

FINAL REPORT

Appalachian Diseases of Despair

AUGUST 2017

PREPARED FOR:
Appalachian Regional Commission

PREPARED BY:
Michael Meit, MA, MPH
Megan Heffernan, MPH
Erin Tanenbaum, MA
Topher Hoffmann, MPH, MPA

The Walsh Center
for Rural Health Analysis



NORC AT THE UNIVERSITY OF CHICAGO



The Walsh Center's mission is to conduct timely policy analyses and research that address the needs of government policy makers, clinicians, and the public on issues that affect health care and public health in rural America. The Walsh Center is part of the Public Health Research Department at NORC at the University of Chicago, and its offices are located in Bethesda, Maryland. The Center is named in honor of William B. Walsh, M.D., whose lifelong mission was to bring health care to under-served and hard-to-reach populations. For more information about the Walsh Center and its publications, please contact:

Michael Meit, MA, MPH
The Walsh Center for Rural Health Analysis
NORC at the University of Chicago
4350 East West Highway, Suite 800
Bethesda, Maryland 20814
301-634-9324
[HTTP://WALSHCENTER.NORC.ORG](http://WALSHCENTER.NORC.ORG)

Acknowledgements

This report was funded by and prepared for the Appalachian Regional Commission (ARC). It was commissioned by ARC to study disparities related to diseases of despair in the Appalachian Region. The Walsh Center for Rural Health Analysis at NORC at the University of Chicago conducted this study. Michael Meit, MA, MPH is the lead author and Principal Investigator, and Megan Heffernan, MPH, is the Project Manager. Contributing authors to this report were Erin Tanenbaum, MA and Topher Hoffmann, MPH, MPA. The research, analysis, and report development were guided by Julie Marshall, PhD, Economist at ARC.

All data analysis, reporting, and subsequent publications were approved by NORC's Institutional Review Board. The views expressed are those of the authors and not necessarily those of ARC or NORC.

Table of Contents

Introduction	1
Methods	2
Findings	4
Overall Mortality	4
Diseases of Despair: Comparisons between Appalachia and the non-Appalachian U.S.	5
Diseases of Despair: Appalachian States	8
Diseases of Despair: Disparities within Appalachia	10
A Closer Look at Overdose Deaths	14
Discussion	18
Appendix A: ICD-10 Codes	21
Appendix B: Additional Data Tables	22

List of Exhibits

Exhibit 1.	Appalachian subregions.....	3
Exhibit 2.	All-cause annual mortality rates, ages 15–64, by region (1999–2015)‡*	4
Exhibit 3.	Diseases of despair annual mortality rates, ages 15–64, by region (1999–2015)*‡ 5	
Exhibit 4.	Diseases of despair mortality rates, ages 15–64, by disease and region (2015)‡* ..	6
Exhibit 5.	Diseases of despair mortality rates, ages 15–64, by age and region (2015)‡*	7
Exhibit 6.	Differences in diseases of despair mortality rates, ages 15–64, by state (2015)‡ ...	8
Exhibit 7.	Diseases of despair mortality rates, ages 15–64, by state^ and disease (2015)‡....	9
Exhibit 8.	Diseases of despair mortality rates, ages 15–64, by subregion (2015)‡.....	10
Exhibit 9.	Diseases of despair mortality rates, ages 15–64, by subregion and gender (2015)‡*	11
Exhibit 10.	Diseases of despair mortality rates, ages 15–64, by disease and county economic status (2015)‡.....	12
Exhibit 11.	Diseases of despair mortality rates, ages 15–64, by disease and rurality (2015)‡*	13
Exhibit 12.	Overdose mortality rates for males, ages 15–64, by age group and region (2015)‡.....	14
Exhibit 13.	Overdose mortality rates for females, ages 15–64, by age group and region (2015)‡*	15
Exhibit 14.	Overdose mortality rates, ages 15–64, by state^ and type of overdose (2015)‡ ...	16
Exhibit 15.	Underlying cause of death – ICD-10 codes for diseases of despair	21
Exhibit 16.	Multiple causes of death – ICD-10 codes for opioid-related overdose.....	21
Exhibit 17.	Overdose and opioid-related mortality rates, comparing Appalachian and non- Appalachian portions of states, ages 15-64, by disease and state (2015)‡.....	22
Exhibit 18.	Diseases of despair mortality rates, ages 15–64, by disease and state^ (2015)‡.	23

Introduction

The Appalachian Region, as defined in the Appalachian Regional Commission (ARC)'s authorizing legislation, is a 205,000-square-mile region that spans the Appalachian Mountains from southern New York to northern Mississippi. It includes all of West Virginia and parts of 12 other states: Alabama, Georgia, Kentucky, Maryland, Mississippi, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, and Virginia. The Region includes 420 counties and 8 independent cities in 13 states and has a population of 25 million people.¹

Compared to the rest of the nation, the Appalachian Region faces disparities related to educational attainment, employment, income, and a number of health outcomes. Prior work conducted by NORC has demonstrated disparities in mortality within Appalachia, particularly by levels of rurality.^{2,3} Appalachia's household income is 80 percent of the U.S. average, and 17 percent of Appalachians live below the poverty level.⁴ Certain Appalachian subregions experience greater disparities than others; for example, labor force participation, household income, and bachelor's degree attainment are lowest in Central Appalachia.^{4,5,6}

Socioeconomic factors, including education, employment, and income, are potential contributors to the growing opioid crisis in the United States. According to data from the Centers for Disease Control and Prevention (CDC), the number of overdose deaths in the United States involving opioids has quadrupled since 1999.⁷ In 2008, NORC conducted a study on behalf of ARC titled, "An Analysis of Mental Health Services and Substance Abuse Disparities and Access to Treatment Services in the Appalachian Region," which found that admission rates for primary abuse of opiates and synthetics were higher in Appalachia than the rest of the nation, and also growing at a faster pace.⁸ While this study provided valuable information to ARC regarding mental health and substance abuse in the Region, additional research was needed to understand how recent trends are impacting Appalachia.

In 2017, ARC commissioned NORC to investigate "diseases of despair" in Appalachia. Over the past several years, research conducted by health economists Anne Case and Angus Deaton has focused on the increasing morbidity and mortality from three main causes—alcohol, prescription drug and illegal drug overdose; suicide; and alcoholic liver disease/cirrhosis of the liver, which have been referred to as "deaths of despair" or "diseases of despair."⁹ The goal of this study was to analyze the impact of the diseases of despair on mortality within the Appalachian Region. Specifically, NORC investigated the following hypotheses:

- **Hypothesis 1:** Disparities related to diseases of despair are greater within the Appalachian Region than the non-Appalachian United States.
- **Hypothesis 2:** Appalachian disparities are driving national trends showing rising mortality from diseases of despair.
- **Hypothesis 3:** Within Appalachia, disparities are concentrated based on Appalachian subregion, county economic status, and/or rurality.

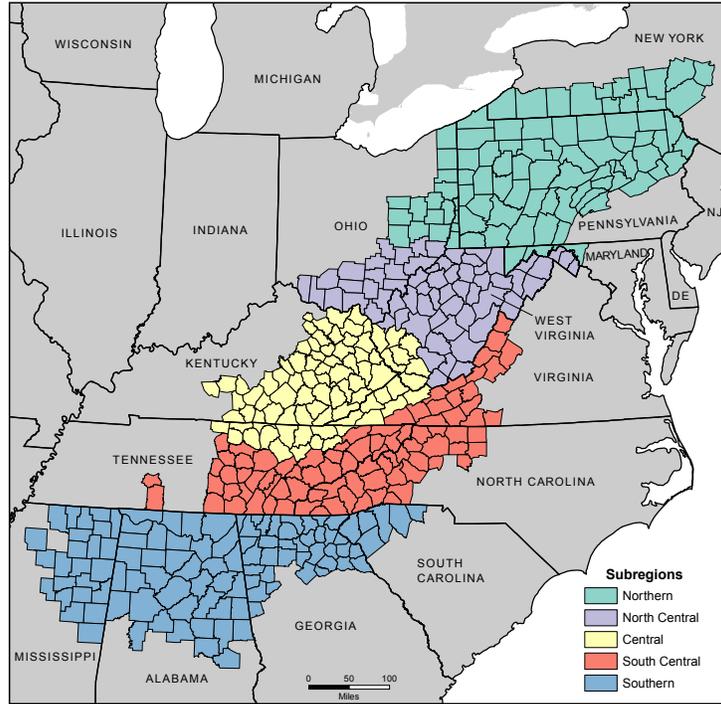
Methods

This report presents 2015 mortality data from the Multiple Cause of Death database, which is publically available through CDC Wide-ranging Online Data for Epidemiologic Research (CDC WONDER), an online data system that provides access to data from the CDC National Center for Health Statistics (NCHS) National Vital Statistics System (NVSS).¹⁰ NVSS collects and presents U.S. resident data for the aggregate of 50 states, New York City, and the District of Columbia, as well as for each individual state. 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.¹¹ Deaths are coded to the International Classification of Disease Tenth Revision (ICD-10) codes. These analyses include the ICD-10 codes referenced by Case and Deaton, reflecting underlying cause-of-death from each of the three diseases of despair—alcohol, prescription drug and illegal drug overdose; suicide; and alcoholic liver disease/cirrhosis of the liver.⁹ In order to determine the percentage of alcohol, prescription drug and illegal drug overdose deaths attributed to opioids, we use the multiple cause-of-death ICD-10 codes that specify the type of drug causing the overdose.¹² Appendix A provides the underlying cause-of-death ICD-10 codes used to identify the disease of despair, and the multiple cause-of-death ICD-10 codes used to identify overdoses caused by opioids.

