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## Tracking the Impact of Diseases of Despair in Appalachia—2015 to 2018

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# Tracking the Impact of Diseases of Despair in Appalachia—2015 to 2018

## Abstract

**Introduction:** This study provides an update on mortality due to diseases of despair within the Appalachian Region, comparing 2015 to 2018.

**Methods:** Diseases of despair include: alcohol, prescription drug and illegal drug overdose, suicide, and alcoholic liver disease/cirrhosis of the liver. Analyses are based on National Vital Statistics System (NVSS) mortality data for individuals aged 15-64.

**Results:** Between 2015 and 2017, the diseases of despair mortality rate increased in both Appalachia and the non-Appalachian U.S., and the disparity grew between Appalachia and the rest of the county. In 2018, the disease of despair mortality rate declined by 8 percent in Appalachia, marking the first decline for the Region since 2012. Diseases of despair continue to impact the working-age population, and while males experience a higher burden of mortality due to diseases of despair, the disparity between Appalachia and the rest of the United States is greater for females. Overdose mortality rates in Appalachia increased between 2015 and 2017, followed by a decline in 2018. During this same time frame, suicide also increased notably within the Appalachian region, and the disparity between Appalachia and the non-Appalachian U.S. increased by 50 percent.

**Implications:** These findings document that the diseases of despair continue to have a greater impact in the Appalachian Region than in the rest of the United States. While the declining trends between 2017 and 2018 are promising, data has shown that these rates are likely to increase again, particularly as a result of the COVID-19 pandemic.

## Keywords

Appalachia, substance use, opioid use, diseases of despair

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## Cover Page Footnote

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## INTRODUCTION

The concept of diseases or deaths of despair originated from research by Case and Deaton<sup>1</sup> that highlighted rising morbidity and mortality among white non-Hispanic Americans from three main causes: alcoholic, prescription drug, and illegal drug overdose; suicide; and alcohol liver disease/cirrhosis of the liver. The initial Case and Deaton article was published in 2015, at a time when life expectancy in the U.S. fell for the first time in decades, and many researchers began to hypothesize what may be contributing to this decline. This also marked the beginning of the surge in drug overdose deaths in the U.S., driven by rapid increases in deaths from synthetic opioids, such as fentanyl.<sup>2</sup>

In 2017, NORC at the University of Chicago (NORC) conducted a study on behalf of the Appalachian Regional Commission (ARC) to further understand how the diseases of despair may have disproportionately impacted the Appalachian Region.<sup>3</sup> In this study, NORC identified many disparities between the Appalachian Region and the non-Appalachian U.S., most notably in terms of overdose mortality. Specifically, in 2015, the overdose mortality rate was 65% higher in the Appalachian Region compared to the non-Appalachian U.S.<sup>3</sup> However, the initial study was based on mortality data through 2015, and therefore did not reflect the more recent trends in drug overdose mortality.

In 2019, NORC published findings from the initial diseases of despair study, predominately based on mortality data from 2015, but with the addition of some more recent 2017 mortality data.<sup>4</sup> The burden of diseases of despair in both Appalachia and across the U.S. continued to rise through 2017. The current paper provides an update to the original research on diseases of despair in Appalachia, including mortality data through 2018. The findings compare 2015 and 2018 data in order to show where disparities have shifted during this time period. As we continue to understand how the diseases of despair impact the Appalachian Region, it will help the allocation of resources to address the root causes of these deaths.

## METHODS

Similar to the prior study on diseases of despair in Appalachia, this study aimed to detect differences in the mortality rates from diseases of despair between the Appalachian Region and the non-Appalachian U.S. (the rest of the country, excluding Appalachia), in addition to differences by age groups and gender. Appalachian rates were further analyzed by subregion, county economic status, and levels of rurality. Appalachian subregions, as defined by the Appalachian

Regional Commission (ARC), represent contiguous geographies of relatively homogeneous characteristics (topography, demographics, economics, and transportation) and include: Northern, North Central, Central, South Central, and Southern Appalachia. ARC also provides county-level economic classifications based on an index of three economic indicators (3-year unemployment rate, per capita market income, and poverty rate). Counties are designated based on the index as distressed, at-risk, transitional, competitive, or attainment.<sup>5</sup> Last, ARC designations for rurality were used for these analyses. These designations of large metro, small metro, nonmetro adjacent to large metros, nonmetro counties adjacent to small metros, and rural counties are based on a simplification of the UDSA's Economic Research Services (ERS) 2013 Urban Influence Codes (UIC).<sup>6</sup>

