

The Ripple Effect

National and State Estimates
of the U.S. Opioid Epidemic's
Impact on Children



Acknowledgments

This chartbook was authored by Suzanne C. Brundage, director of United Hospital Fund's Children's Health Initiative; Adam Fifield, UHF's director of communications; and Lee Partridge, UHF senior fellow. The analysis was produced as a collaboration between UHF and Boston Consulting Group through a pro-bono engagement. Special thanks to Boston Consulting Group's Edoardo Cavallazzi, Leonardo Fascione, and Jacob Luce, working under the direction of Christophe Durand and Bob Lavoie, for creating the analytic model and providing their expertise. This chartbook also benefited from the insights of UHF

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Contents

Overview	2
Figures	
1. Children affected by the opioid epidemic in 2017	4
2. Number of children affected by the opioid epidemic by 2030: Three scenarios	5
3. Opioid epidemic's impact on children in 2017 compared to common childhood health conditions	6
4. Rate of children affected by the opioid epidemic in 2017 by state	7
5. State rankings by rate of children affected by the opioid epidemic and total number per state in 2017	8
6. Number of children affected by the opioid epidemic in 2017 by age	9
7. Societal cost during childhood	10
8. Long-term societal cost	11
9. Lifetime societal cost of the opioid epidemic's impact on children in 2030	12
10. Projected societal cost of the opioid epidemic by state	13
Conclusion	14
Appendices	
A. Detailed state estimates for 2017 and projected state costs for 2030	15
B. Data sources	17
C. Methodology	20

Overview

The opioid crisis is the deadliest drug epidemic in U.S. history, leaving virtually no community unscathed. The immense toll of opioids has been well-documented by media organizations and researchers, but one aspect that has received little attention or study is the long-lasting impact on children of people suffering from opioid use disorder as well as the children's caregivers. In March 2019, United Hospital Fund (UHF) examined this critical issue in a report titled *The Ripple Effect: The Impact of the Opioid Epidemic on Children and Families*. Based on extensive interviews, literature reviews, and takeaways from a pivotal two-day gathering of experts hosted by UHF, the report provided a comprehensive look at the successive waves of loss and trauma experienced by newborns, young children, adolescents, and their families affected by opioid use disorder. This included children directly affected by the opioid epidemic—for example, by experiencing neonatal abstinence syndrome at birth or developing an opioid addiction in their youth—as well as those who may experience the also profound consequences of parental opioid use. The report can be found here: <https://uhfnyc.org/publications/publication/ripple-effect-opioid-epidemic-children-and-families/>.

Two key questions were left unanswered by the first *Ripple Effect* report: How many children are facing the consequences of the opioid epidemic? And what is the societal cost?

UHF partnered with the Boston Consulting Group to answer these questions and to quantify the number of children affected by the opioid epidemic on national and state-specific levels. Among the key findings:

- In 2017, an estimated **2.2 million children and adolescents** had a parent with opioid use disorder (OUD) or had OUD themselves.
- If current trends continue, an estimated **4.3 million children** will have had OUD or a parent with OUD by 2030.
- By 2030, the cumulative, lifetime cost of the “ripple effect” will be **\$400 billion** (this includes additional spending in health care, special education, child welfare, and criminal justice stemming from the multiple impacts of parental opioid use disorder on a child's physical, mental, and social-emotional health; it does not include productivity losses or missed opportunities).
- The rate of children affected by the opioid epidemic in 2017 varied significantly from state to state.

These estimates paint an alarming picture, but they should not cause despair. To the contrary, they highlight the urgent need to take action.

The information shared in this report shines a light on a population affected by opioids that is often hidden from view, allows for comparison of the “ripple effect” to

A NOTE ON TERMINOLOGY

In this report, “children” are individuals under the age of 18. People with “OUD” or “opioid use” refer to those diagnosed with an opioid use disorder due to prescription-based opioids (like Oxycontin or morphine) or those using any non-prescription-based opiate (like heroin or street fentanyl). People who report misusing a prescription-based opiate but are not considered to have an OUD are excluded.