Analyses use age-adjusted mortality rates and focus on the population ages 15 to 64; however, select analyses report mortality rates by age group (10 year increments between ages 15 and 64). If the Appalachian counties in a specific state had fewer than 20 deaths, the state-specific mortality rate for that disease of despair is considered unreliable. The few instances of unreliable data are noted in the findings. This study aimed to detect differences in the mortality rates from diseases of despair between Appalachia and the non-Appalachian United States (the rest of the country, excluding Appalachia), in addition to differences by age groups and gender. Statistical significance was assessed at the 0.05 level using two-sided significance tests (z-tests).

Appalachian rates were further analyzed by subregion, county economic status, and levels of rurality. Appalachian subregions represent contiguous geographies of relatively homogeneous characteristics (topography, demographics, economics, and transportation) and include: Northern, North Central, Central, South Central, and Southern Appalachia. The five Appalachian subregions are shown in Exhibit 1. ARC's economic classifications rely on an index of three economic indicators (three-year unemployment rate, per capita market income, and poverty rate). Counties are then designated based on the index as distressed, at-risk, transitional, competitive, or attainment.¹³ For these analyses, counties were classified as distressed or non-distressed—the non-distressed category includes all counties in the four classifications outside of the distressed designation. Lastly, for rurality, we used ARC designations of "Metropolitan counties" (counties that include large metropolitan centers of one million population or greater and counties with metropolitan centers of less than one million population), and "Nonmetropolitan counties" (nonmetro counties adjacent to large metros, nonmetro counties adjacent to small metros, and rural counties). These designations are based on a simplification of the USDA's Economic Research Services (ERS) 2013 Urban Influence Codes (UIC).¹⁴

Exhibit 1. Appalachian subregions



Data source: Appalachian Regional Commission, Created November 2009

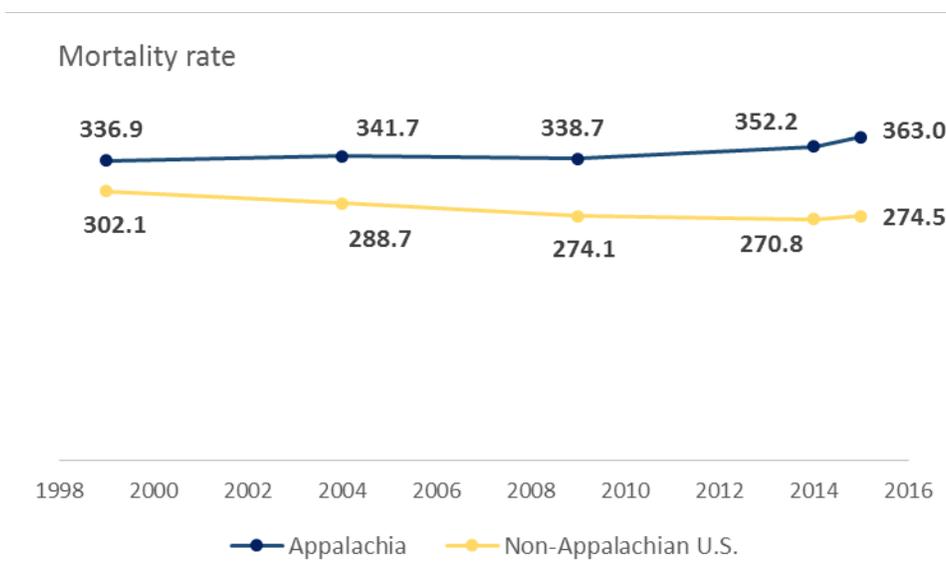
Findings

Overall Mortality

The all-cause mortality rate (overall mortality) among individuals ages 15 to 64 in the non-Appalachian U.S. steadily declined between 1999 and 2014, before increasing between 2014 and 2015 (see Exhibit 2). Between 1999 and 2014, the overall mortality rate in the non-Appalachian U.S. *decreased* by 10 percent, while the overall mortality rate in the Appalachian Region *increased* by 5 percent—resulting in an increasing disparity between the Region and the rest of the nation. In 1999, the all-cause mortality rate in Appalachia was 12 percent higher than the rate in the non-Appalachian U.S.—by 2015 this difference had increased to 32 percent.

Between 2014 and 2015, the non-Appalachian U.S. saw its first increase in the overall mortality rate, increasing from 270.8 deaths per 100,000 population to 274.5 deaths per 100,000 (a 1.4 percent increase). During this same period, the overall mortality rate in the Appalachian Region increased from 352.2 deaths per 100,000 to 363.0 deaths per 100,000 (a 3.1 percent increase). Overall mortality in Appalachia is increasing at a faster rate than in non-Appalachian U.S., which suggests the increasing mortality rate in the Appalachian Region is contributing to the increase in overall mortality in the United States.

Exhibit 2. All-cause annual mortality rates, ages 15–64, by region (1999–2015)‡*



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

*For all years, the Appalachian rates are significantly different from the non-Appalachian U.S. rate, $p \leq 0.05$

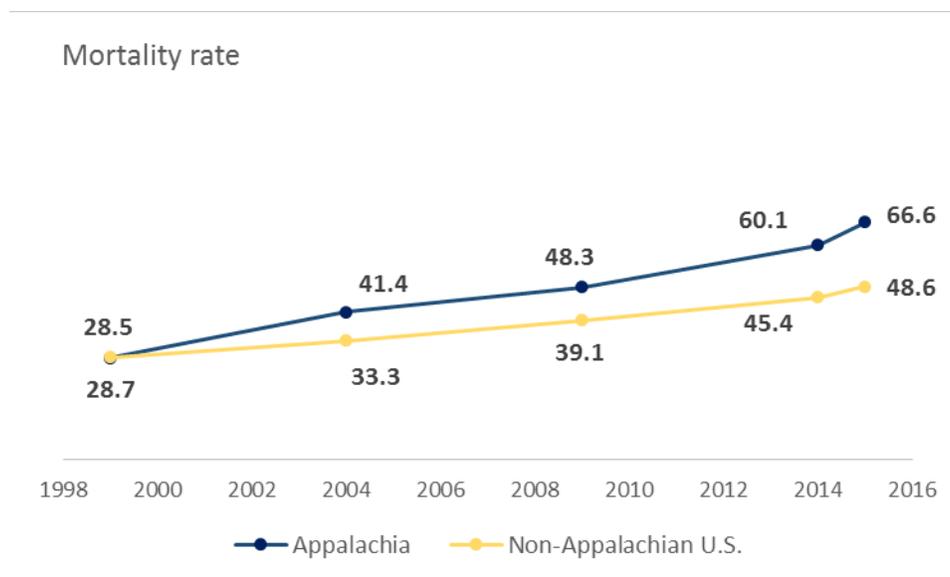
Source: Mortality Rates and Standard Errors provided by Centers for Disease Control and Prevention, National Center for Health Statistics.

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

Diseases of Despair: Comparisons between Appalachia and the non-Appalachian U.S.

Exhibit 3 compares the burden from the diseases of despair between the Appalachian Region and the non-Appalachian U.S. from 1999 to 2015. The disparity between the Appalachian Region and the rest of the nation has been growing since 1999. In 1999, the mortality rate was slightly higher in the non-Appalachian U.S. than in the Appalachian Region. In both 2004 and 2009, the mortality rate in the Appalachian Region was 24 percent higher than the non-Appalachian U.S. By 2014, the difference had grown to 32 percent, followed by another increase between 2014 and 2015 as the mortality rate in Appalachia reached 66.6 deaths per 100,000 population, which was 37 percent higher than the rest of the nation. In 2015, 11,187 deaths among 15 to 64 year olds in Appalachia were attributable to diseases of despair. In 2015, the 15 to 64 year old population in the Appalachian Region represented 7.8 percent of the total population in the United States for this age group, yet contributed to 10.3 percent of the total deaths from diseases of despair.