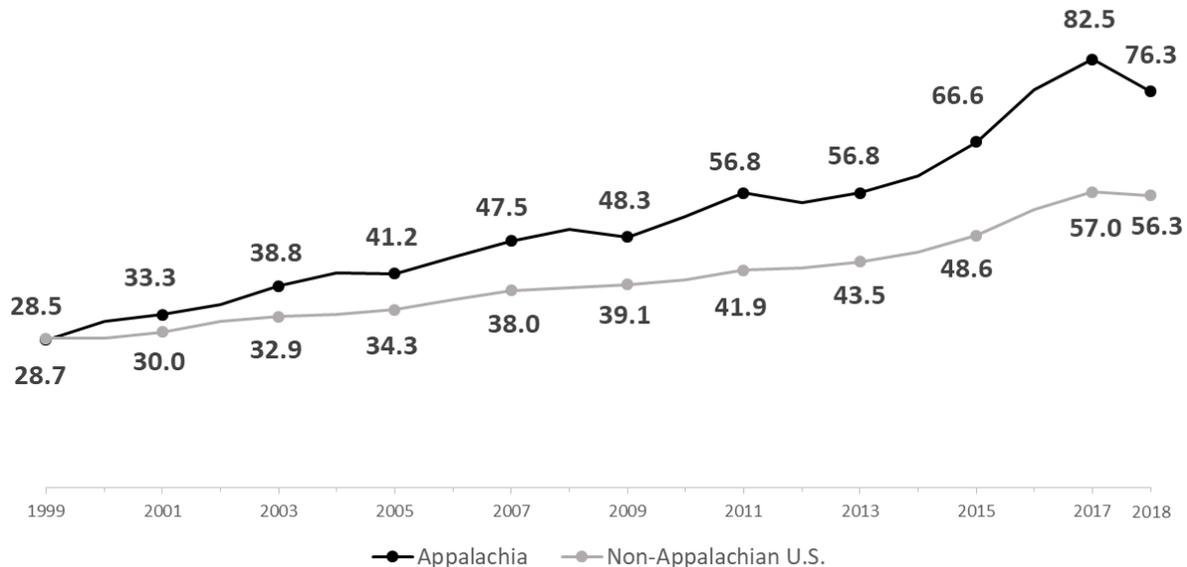
The majority of the findings presented are from 2018 mortality data from the National Center for Health Statistics (NCHS) National Vital Statistics System (NVSS) Multiple Cause of Death database, accessed through the CDC Wide-ranging Online Data for Epidemiologic Research (CDC WONDER).<sup>7</sup> Comparisons to 2015 mortality data are also included. The Multiple Cause of Death database provides the underlying cause of death, as well as up to 20 additional multiple causes, as reported on an individual's death certificate by a physician, coroner, and/or medical examiner.<sup>8</sup> Deaths are coded to the International Classification of Disease Tenth Revision (ICD-10) codes.

These analyses included the ICD-10 codes referenced by Case and Deaton,<sup>1</sup> reflecting the underlying cause of death from each of the three diseases of despair: alcohol, prescription drug, and illegal drug overdose (X40–X45, Y10–Y15, Y45–Y49); suicide (Y87.0, X60–X84); and alcoholic liver disease/cirrhosis of the liver (K70, K73–K74). Multiple cause-of-death ICD-10 codes (T40.0, T40.1, T40.2, T40.3, T40.4, T40.6) that specify the type of drug causing the overdose were used to determine the percentage of alcohol, prescription drug, and illegal drug overdose deaths attributed to opioids.<sup>9</sup> The findings present age-adjusted mortality rates for the population aged 15 to 64. Statistical significance was assessed at the 0.05 level using two-sided significance tests (z-tests).