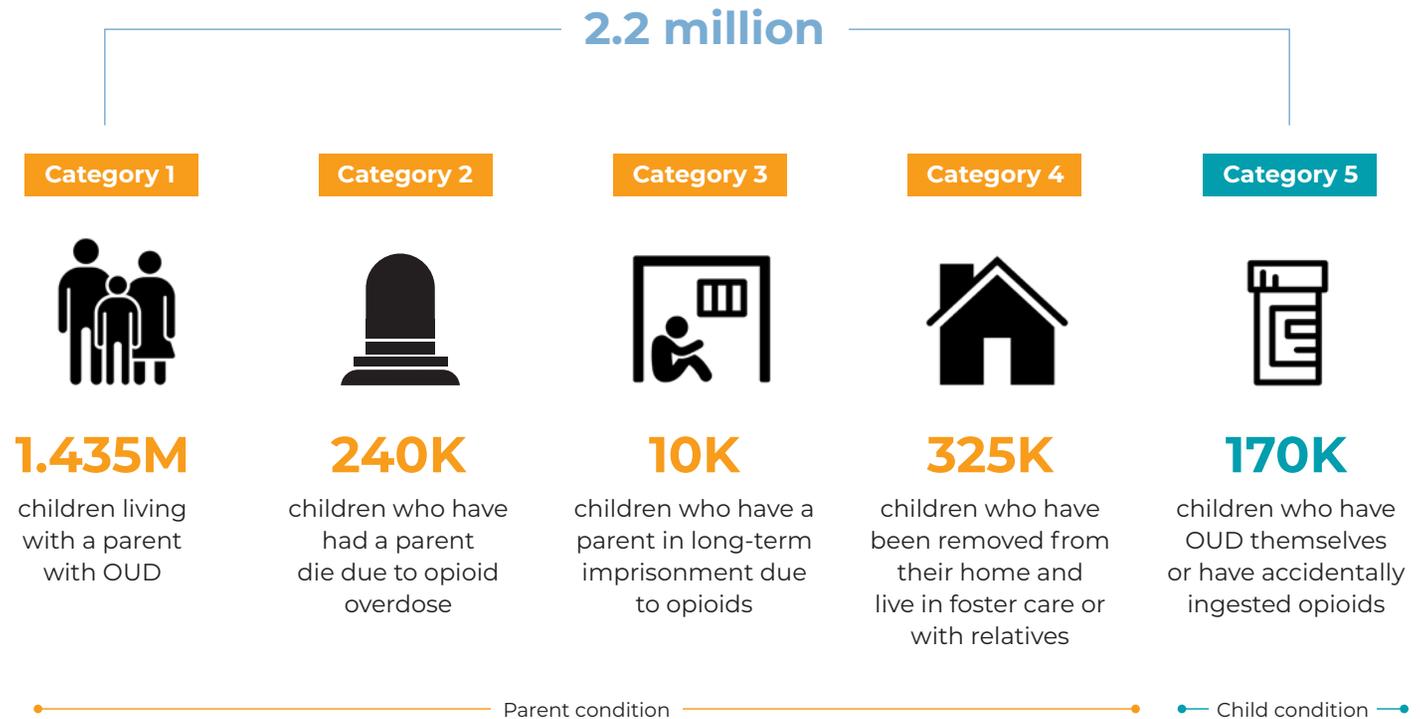
other public health problems, and offers an opportunity to identify strategies to blunt the epidemic’s impact on children. These strategies include the use of evidence-based interventions that help stabilize and strengthen families with substance use disorder (SUD) whenever possible, in the hope of avoiding out-of-home placements; policies and programs that promote the healthy development of children and adolescents adversely affected by family substance use; expansion of treatment and recovery programs for adolescents; and supporting foster and kinship caregivers.

Significant local, state, and federal funding streams have been dedicated to combatting the opioid epidemic. Considering the estimates presented herein, it is useful to take a new look at these funding streams specifically in the context of children and families. This analysis focuses on the opioid epidemic, but policymakers should recognize that other forms of substance use disorder can also affect children. Some of the strategies identified to support families with OUD could be equally effective for families with substance use other than opioids.

Figure 1

Children affected by the opioid epidemic in 2017

In 2017, an estimated 2.2 million children—approximately 2.8% of the 74.3 million children in the United States—were directly affected by parental opioid use or their own use. Approximately 2 million young people were affected primarily by parental use: they were either living with a parent with opioid use disorder, had lost a parent to an opioid-related death (at any time in their life), had a parent in prison or jail because of opioids, or had been removed from their home due to an opioid-related issue. An additional 170,000 children had OUD themselves or had accidentally ingested opioids. Most young people (1.4 million) affected by the epidemic are primarily influenced by living in a home with a parent with OUD. Strategies that keep families together by supporting treatment and recovery for parents and improving household functioning would play a large role in stemming the impact on children.