Exhibit 3. Diseases of despair annual mortality rates, ages 15–64, by region (1999–2015)*‡



‡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, $p \leq 0.05$

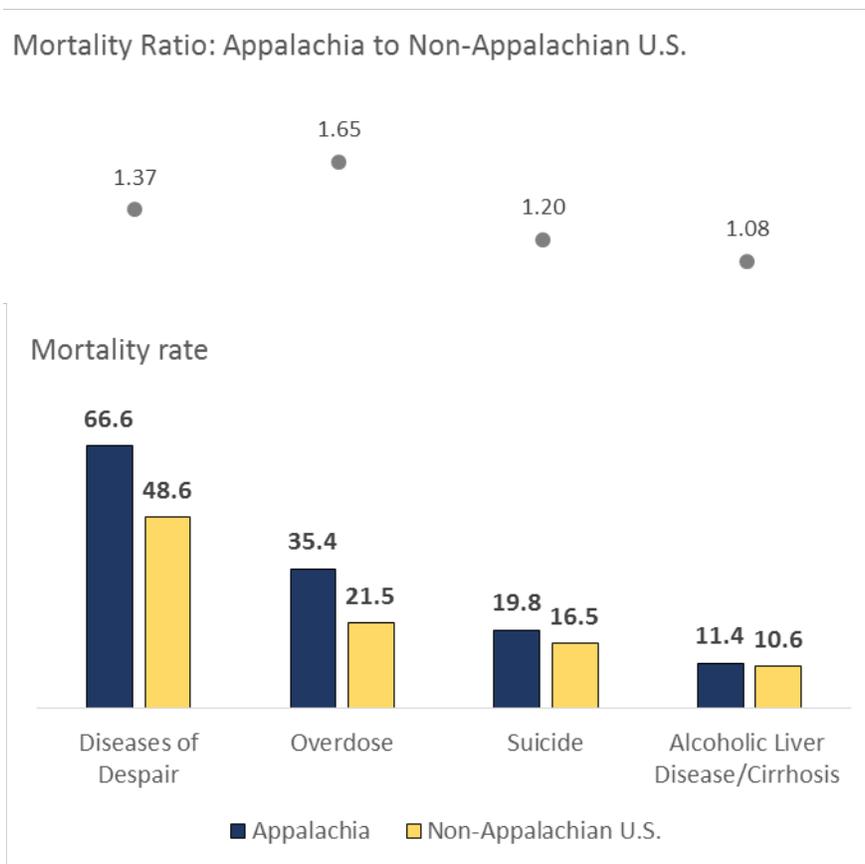
Source: Mortality Rates and Standard Errors provided by Centers for Disease Control and Prevention, National Center for Health Statistics.

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

Exhibit 4 compares the burden from each disease of despair between the Appalachian Region and the non-Appalachian U.S. In 2015, among 15 to 64 year olds in Appalachia, there were 5,594 overdose deaths, 3,297 suicide deaths, and 2,296 alcoholic liver disease/cirrhosis deaths. Of the three diseases of despair, the overall burden in Appalachia and the disparity between Appalachia and the non-Appalachian U.S. was most notable for overdose mortality. In 2015, the overdose mortality rate among individuals ages 15 to 64 was 65 percent higher in the Appalachian Region compared to the rest of the nation—there were 35.4 deaths per 100,000 population in the Region, compared to 21.5 deaths per 100,000 population

in the non-Appalachian U.S. While there are also higher mortality rates for suicide and alcoholic liver disease/cirrhosis in Appalachia, the disparities are not as large.

Exhibit 4. Diseases of despair mortality rates, ages 15–64, by disease and region (2015)‡*



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

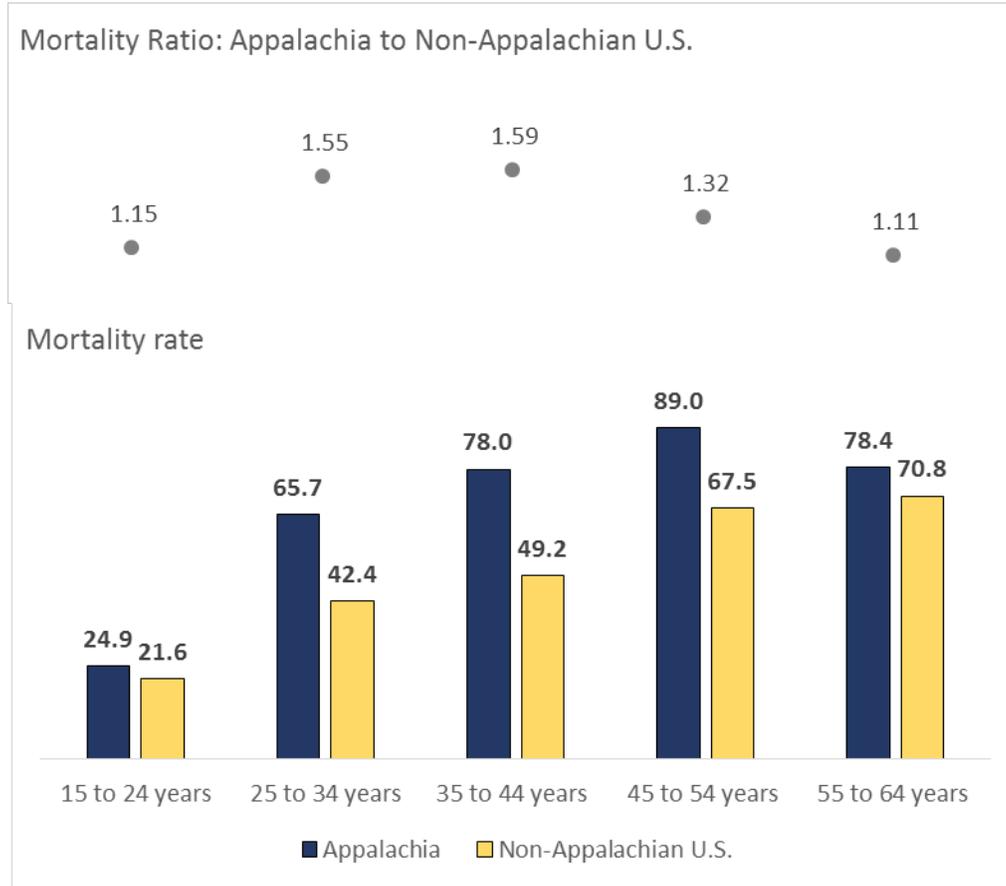
*For all diseases, the Appalachian rate is significantly different from the non-Appalachian U.S. rate, $p \leq 0.05$

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>

There are differences in mortality from the diseases of despair by age group. The Appalachian Region experienced higher rates of mortality than the non-Appalachian U.S. for all 10-year age ranges between 15 and 64. The disparities between Appalachia and the rest of the nation were the greatest for individuals ages 25 to 54, as shown in Exhibit 5. The mortality rate for the 25 to 34 age group in Appalachia was 55 percent higher than the rate in the non-Appalachian U.S. and 59 percent higher for Appalachians in the 35 to 44 age group. The burden was greatest among individuals ages 45 to 54, where the mortality rate was 89.0 deaths per 100,000 population.