## **RESULTS**

Over the past 2 decades, the mortality rate due to diseases of despair has been increasing across the U.S. Between 2015 and 2017, the mortality rate increased notably across the country, and the gap between the Appalachian Region and non-Appalachian U.S. continued to widen. As shown in Figure 1, the diseases of despair mortality rate in the Appalachian Region increased by 24% between 2015 and 2017, compared to an increase of 17% for the non-Appalachian U.S. In 2017,

the diseases of despair mortality rate was 45% higher in Appalachia than the non-Appalachian U.S. However, 2018 showed the first decline in diseases of despair mortality for the Appalachian Region since 2012. Within the Appalachian Region, the diseases of despair mortality rate decreased by approximately 8% between 2017 and 2018.



**Figure 1. Annual Mortality Rates Attributable to Diseases of Despair, Ages 15–64, by Region (1999–2018)\*‡**

‡Rates are presented as deaths per 100,000 population. Rates are age-adjusted.

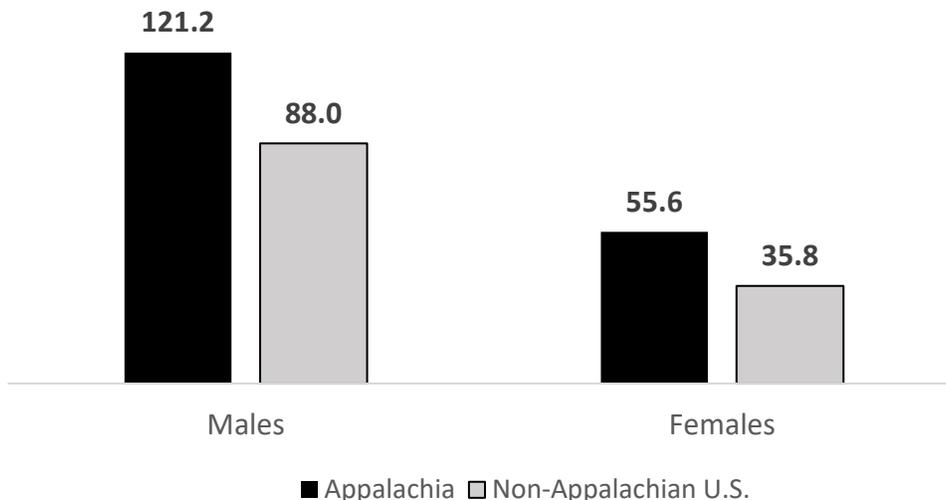
\*In all years except 1999, the Appalachian rate is significantly different from the non-Appalachian U.S. rate,  $p \leq 0.05$

Source: Mortality Rates and Standard Errors provided by Centers for Disease Control and Prevention, National Center for Health Statistics.

Accessed at <http://wonder.cdc.gov/mcd-icd10.html>

The burden of diseases of despair mortality and the disparity between Appalachia and the non-Appalachian U.S. is particularly notable for the working-age population (individuals aged 25 to 54). As shown in Figure 2, in 2018, the diseases of despair mortality rate for males aged 25 to 54 was 121.2 deaths per 100,000 in Appalachia and 88.0 deaths per 100,000 in the non-Appalachian U.S. For females aged 25 to 54, the diseases of despair mortality rate was 55.6 deaths per 100,000 in Appalachia, compared to 35.8 deaths per 100,000 in the non-Appalachian U.S. While the burden of diseases of despair mortality for males was more than double that of females in the Appalachian Region, the disparity between the Appalachian Region and non-Appalachian U.S.

was wider for females. The mortality rate among females was 55% greater in the Appalachian Region than the non-Appalachian U.S, and the mortality rate among males was 38% higher in the Appalachian Region than the non-Appalachian U.S.



**Figure 2. Annual Mortality Rates Attributable to Diseases of Despair, Ages 25–54, by Region (2018)\*‡**

‡Rates are presented as deaths per 100,000 population. Rates are age-adjusted.

\*For both genders, Appalachian rate is significantly different from the non-Appalachian U.S. rate,  $p \leq 0.05$ .

Source: Mortality Rates and Standard Errors provided by Centers for Disease Control and Prevention, National Center for Health Statistics.