Sources: See Appendix B

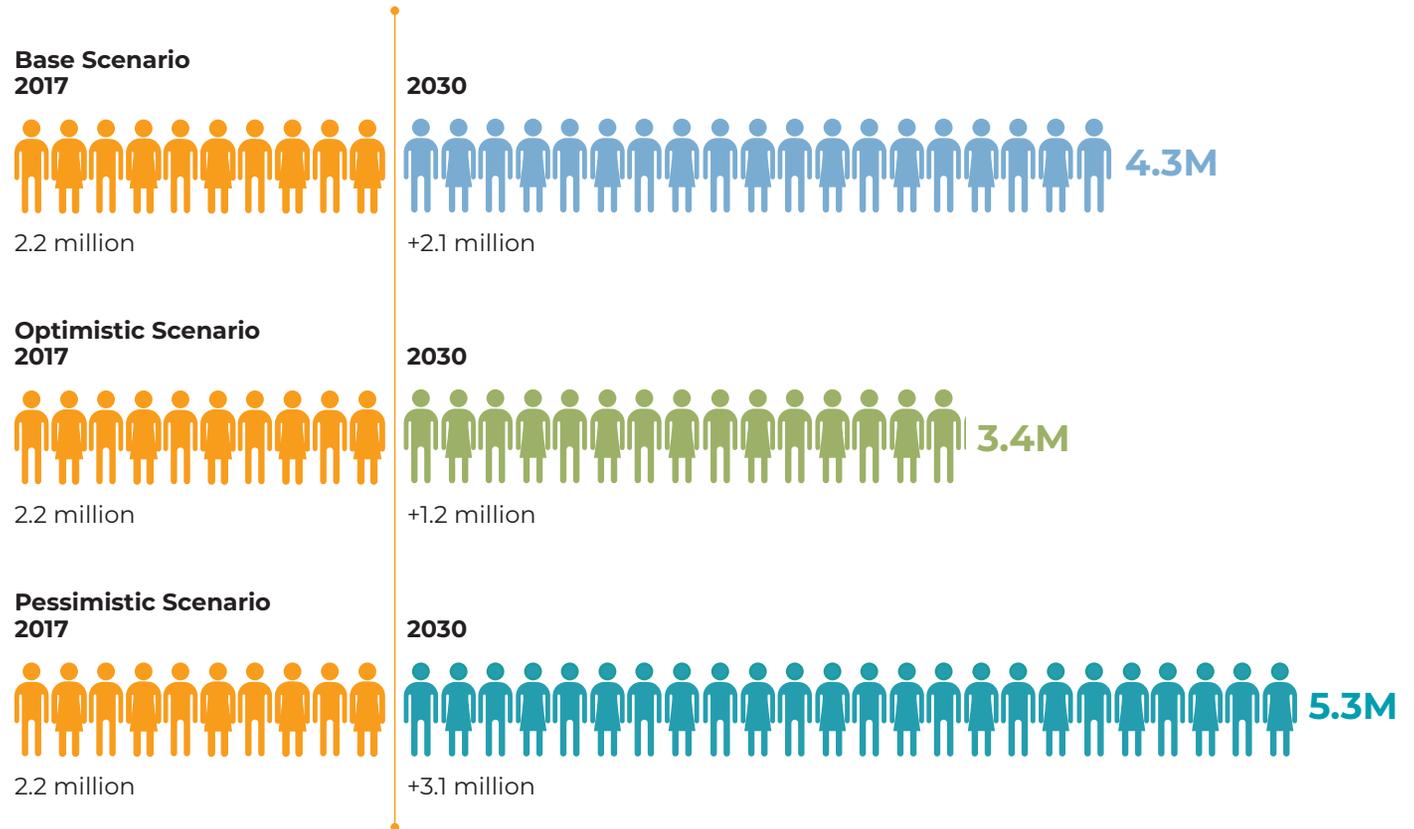
NOTES:

1. Estimates have been adjusted to account for underreporting of opioid use in the National Survey on Drug Use and Health and on death certificates.
2. To arrive at a nonduplicative count of the number of children affected, estimates have been adjusted to remove double-counting between categories. The unadjusted numbers are: 280,000 children who have experienced a parent death due to opioids; 15,000 children who have a parent imprisoned for possession of heroin; 353,000 children removed from home; and 194,000 children who have OUD themselves or who accidentally ingested opioids.