Exhibit 5. Diseases of despair mortality rates, ages 15–64, by age and region (2015)‡*



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

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

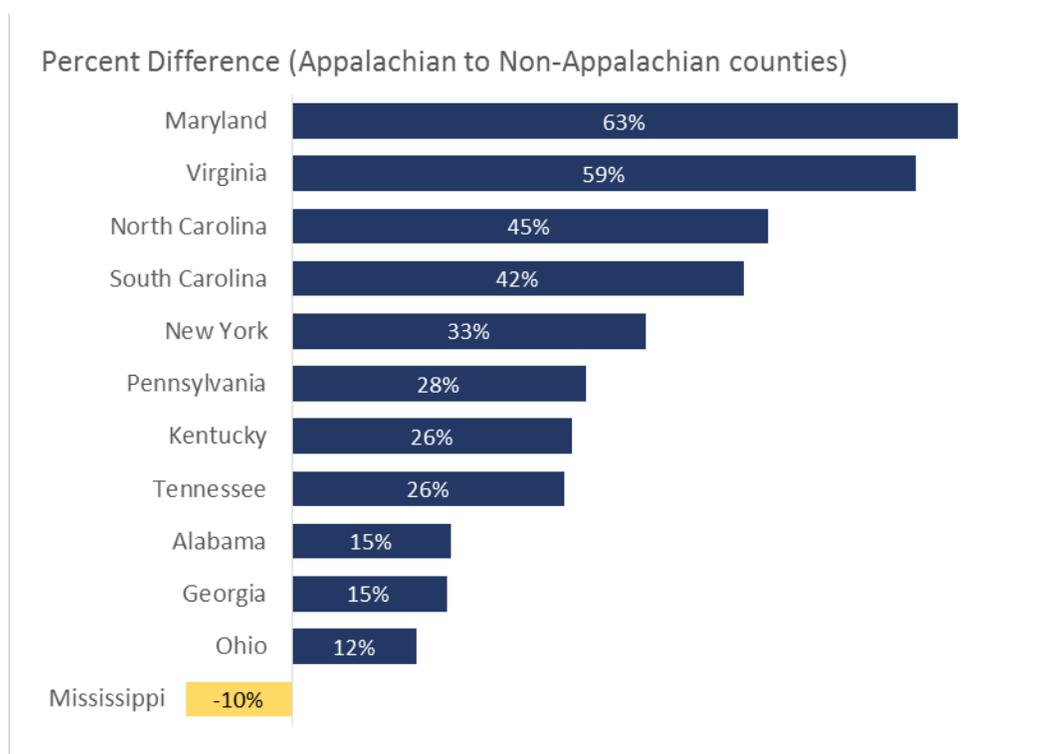
Source: Mortality Rates and Standard Errors provided by Centers for Disease Control and Prevention, National Center for Health Statistics.

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

Diseases of Despair: Appalachian States

For the states in the Appalachian Region, there were differences in mortality rates between the Appalachian and non-Appalachian portions of the state. Exhibit 6 shows the percentage difference between the mortality rates from the diseases of despair in the Appalachian portion of each state, compared to the non-Appalachian portion. West Virginia is omitted because the entire state is included in the Appalachian Region. In Appalachian Maryland and Appalachian Virginia, the mortality rates were 63 and 59 percent higher, respectively, than in the non-Appalachian portions of each state. Mississippi was the only state where the non-Appalachian counties had higher mortality from the diseases of despair than the Appalachian counties. Exhibit 17 in Appendix B shows the mortality rates for the individual diseases of despair comparing Appalachian and non-Appalachian counties.

Exhibit 6. Differences in diseases of despair mortality rates, ages 15–64, by state (2015)‡



‡Rates used to calculate percentage differences are age adjusted.

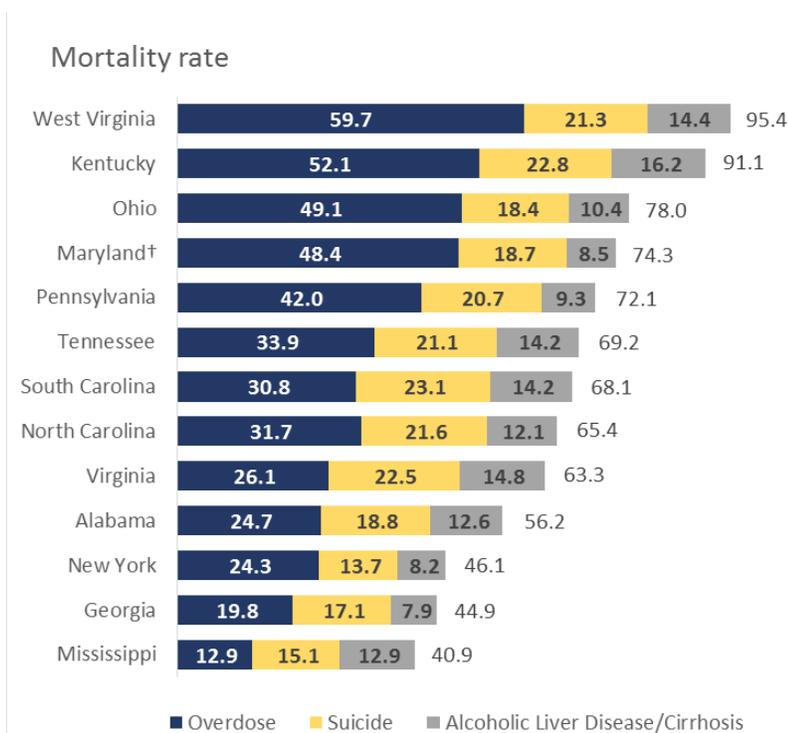
Source: Mortality Rates and Standard Errors provided by Centers for Disease Control and Prevention, National Center for Health Statistics.

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

Exhibit 7 shows the mortality rate for each individual disease of despair by state. For each state, only the mortality rate for the Appalachian portion is shown. For the combined diseases of despair, West Virginia and Appalachian Kentucky had the highest mortality rates of all Appalachian states at 95.4 deaths per 100,000 population and 91.1 deaths per 100,000 population, respectively. The Appalachian portions of Mississippi, Georgia, and New York had the lowest combined mortality rates from the diseases of despair. Compared to the other states, Appalachian Maryland had the highest proportion of deaths due to

overdose. While their combined mortality rates from the diseases of despair were lower overall, Appalachian Georgia had the highest proportion of deaths due to suicide, and Appalachian Mississippi had the highest proportion of deaths due to alcoholic liver disease/cirrhosis. Exhibit 18 in Appendix B shows the disease-specific mortality rates, in addition to the combined diseases of despair mortality rate, for all states, with comparisons to the non-Appalachian U.S. rates.

Exhibit 7. Diseases of despair mortality rates, ages 15–64, by state[^] and disease (2015)[‡]



[^]For states within Appalachia, only the mortality rate for the Appalachian counties is shown.

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

[†]Due to small number of deaths, alcoholic liver disease/cirrhosis mortality rate is unreliable and not age adjusted.

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

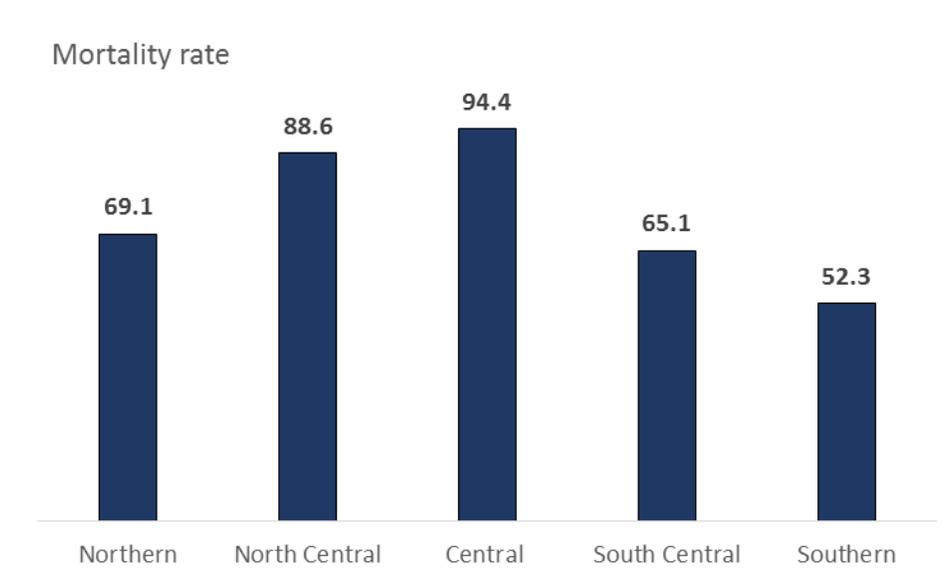
Accessed at <http://wonder.cdc.gov/mcd-icd10.html>

Diseases of Despair: Disparities within Appalachia

While the Appalachian Region as a whole experiences disparities attributable to the diseases of despair compared to the rest of the United States, there are subregions within Appalachia where the burden is most concentrated. The following findings describe the disparities within the Appalachian Region by subregion, county economic status, and rurality.

Within Appalachia, the highest burden of diseases of despair was concentrated in Central Appalachia and North Central Appalachia. Exhibit 8 shows the mortality rates for Appalachian subregions. Central Appalachia had a mortality rate from the diseases of despair of 94.4 deaths per 100,000 population, which was 7 percent higher than the rate in North Central Appalachia, 37 percent higher than the rate in Northern Appalachia, 45 percent higher than the rate in South Central Appalachia, and 80 percent higher than the rate in Southern Appalachia. Southern Appalachia had the lowest mortality rate from the diseases of despair at 52.3 deaths per 100,000 population.

