar trends nationwide.⁵⁶ Finally, due to the pandemic, people using drugs may have had less access to emergency treatment and opioid reversal medication like naloxone.⁵⁷ It is conceivable that exposure to these factors may have been differential by occupation. Further research should examine how these factors may have affected workers.

Notably, the three occupation groups found to have an increase in the risk for drug poisoning deaths during the pandemic in this study are also occupations that have been shown to disproportionately employ workers of color using nationwide data.⁵⁸ It has already been established that workers of color are more likely to be employed in occupations with increased risk of SARS-CoV-2 exposure and that

there are elevated rates of COVID-19, hospitalization, and death among people of color.⁵⁹ Additionally, in Massachusetts, while the rate of drug opioid-related deaths have been declining among White, non-Hispanic residents, they have been increasing among Black, non-Hispanic, and Hispanic residents.⁶⁰ Similar increases in drug poisoning mortality were observed among Black workers in this study. The extent to which occupational factors, including occupational exposure to SARS-CoV-2, have contributed to these increases should be investigated further.

This study has limitations. Massachusetts is not the ideal state to study occupational factors related to increases in drug poisoning deaths because Massachusetts had a lower increase in drug overdose deaths compared to the national average.² This lower increase in drug poisoning deaths likely resulted in the study being underpowered contributing to the fact that few *p* values for the calculated rate ratios were less than the traditional significance level of 0.05. Furthermore, comparisons were made for each of the 22 occupations included in the analysis, some of the significant results may have been due to chance. Additionally, death certificate occupation information refers to the usual occupation of the worker and not necessarily the occupation that they were working at the time of death.³⁷ Any difference between usual and current occupation can result in differences in the rates for these occupations. Studies suggest that there is generally a match between usual and current occupation.^{61,62}

Further research should examine how occupational factors may have contributed to increases in drug poisoning deaths during the COVID-19 pandemic. This study should focus on both documenting changes in poisoning death rates by occupation nationally and in different states and also determining the role played by two likely contributors to these increases: exposure to SARS-CoV-2 at the workplace and related stressors and unemployment/job insecurity.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

DISCLOSURE BY AJIM EDITOR OF RECORD

John Meyer declares that he has no conflict of interest in the review and publication decision regarding this article.

AUTHOR CONTRIBUTIONS

Devan Hawkins conceived of this study, acquired data, performed the initial analysis, and drafted the paper. Anh Tuan Phan performed additional analysis, created tables, and reviewed and edited drafts of the paper. Both authors approve this version of the manuscript and agree to be accountable for all aspects of the work.

DATA AVAILABILITY STATEMENT

The data in this report is publicly available data. It can be obtained by making a public data requested to the Massachusetts Registry of Vital Records and Statistics.

INSTITUTION AND ETHICS APPROVAL AND INFORMED CONSENT

This project was considered exempt from review by the MCPHS University Institutional Review Board because it was conducted with previously collected, deidentified data.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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