Figure 2

Number of children affected by the opioid epidemic by 2030: Three scenarios

Despite promising signs that the opioid epidemic has hit an inflection point, it is far from over. The number of children affected by the crisis will continue to grow. Assuming the current downward trends in opioid use continue, the estimated number of children affected by the opioid epidemic will nearly double by 2030 to 4.3 million. Even under the most optimistic scenario modeled—during which the prevalence of prescription-based OUD and non-prescription opioid use declines at twice the rate of current trends—an additional 1.2 million children will be affected by 2030. Under the worst-case scenario, during which efforts to curb the epidemic slow, the estimated total number of children affected could reach 5.3 million by 2030.



NOTES:

1. Included in the 2030 estimates are additional children born to people with OUD in 2017, children of people who will have developed an OUD between 2018 and 2030, and children who will have developed an OUD between 2018 and 2030.
2. Individuals do not age out of the predictive model. For example, children in foster care due to parental opioid use who turn 18 before 2030 are still counted in the 2030 estimate because they were affected by the opioid epidemic during childhood.

Figure 3

Opioid epidemic's impact on children in 2017 compared to common childhood health conditions

To put the “ripple effect” in perspective, it is helpful to compare it to the prevalence of other major childhood health conditions in the United States. In 2017, the estimate of the number of children affected by the opioid epidemic was 11 times higher than the number with diabetes, exceeded the number with autism, and was about one-third the number with asthma.