Exhibit 8. Diseases of despair mortality rates, ages 15–64, by subregion (2015)‡



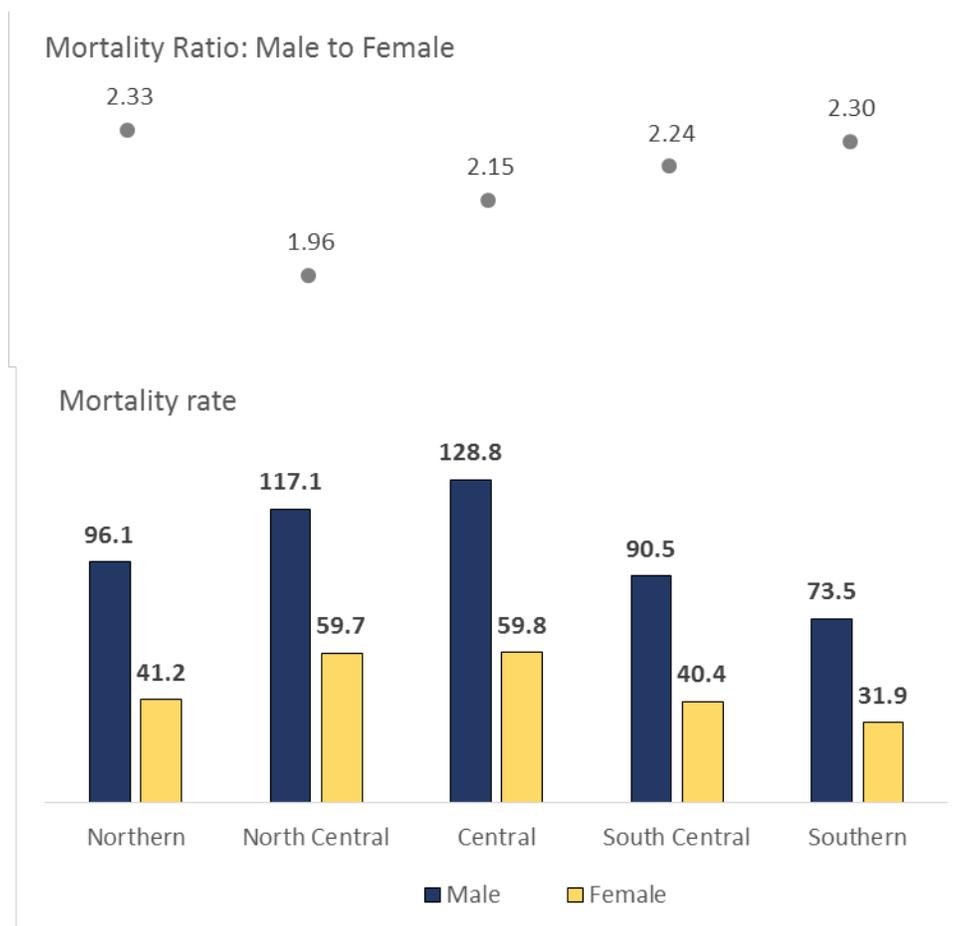
‡Rates are presented as deaths per 100,000 population. Rates are age adjusted.

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>

Exhibit 9 shows mortality rates from the diseases of despair by subregion and gender. While males had a significantly higher mortality rate than females in all subregions, the mortality rates for both genders were the highest in Central and North Central Appalachia. While the overall burden was lower in Northern, South Central, and Southern Appalachia compared to Central and North Central Appalachia, the disparity between males and females was greater in these subregions. For example, in Northern Appalachia, Southern Appalachia, and South Central Appalachia, the mortality rate among males was 2.33 times, 2.30 times, and 2.24 times the rate among females, respectively.

Exhibit 9. Diseases of despair mortality rates, ages 15–64, by subregion and gender (2015)‡*



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

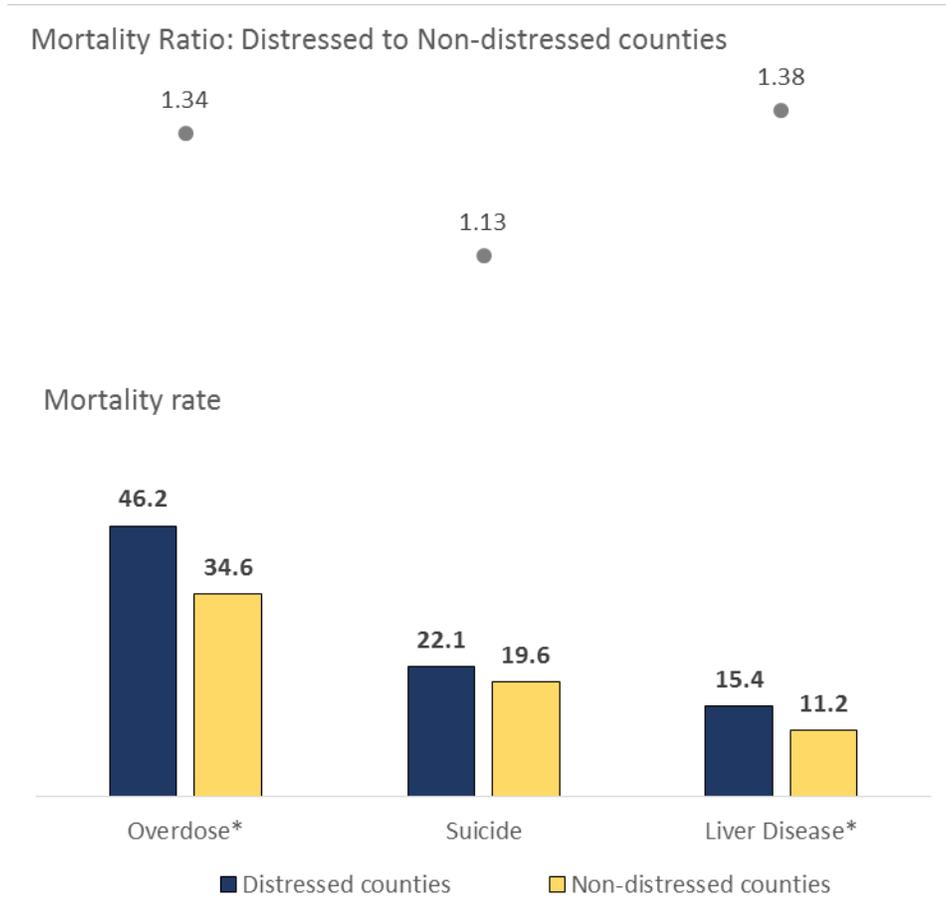
*For all subregions, the rates for males are significantly different from the rates for females, $p \leq 0.05$

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>

Exhibit 10 shows the mortality rate for each individual disease of despair, comparing distressed and non-distressed counties. While overdose deaths were the most common among the three diseases of despair, the disparity between the distressed and non-distressed counties was greatest for alcoholic liver disease/cirrhosis (38 percent higher in distressed counties). The difference was also significant for overdose, as the mortality rate was 34 percent higher in distressed counties.

Exhibit 10. Diseases of despair mortality rates, ages 15–64, by disease and county economic status (2015)‡



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

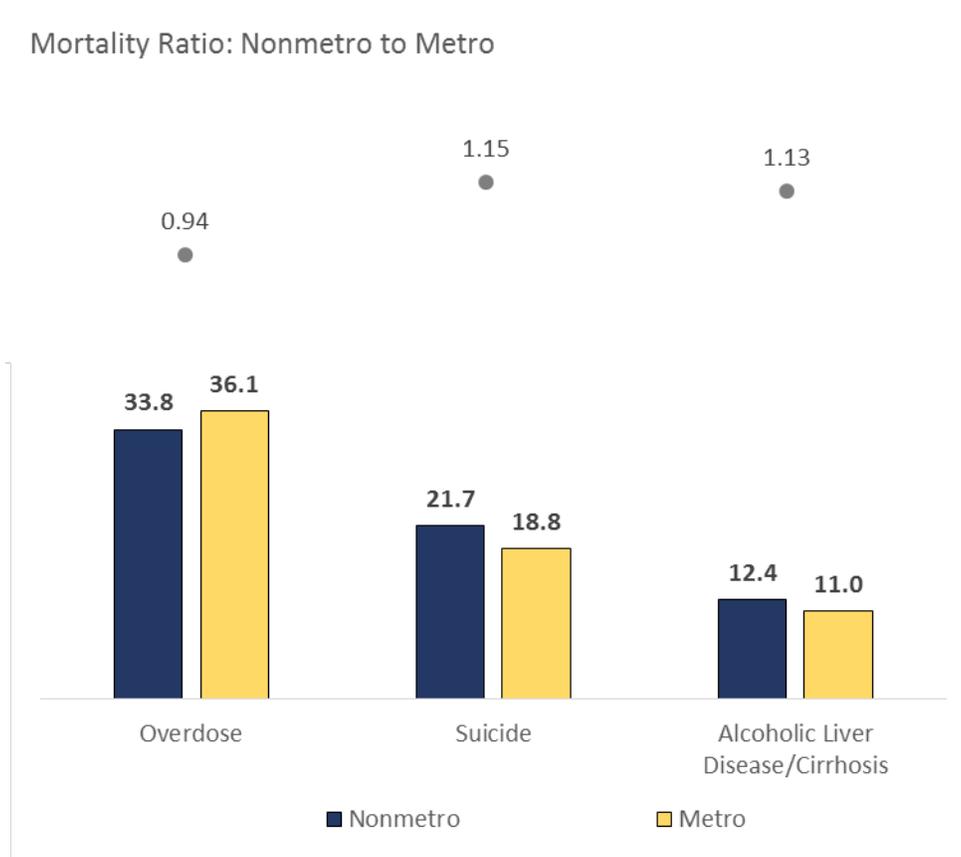
*Rates for distressed counties are significantly different from the rates for non-distressed counties, $p \leq 0.05$