Accessed at <http://wonder.cdc.gov/mcd-icd10.html>

Table 1 compares the 2018 mortality rates to 2015 mortality rates for overdose, suicide, and alcoholic liver disease/cirrhosis for various subgroups. In 2015, the overdose mortality rate among those aged 15 to 65 years in Appalachia was 65% greater than the non-Appalachian U.S. (35.4 deaths per 100,000 population compared to 21.5 deaths per 100,000 population). For both the Appalachian Region and the non-Appalachian U.S., the overdose mortality rate increased between 2015 and 2018; however, the disparity between Appalachia and the non-Appalachian U.S. decreased. In 2018, the overdose mortality rate was 48% greater in Appalachia than the non-Appalachian U.S. (41.6 deaths per 100,000 population compared to 28.1 deaths per 100,000 population. Between 2015 and 2018, the overdose mortality rates increased across all subregions of

**Table 1. Diseases of Despair Mortality Rates (2018 vs. 2015), ages 15–64‡**

	Overdose		Suicide		Alcoholic liver disease/cirrhosis	
	2015	2018	2015	2018	2015	2018
<b>Region</b>						
Appalachia	35.4	41.6	19.8	22.7	11.4	12.0
Non-Appalachian U.S.	21.5	28.1	16.5	17.5	10.6	10.6
<b>Appalachian Subregion</b>						
Northern	40.2	49.9	19.7	22.0	9.3	9.4
North Central	56.3	69.8	19.4	26.9	13.0	13.1
Central	54.9	52.3	23.3	24.1	16.2	17.7
South Central	30.7	41.2	21.1	23.3	13.3	15.6
Southern	22.7	24.0	18.5	21.6	11.0	10.7
<b>Economic Status in Appalachia</b>						
Distressed	46.2	48.5	22.1	25.1	15.4	18.2
Nondistressed	34.6	41.2	19.6	22.3	11.2	11.6
<b>Rurality (within Appalachia)</b>						
Metro	36.1	43.5	18.8	21.5	11.0	11.1
Nonmetro	33.8	37.8	21.7	25.2	12.4	13.7
<b>Gender (within Appalachia)</b>						
Male	45.1	53.6	31.1	35.4	16.0	16.6
Female	25.6	29.6	8.5	10.0	7.0	7.5
<b>Age Group (within Appalachia)*</b>						
15–24	12.3	13.6	12.6	16.9	--	--
25–34	44.5	53.5	19.4	23.6	1.7	1.8
35–44	47.8	61.6	21.9	24.4	8.3	8.4
45–54	42.7	42.9	24.5	25.0	21.8	22.8
55–64	23.2	28.3	20.7	23.7	34.5	36.6

‡Rates are presented as deaths per 100,000 population. Rates are age-adjusted.

\*Crude mortality rates are reported.

Source: Mortality Rates and Standard Errors provided by Centers for Disease Control and Prevention, National Center for Health Statistics.

Accessed at <http://wonder.cdc.gov/mcd-icd10.html>

Appalachia except Central Appalachia, where the overdose mortality rate declined from 54.9 deaths per 100,000 population to 52.3 deaths per 100,000 population. While the overdose mortality rate declined between the two time periods in Central Appalachia, several other subregions within Appalachia saw