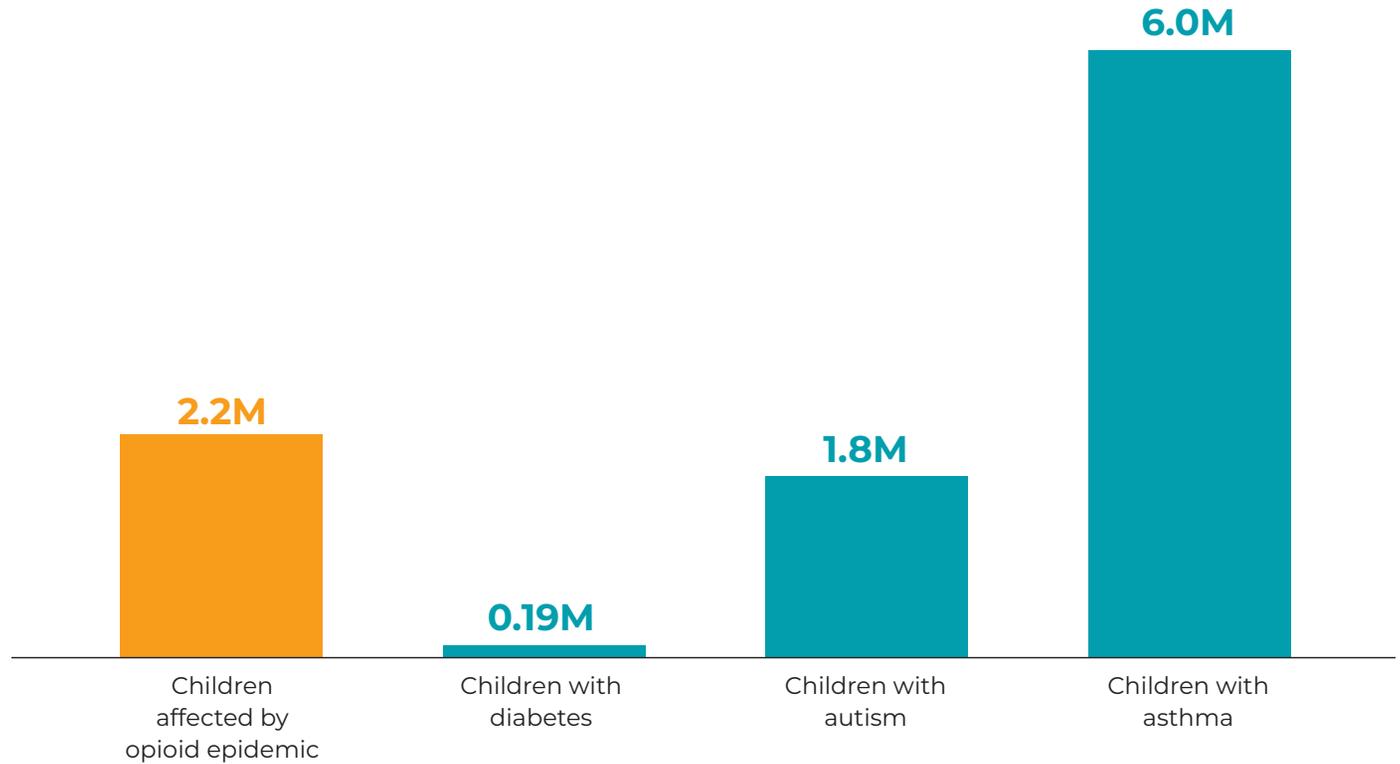


Figure 4

Rate of children affected by the opioid epidemic in 2017 by state

In 2017, 28 out of every 1,000 children in the United States were affected by opioids. West Virginia had the highest rate of children affected, with 54 out of 1,000—at least twice the rate of 17 other states. New Hampshire (51 out of 1,000) and Vermont (46 out of 1,000) had the second and third highest rates, respectively. In contrast, California had the lowest rate, with 20 children per 1,000.