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>

Findings varied based on rurality, as shown in Exhibit 11. In nonmetro counties, the suicide rate was 15 percent higher than in metro counties, and the alcoholic liver disease/cirrhosis mortality rate was 13 percent higher. The overdose rate in nonmetro counties was six percent lower in nonmetro counties than in metro counties.

Exhibit 11. Diseases of despair mortality rates, ages 15–64, by disease and rurality (2015)†*



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

*For all diseases, rates for metro counties are significantly different from the rates for nonmetro counties, $p \leq 0.05$

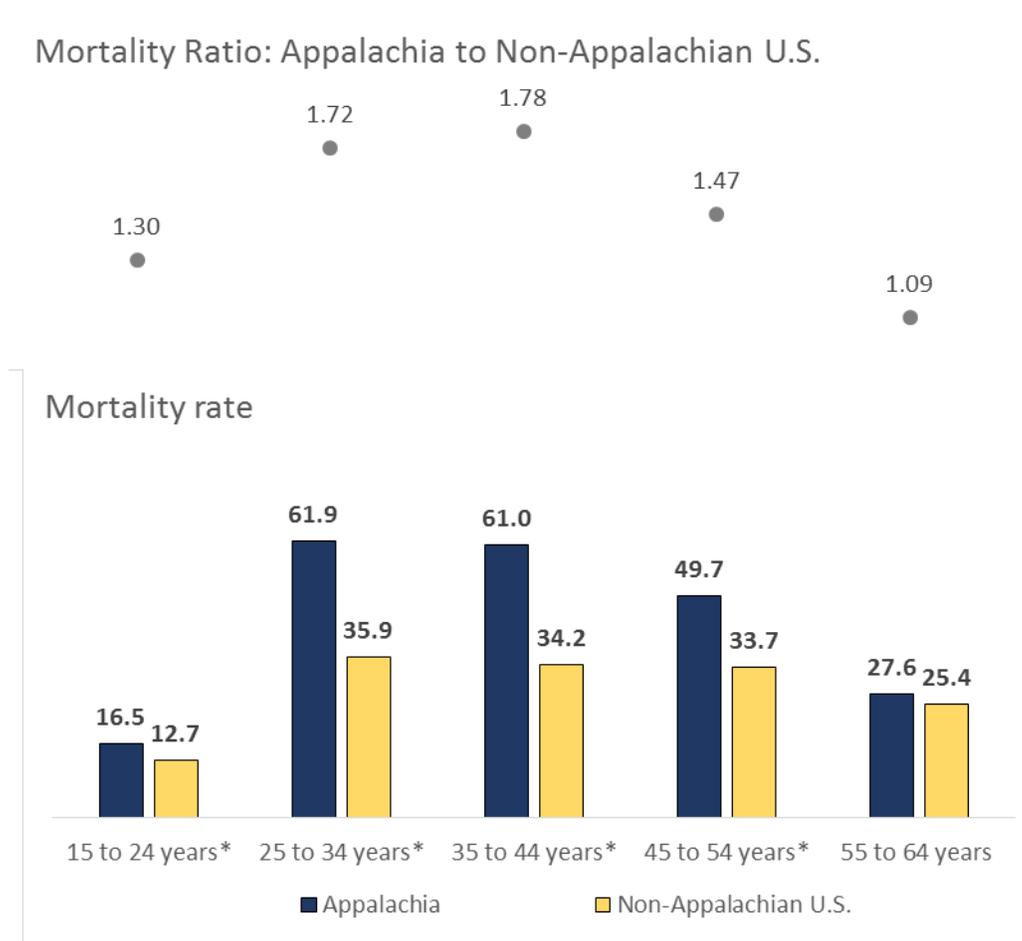
Source: Mortality Rates and Standard Errors provided by Centers for Disease Control and Prevention, National Center for Health Statistics.

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

A Closer Look at Overdose Deaths

The remaining findings focus solely on deaths due to alcohol, prescription drug and illegal drug overdose (overdose deaths). Males in Appalachia between the ages of 25 and 44 experienced notable disparities compared to non-Appalachian males. In Appalachia, the overdose mortality rate was 78 percent higher among 35 to 44 year olds and 72 percent higher among 25 to 34 year olds compared to non-Appalachian males. The burden in the Region was also highest for these two age groups, at 61.0 deaths per 100,000 population and 61.9 deaths per 100,000, respectively.

Exhibit 12. Overdose mortality rates for males, ages 15–64, by age group and region (2015)‡



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

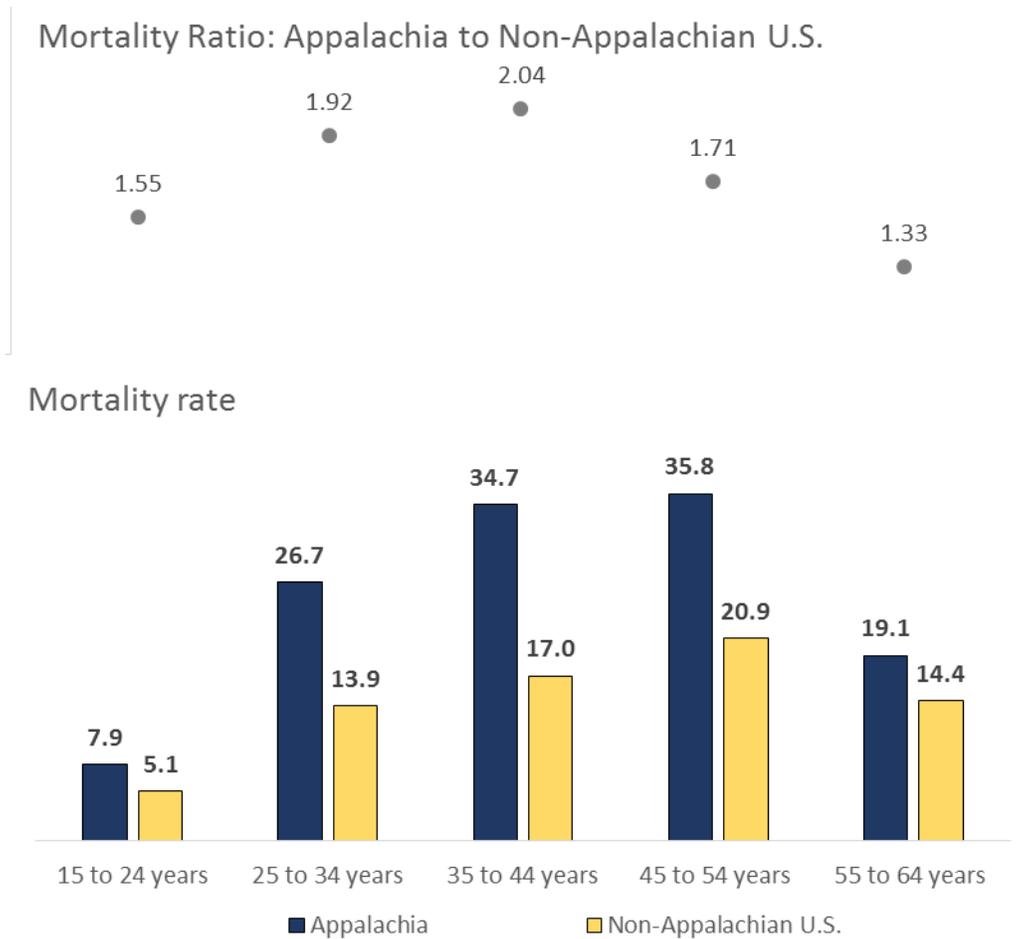
*Appalachian rates are significantly different from the non-Appalachian U.S. rate for the same age group, $p \leq 0.05$

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>

While the overall burden was lower among females than males, the disparity between Appalachia and the non-Appalachian U.S. in terms of overdose mortality among females was even larger than the disparity among males. The female age groups most impacted were 35 to 54 year olds. The overdose mortality rate for Appalachian females ages 35 to 44 was more than double the rate for females in the non-Appalachian U.S., and among 25 to 34 year olds, the Appalachian rate was 92 percent higher. Among females, the highest overdose mortality rate was among 45 to 54 year olds, at 35.8 deaths per 100,000 population.