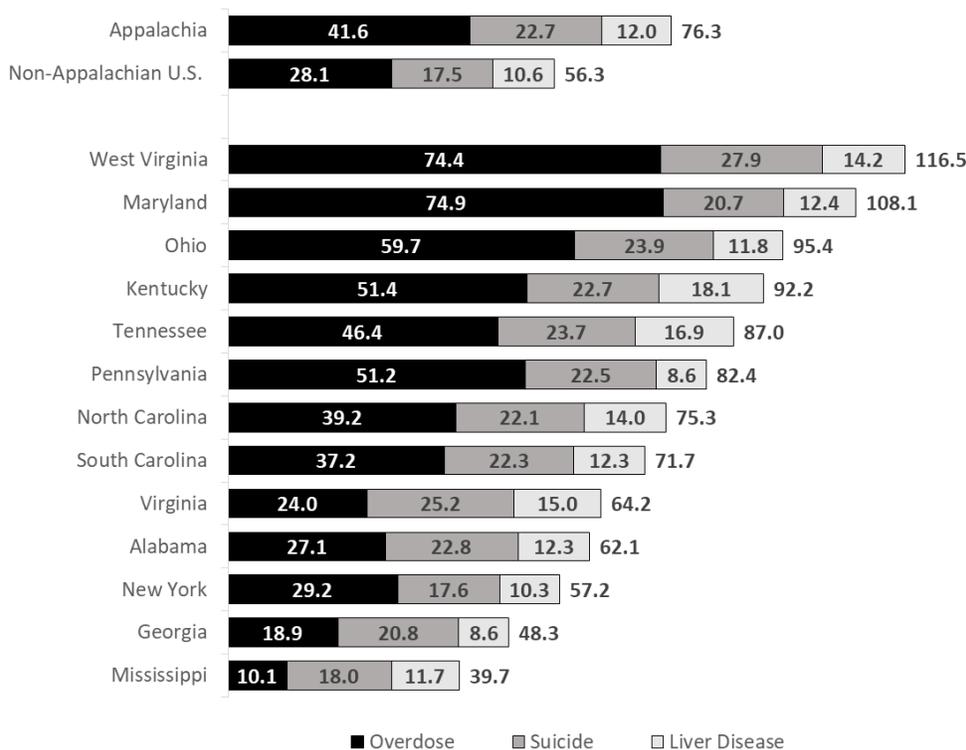
significant increases in overdose mortality. Between 2015 and 2018, the overdose mortality rate in Northern, North Central, and South Central Appalachia increased by at least 20%. North Central Appalachia had the highest drug overdose mortality rate in 2018 of the five Appalachian subregions – 69.8 deaths per 100,000 population, which was almost 2.5 times the non-Appalachian U.S. overdose mortality rate. In 2018, overdose mortality continued to be greater in economically distressed counties than nondistressed counties and in metro counties than nonmetro counties. The group aged 35–44 years experienced the largest rise in overdose mortality, increasing by 29% between 2015 (47.8 deaths per 100,000 population) and 2018 (61.6 deaths per 100,000 population).

While the burden associated with suicide is lower than that of overdose mortality, the disparity between Appalachia and the non-Appalachian U.S. grew between 2015 and 2018. Specifically, in 2018, the suicide mortality rate was 30% higher in Appalachia (22.7 deaths per 100,000 population) than the non-Appalachian U.S. (17.5 deaths per 100,000 population). Only 3 years prior, in 2015, the suicide mortality rate was 20% higher in Appalachia (19.8 deaths per 100,000 population) than the non-Appalachian U.S. (16.5 deaths per 100,000 population). While suicide rates increased in both the Appalachian Region and non-Appalachian U.S. between 2015 and 2018, the rate increased more quickly in Appalachia. This increase was driven by North Central Appalachia, where the suicide rate increased by 39% between 2015 and 2018. By comparison, the suicide rate in the other four subregions of Appalachia increased by less than 20%. In 2018, within Appalachia, the suicide mortality rates continued to be higher among economically distressed counties and nonmetro counties. The suicide mortality rate increased by the highest percentage between 2015 and 2018 for the groups aged 15 to 24 years and those aged 25 to 34 years. Among the youngest population, individuals aged 15 to 24, the suicide mortality rate increased by 34% between 2015 and 2018.

For alcoholic liver disease/cirrhosis, the mortality rate remained fairly constant between 2015 and 2018; however, certain subregions experienced a greater increase in mortality and the disparity grew within the Appalachian Region among specific subpopulations. The alcoholic liver disease/cirrhosis mortality rate increased by 17% in South Central Appalachia, which was the largest percentage increase of any subregion between 2015 and 2018. Additionally, the disparity between distressed and nondistressed counties and nonmetro and metro counties continued to grow. In 2015, the mortality rate in distressed counties was 38% higher than in nondistressed counties, and by 2018, this difference grew to 57%: 18.2 deaths per 100,000 population for distressed counties, compared to 11.6 deaths per 100,000 for nondistressed counties. In

2015, the mortality rate in nonmetro counties was 13% higher than in metro counties, and by 2018, this difference grew to 23%: 13.7 deaths per 100,000 population for nonmetro counties, compared to 11.1 deaths per 100,000 for metro counties.