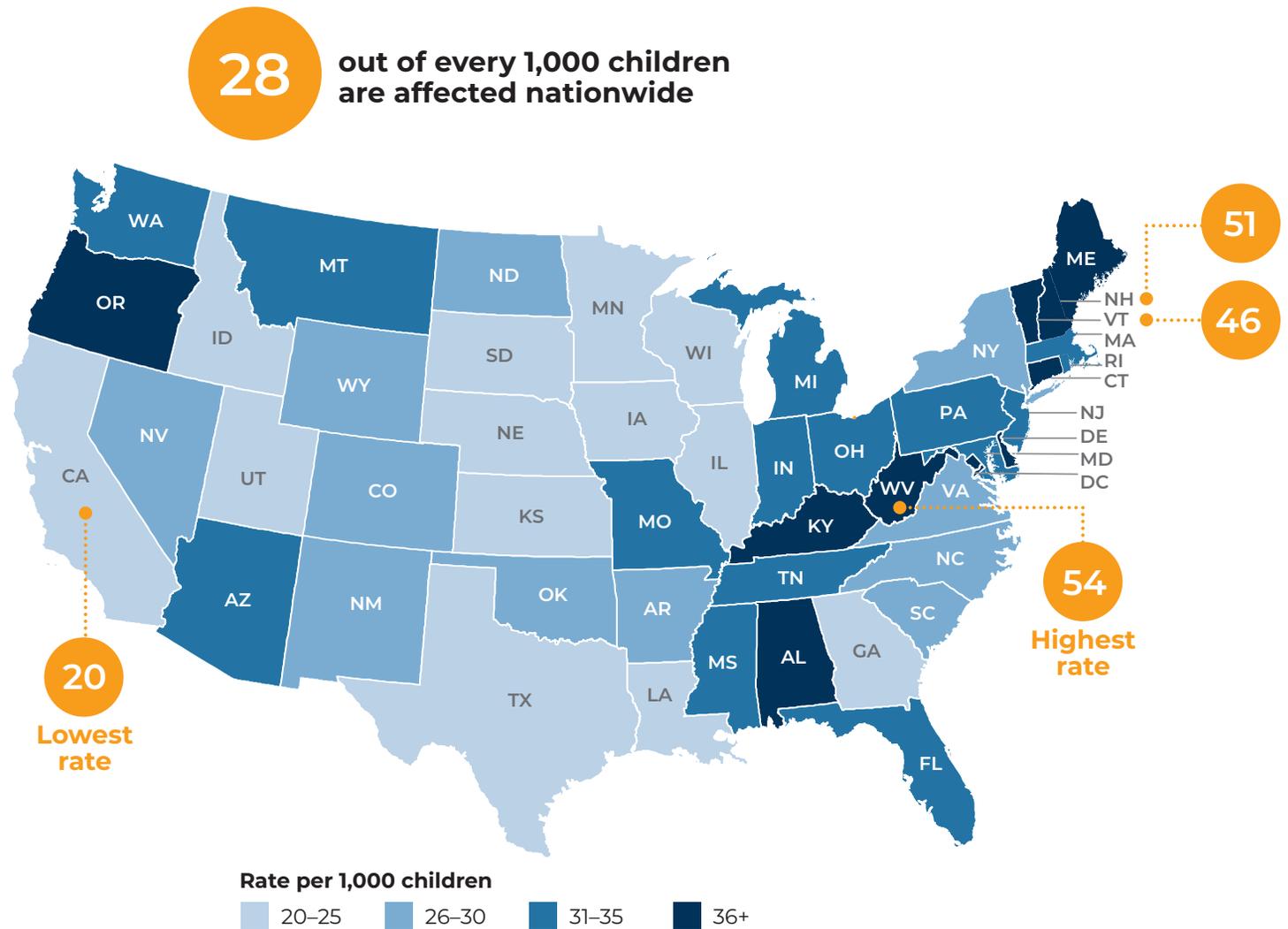


Figure 5

State rankings by rate of children affected by the opioid epidemic and total number per state in 2017

Although the rates of children affected in the four most populous states (California, Texas, Florida, and New York) are at or below the national median, together these four states account for nearly 30% of the 2.2 million children. West Virginia, a small, rural state with the highest per capita rate, was home to approximately 22,000 affected children. Wyoming had the lowest number of affected children, 4,000.

	State	Rate per 1,000	Total children affected		State	Rate per 1,000	Total children affected
1	West Virginia	54	22,000	27	New Mexico	30	16,500
2	New Hampshire	51	14,000	28	Arkansas	30	22,000
3	Vermont	46	5,500	29	Oklahoma	30	30,500
4	Kentucky	42	45,500	30	North Carolina	30	71,500
5	Delaware	41	9,000	31	Colorado	29	39,000
6	Oregon	39	35,000	32	South Carolina	29	33,000
7	Alaska	39	7,500	33	New York	28	125,000
8	Connecticut	39	31,000	34	Wyoming	28	4,000
9	Maine	38	10,500	35	Nevada	27	20,000
10	District of Columbia	37	4,500	36	Virginia	27	52,500
11	Alabama	37	42,000	37	North Dakota	27	4,500
12	Rhode Island	35	8,000	38	Wisconsin	25	34,500
13	Indiana	35	57,500	39	South Dakota	25	5,500
14	Mississippi	34	25,500	40	Idaho	25	11,500
15	Washington	34	58,000	41	Kansas	25	18,500
16	Pennsylvania	33	95,500	42	Hawaii	24	8,000
17	New Jersey	32	68,500	43	Minnesota	24	32,500
18	Maryland	32	47,000	44	Iowa	24	18,000
19	Missouri	32	47,000	45	Utah	24	23,500
20	Ohio	32	90,000	46	Louisiana	24	28,000
21	Montana	31	7,500	47	Georgia	23	60,500
22	Tennessee	31	50,000	48	Texas	23	171,000
23	Florida	31	138,000	49	Nebraska	22	11,000
24	Arizona	31	54,000	50	Illinois	21	67,500
25	Massachusetts	31	47,000	51	California	20	196,000
26	Michigan	31	71,000		USA	28	2,195,500

Figure 6

Number of children affected by the opioid epidemic in 2017 by age

Most children affected by opioids in the United States in 2017—nearly 1.6 million out of the total 2.2 million—were under the age of 12. Growing up in a household with substance use exposure is an adverse childhood experience (ACE) and can make children vulnerable to additional ACEs, such as abuse and neglect, loss or separation from a parent, or exposure to violence. The presence of such potentially traumatic experiences can be especially harmful to young children, as it can interfere with brain development. Recent research, however, teaches us that these ACEs can be prevented or their impact reduced, if these children and their families receive appropriate support.