Exhibit 13. Overdose mortality rates for females, ages 15–64, by age group and region (2015)‡*



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

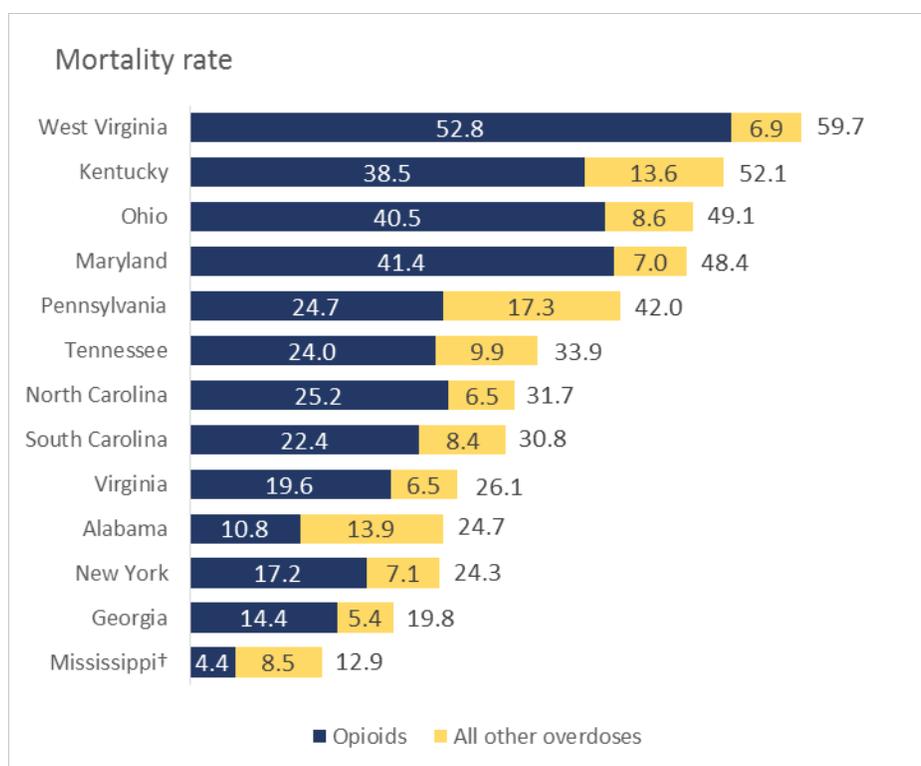
*For all age groups, Appalachian rates is significantly different from the non-Appalachian U.S. rate, $p \leq 0.05$

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>

Exhibit 14 shows the total overdose mortality rates, in addition to the opioid-related overdose rates in the Appalachian portions of each state. Additionally, Exhibit 15 shows the percentages of overdose deaths attributed to opioids in each state. In the Appalachian Region in 2015, 3,859 of the 5,594 overdose deaths—69 percent—were caused by opioids. The states with the highest opioid-related overdose mortality rates were West Virginia (52.8 deaths per 100,000 population), Appalachian Maryland (41.4 deaths per 100,000 population), and Appalachian Ohio (40.5 deaths per 100,000 population). These three states also had the highest percentages of overdose deaths attributed to opioids within their Appalachian portions, at 88, 86, and 82 percent, respectively. The opioid-related overdose mortality rate was lowest in Appalachian Mississippi (4.4 deaths per 100,000 population), Appalachian Alabama (10.8 deaths per 100,000 population), and Appalachian Georgia (14.4 deaths per 100,000 population).

Exhibit 14. Overdose mortality rates, ages 15–64, by state[^] and type of overdose (2015)[‡]



[^]For states within Appalachia, only the mortality rates for the Appalachian counties are shown.

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

[†]Due to small number of deaths, opioid mortality rate is unreliable and not 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>

Exhibit 15. Overdose and opioid-related overdose mortality rates, ages 15–64, by state[^] (2015)[‡]

	Overdose	Opioid-related Overdose	Percent Opioid-related
Alabama	24.7*	10.8*	44%
Georgia	19.8	14.4	73%
Kentucky	52.1*	38.5*	74%
Maryland	48.4*	41.4*	86%
Mississippi	12.9*	4.4†	34%
New York	24.3	17.2*	71%
North Carolina	31.7*	25.2*	79%
Ohio	49.1*	40.5*	82%
Pennsylvania	42.0*	24.7*	59%
South Carolina	30.8*	22.4*	73%
Tennessee	33.9*	24.0*	71%
Virginia	26.1	19.6*	75%
West Virginia	59.7*	52.8*	88%
Appalachia	35.4*	24.6*	69%
Non-Appalachian U.S.	21.5	16.5	64%

[^]For states within Appalachia, only the mortality rate for the Appalachian counties is shown.

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

*Mortality rate is significantly different than the non-Appalachian U.S. rate for the same disease, $p \leq 0.05$

†Due to small number of deaths, opioid mortality rate is unreliable and not 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>

Discussion

Findings from this study highlight increasing disparities within the Appalachian Region related to diseases of despair, and demonstrate ongoing challenges first documented in the 2008 report, “An Analysis of Mental Health and Substance Abuse Disparities and Access to Treatment Services in the Appalachian Region.”⁸ Summary findings for each of the key project hypotheses include:

Hypothesis 1: Disparities related to diseases of despair are greater within the Appalachian Region than the non-Appalachian United States.

The combined mortality rate from the diseases of despair was 37 percent higher in Appalachia than the non-Appalachian U.S. In 2015, 11,187 deaths in Appalachia among 15 to 64 year olds were attributable to diseases of despair. Compared to the rest of the nation, the Appalachian Region experienced higher rates of mortality from the diseases of despair for all 10-year age ranges between 15 and 64. The most notable disparities existed for the 25 to 44 year age group. More specifically, when analyzing overdose deaths, 25 to 44 year olds experience mortality rates greater than 70 percent higher than the non-Appalachian U.S. These findings have significant implications, particularly in terms of economic development, as individuals during their prime working years are most impacted.

Hypothesis 2: Appalachian disparities are driving national trends showing rising mortality from diseases of despair.

The disparity in mortality from the diseases of despair between the Appalachian Region and the non-Appalachian U.S. has been growing over the past two decades. The gap widened dramatically between 2009 and 2015. For the five years between 2004 and 2009, the mortality rate remained 24 percent higher in the Appalachian Region than the non-Appalachian U.S. Between 2009 and 2015, the mortality rate in the Region grew to 37 percent higher than the rest of the nation. The high burden of diseases of despair in Appalachia, particularly among younger populations, is a contributor to declining life expectancy nationally.

Hypothesis 3: Within Appalachia, disparities are concentrated based on Appalachian subregion, county economic status, and/or rurality.

Within Appalachia, the disparities from the diseases of despair were concentrated most in the Central and North Central subregions, and also among the economically distressed counties. Specifically in terms of overdose deaths, distressed counties had a mortality rate 34 percent higher than non-distressed counties. Findings varied by rurality based on the specific disease of despair. While the rate of overdose deaths was greater in metro counties in Appalachia, the rates of suicide and alcoholic liver disease/cirrhosis were higher in nonmetro counties. More detailed analyses on opioid-related overdose deaths showed that 69 percent of the overdose deaths in Appalachia, or 3,859 deaths in 2015, were caused by opioids. The Appalachian counties of states within the Region varied dramatically in terms of their overall overdose mortality, and also the percentage attributable to opioids.

These findings document the scale and scope of the problem in Appalachia, and highlight the need for additional research and discussion in terms of effective interventions, policies, and strategies to address the diseases of despair. Notably, the opioid crisis has grown across the country since 2015, particularly with the emergence of more powerful synthetic opioids, such as fentanyl.¹⁵ Given that the data available for this study predate these more recent trends, the burden within the Region is likely greater than seen in this report.

This study, as well as research from Case and Deaton, have also shown the link between economic status and mortality from these causes.¹⁶ Economic development strategies and interventions that address other underlying contributors to the diseases of despair, in addition to increased access to treatment services, prevention, and overdose medications, may be important considerations in addressing this problem.