As shown in Figure 3, the overall burden and distribution of diseases of despair mortality differ by state. In 2018, West Virginia, Appalachian Maryland, and Appalachian Ohio had the highest overall diseases of despair mortality rates, in addition to the highest overdose mortality rates. The suicide mortality rate was highest in West Virginia, Appalachian Virginia, and Appalachian Ohio. The liver disease mortality rate was highest in Appalachian Kentucky, Appalachian Tennessee, and Appalachian Virginia.



**Figure 3. Diseases of despair mortality by state<sup>^</sup>, aged 15–64 (2018)<sup>‡</sup>**

<sup>^</sup>For states within Appalachia, only the mortality rate for the Appalachian counties is shown.

<sup>‡</sup>Rates are presented as deaths per 100,000 population. Rates are age-adjusted.

Source: Mortality Rates and Standard Errors provided by Centers for Disease Control and Prevention, National Center for Health Statistics.

Accessed at <http://wonder.cdc.gov/mcd-icd10.html>

## **IMPLICATIONS**

These findings provide an update to prior research on the scale and scope of the impact of the diseases of despair in Appalachia. The Appalachian Region continues to face disparities in terms of mortality from overdose, suicide, and alcoholic liver disease/cirrhosis. Overdose mortality rates increased in Appalachia between 2015 and 2017, followed by a decline in 2018.<sup>10</sup> The increase in overdose mortality between 2015 and 2017 in Appalachia aligns with the time period where deaths from synthetic opioids increased rapidly in the U.S.<sup>2</sup> In 2018, the decline in overdose mortality in the U.S. was largely driven by the decrease in prescription opioid-involved mortality.<sup>11</sup> Between 2017 and 2018, both West Virginia and Kentucky, which are included in Central Appalachia, saw declines in opioid overdose mortality rates.<sup>11</sup> Central Appalachia was the only Appalachian subregion that did not see an increase in overdose mortality between 2015 and 2018. During this same time period, North Central Appalachia experienced a notable increase in overdose mortality, likely driven by deaths from synthetic opioids, such as fentanyl. Suicide rates also increased notably within the Appalachian region between 2015 and 2018, and the disparity between Appalachia and the non-Appalachian U.S. increased by 50%.

These disparities are not evenly distributed across the Appalachian regions, and certain Appalachian subpopulations experience greater burden. In particular, the working-age population (individuals aged 25 to 54) in Appalachia faces some of the greatest disparities compared to the non-Appalachian U.S., which has implications for economic development within the region. Disparities within Appalachia have grown among economically distressed and nonmetro counties, and women in Appalachia face greater disparities across diseases of despair as compared to Appalachian men, though mortality rates remain higher for Appalachian men.

While the 2018 data showed declines in diseases of despair mortality for both Appalachia and the non-Appalachian U.S., we anticipate that these improvements will be short-lived, particularly as the impacts of the COVID-19 pandemic are observed in the data. Provisional data from CDC indicate that overdose deaths have accelerated during the COVID-19 pandemic and, in the 12 months ending in May 2020, the U.S. had over 81,000 drug overdose deaths, which was the highest number ever recorded in a 12-month period.<sup>12</sup> One major limitation to this study is the fact that it is based on 2018 mortality data. When the study was conducted, 2018 was the most recent year of mortality available from CDC WONDER, therefore, the trends have likely shifted over the past several years. In particular, the impact of the COVID-19 pandemic is not

reflected in these findings. Additional research will be needed to determine both short and long-term impacts of the COVID-19 pandemic on diseases of despair mortality.

### SUMMARY BOX

**What is already known on this topic?** Prior research has shown the disparity between the Appalachian Region and the non-Appalachian U.S. in terms of diseases of despair mortality.

**What is added by this report?** This article provides an update to initial findings and compares 2015 to 2018 mortality rates. This report shows increasing diseases of despair mortality rates between 2015 and 2017, followed by a decline in 2018. Disparities continue to exist between Appalachia and the rest of the country.

**What are the implications for further research?** Further research is needed to determine the impact of the COVID-19 pandemic on diseases of despair mortality, particularly in areas like Appalachia that have been impacted significantly by the diseases of despair.

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