References

- ¹ Appalachian Regional Commission. The Appalachian Region. Retrieved from https://www.arc.gov/appalachian_region/TheAppalachianRegion.asp
- ² Beatty, K. and Meit, M. (2015). Reducing Childhood Obesity and Chronic Disease in Central Appalachia. Retrieved from <http://www.appalachiafund.org/data>
- ³ Knudson, A., Meit, M., Tanenbaum, E., Brady, J., Gilbert, T., Klug, M., Arsen, E., Papat, S., Schroeder, S. (2015). Exploring Rural and Urban Mortality Differences. NORC Walsh Center for Rural Health Analysis, Bethesda, MD. Retrieved from <http://www.norc.org/Research/Projects/Pages/exploring-rural-and-urban-mortality-differences.aspx>
- ⁴ Appalachian Regional Commission. Data Snapshot: Income and Poverty in Appalachia. Retrieved from <https://www.arc.gov/noindex/research/ACS-infographics2011-2015/DataSnapshot-Income+PovertyInAppalachia.pdf>
- ⁵ Appalachia Regional Commission. Data Snapshot: Employment in Appalachia. Retrieved from <https://www.arc.gov/noindex/research/ACS-infographics2011-2015/DataSnapshot-EmploymentInAppalachia.pdf>
- ⁶ Appalachia Regional Commission. Data Snapshot: Education in Appalachia. Retrieved from <https://www.arc.gov/noindex/research/ACS-infographics2011-2015/DataSnapshot-EducationInAppalachia-04-06-2017.pdf>
- ⁷ Centers for Disease Control and Prevention. Opioid Overdose. Understanding the Epidemic. Retrieved from <https://www.cdc.gov/drugoverdose/epidemic/index.html>
- ⁸ Zhang, Z., Meit, M., Infante, A., English, N., Dunn, M., & Bowers, K.H. (2008). An Analysis of Mental Health and Substance Abuse Disparities & Access to Treatment Services in the Appalachian Region. Retrieved from https://www.arc.gov/assets/research_reports/AnalysisofMentalHealthandSubstanceAbuseDisparities.pdf
- ⁹ Case, A., & Deaton, A. (2015). Rising morbidity and mortality in midlife among white non-Hispanic Americans in the 21st century. *Proceedings of the National Academy of Sciences*, 112(49), 15078-15083.
- ¹⁰ CDC WONDER. Retrieved from <https://wonder.cdc.gov/>
- ¹¹ Centers for Disease Control and Prevention. Multiple Cause of Death 1999 – 2015. Retrieved from <https://wonder.cdc.gov/wonder/help/mcd.html>
- ¹² Rudd, R.A., Seth, P., David, F. & Scholl, L. (2016). Increases in Drug and Opioid-Involved Overdose Deaths — United States, 2010–2015. *MMWR Morb Mortal Wkly Rep* 2016;65:1445–1452. Retrieved from <https://www.cdc.gov/mmwr/volumes/65/wr/mm65051e1.htm>
- ¹³ Appalachian Regional Commission. County Economic Status in Appalachia, FY 2017. Retrieved from https://www.arc.gov/research/MapsofAppalachia.asp?MAP_ID=116
- ¹⁴ United States Department of Agriculture. Urban Influence Codes. Retrieved from <https://www.ers.usda.gov/data-products/urban-influence-codes.aspx>
- ¹⁵ Centers for Disease Control and Prevention. Synthetic Opioid Data. Retrieved from <https://www.cdc.gov/drugoverdose/data/fentanyl.html>
- ¹⁶ Case, A., & Deaton, A. (2017). Mortality and morbidity in the 21st century. *Brookings Papers on Economic Activity*, 23-24.

Appendix A: ICD-10 Codes

Exhibit 15. Underlying cause of death – ICD-10 codes for diseases of despair

Diseases of Despair	ICD-10 Code	Underlying Cause of Death
Alcoholic poisoning and overdoses of prescription and illegal drugs (Overdose)	X40-45	Accidental poisoning by and exposure to: nonopioid analgesics, antipyretics, and antirheumatics; antiepileptic, sedative-hypnotic, antiparkinsonism, and psychotropic drugs; narcotics and psychodysleptics [hallucinogens]; other drugs acting on the autonomic nervous system; other and unspecified drugs, medicaments, and biological substances; and alcohol
	Y10-15	Poisoning by and exposure to the following (undetermined intent): nonopioid analgesics, antipyretics and antirheumatics, undetermined intent; antiepileptic, sedative-hypnotic, antiparkinsonism and psychotropic drugs; narcotics and psychodysleptics [hallucinogens]; other drugs acting on the autonomic nervous system; other and unspecified drugs, medicaments and biological substances, alcohol)
	Y45	Analgesics, antipyretics and anti-inflammatory drugs
	Y47	Sedatives, hypnotics and antianxiety drugs
	Y49	Psychotropic drugs, not elsewhere classified
Suicide	X60-84	Intentional self-harm
	Y87.0	Sequelae of intentional self-harm
Alcoholic liver disease/cirrhosis	K70	Alcoholic liver disease
	K73	Chronic hepatitis, not elsewhere classified
	K74	Fibrosis and cirrhosis of liver

Exhibit 16. Multiple causes of death – ICD-10 codes for opioid-related overdose

Disease of Despair	ICD-10 Code	Multiple Causes of Death
Alcoholic poisoning and overdoses of prescription and illegal drugs (Overdose)	T40.0	Opium
	T40.1	Heroin
	T40.2	Other opioids
	T40.3	Methadone
	T40.4	Other synthetic narcotics
	T40.6	Other and unspecified narcotics

Appendix B: Additional Data Tables

Exhibit 17. Overdose and opioid-related mortality rates, comparing Appalachian and non-Appalachian portions of states, ages 15-64, by disease and state (2015)‡

	Overdose		Suicide		Alcoholic Liver Disease/Cirrhosis		Diseases of Despair – Total	
	App	Non-App	App	Non-App	App	Non-App	App	Non-App
Alabama	24.7*	18.7	18.8	18.7	12.6	11.4	56.2*	48.9
Georgia	19.8*	16.0	17.1*	14.8	7.9	8.4	44.9*	39.2
Kentucky	52.1*	40.3	22.8	21.0	16.2*	10.9	91.1*	72.1
Maryland	48.4*	29.2	18.7*	10.4	8.5†	6.1	74.3*	45.7
Mississippi	12.9*	17.5	15.1	18.0	12.9	9.9	40.9	45.4
New York	24.3*	19.1	13.7*	9.7	8.2*	5.8	46.1*	34.6
North Carolina	31.7*	19.5	21.6*	15.9	12.1*	9.9	65.4*	45.2
Ohio	49.1*	41.8	18.4	17.7	10.4	10.4	78.0*	69.8
Pennsylvania	42.0*	33.6	20.7*	16.1	9.3*	6.9	72.1*	56.5
South Carolina	30.8*	18.3	23.1*	18.0	14.2*	11.6	68.1*	47.8
Tennessee	33.9*	27.0	21.1*	17.9	14.2*	10.2	69.2*	55.1
Virginia	26.1*	16.2	22.5*	15.4	14.8*	8.4	63.3*	39.9
West Virginia	59.7	N/A	21.3	N/A	14.4	N/A	95.4	N/A

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

*Appalachian rate is significantly different than the non-Appalachian rate for the same disease, $p \leq 0.05$

†Due to small number of deaths, mortality rate is unreliable and not 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>

Exhibit 18. Diseases of despair mortality rates, ages 15–64, by disease and state[^] (2015)[‡]

	Overdose	Suicide	Liver Disease	Diseases of Despair - Total
Alabama	24.7*	18.8*	12.6*	56.2*
Georgia	19.8	17.1	7.9*	44.9*
Kentucky	52.1*	22.8*	16.2*	91.1*
Maryland	48.4*	18.7	8.5†	74.3*
Mississippi	12.9*	15.1	12.9	40.9*
New York	24.3	13.7	8.2*	46.1
North Carolina	31.7*	21.6*	12.1	65.4*
Ohio	49.1*	18.4	10.4	78.0*
Pennsylvania	42.0*	20.7*	9.3*	72.1*
South Carolina	30.8*	23.1*	14.2*	68.1*
Tennessee	33.9*	21.1*	14.2*	69.2*
Virginia	26.1	22.5*	14.8*	63.3*
West Virginia	59.7*	21.3*	14.4*	95.4*
Appalachia	35.4*	19.8*	11.4*	66.6*
Non-Appalachian U.S.	21.5	16.5	10.6	48.6

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

*Rate is significantly different than the non-Appalachian U.S. rates for the same disease, $p \leq 0.05$

†Due to small number of deaths, mortality rate is unreliable and not 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>