Ages 0–5



Ages 6–11



Ages 12–17



Figure 7

Societal cost during childhood

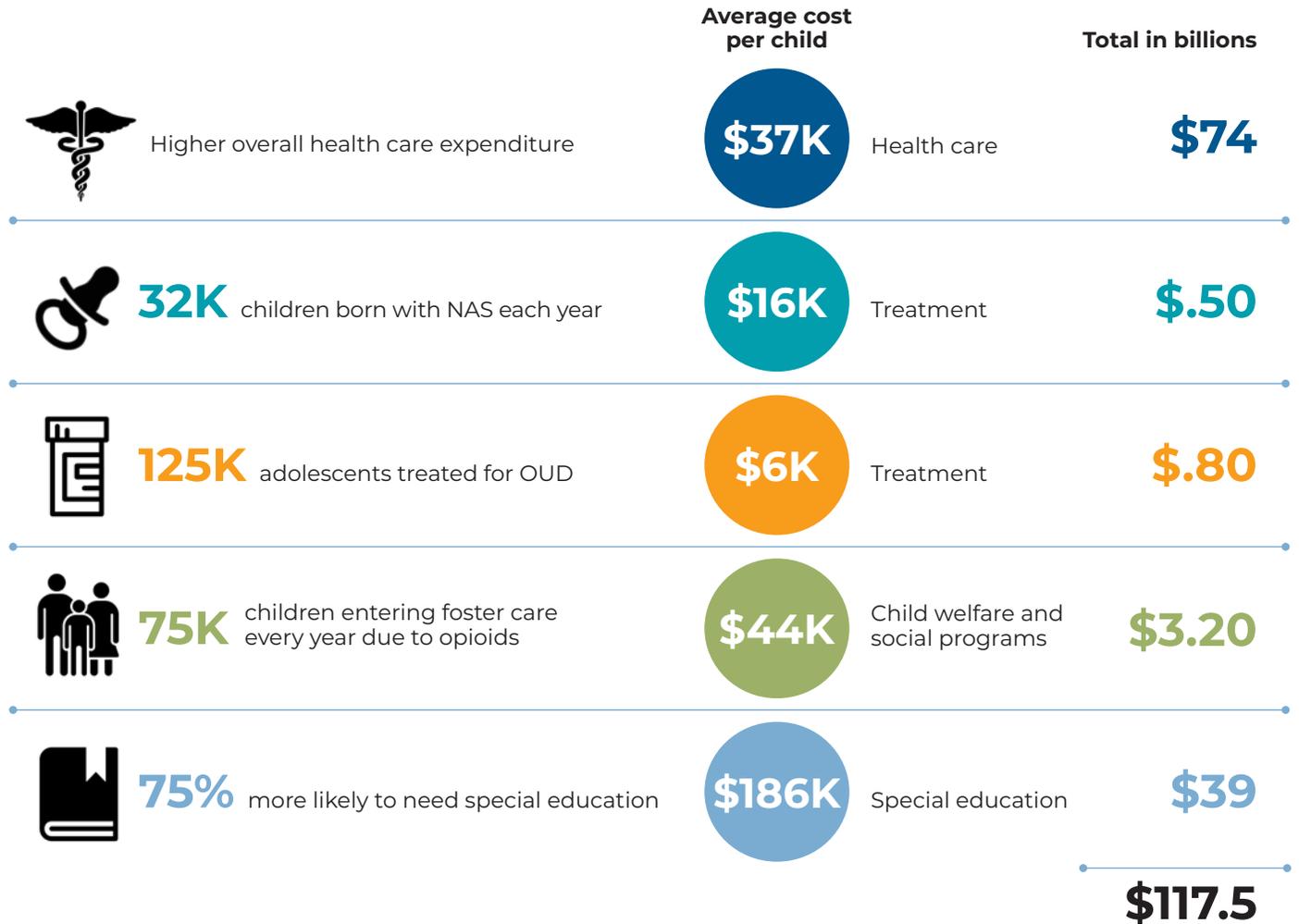
(based on 2.2 million children affected in 2017)

Children affected by the opioid epidemic will likely incur higher expenses during childhood, a trend that persists into adulthood. This lifetime societal cost is estimated to be \$180 billion for the 2.2 million children affected in 2017. This cost has two components: \$117.5 billion incurred during the years of childhood that stems from higher expenses on health care, child welfare, and special education; and \$62.1 billion in long-term expenses that accrue during adulthood (see Figure 8 for more information on these costs). The \$180 billion estimate does not include missed opportunities or productivity losses, which could be significant.

The bulk of the costs that accrue during childhood are for additional general health care and special education services.

Two sets of estimates are provided—a per-child cost and a total cost across the population—to assist policymakers in shaping appropriate interventions.

Total estimated lifetime societal cost
\$180 billion



NOTES:

1. Estimated increases in general health care and special education needs during childhood are based on analyses of costs associated with children who were subjects of child maltreatment investigations (not necessarily substantiated). Child maltreatment was defined by the researchers as both abuse (physical, psychological, or sexual) and neglect.
2. Lifetime cost means the aggregate cost over 50 years.
3. Estimate assumes 75% of adolescents with OUD would receive Medication Assisted Treatment.

Figure 8

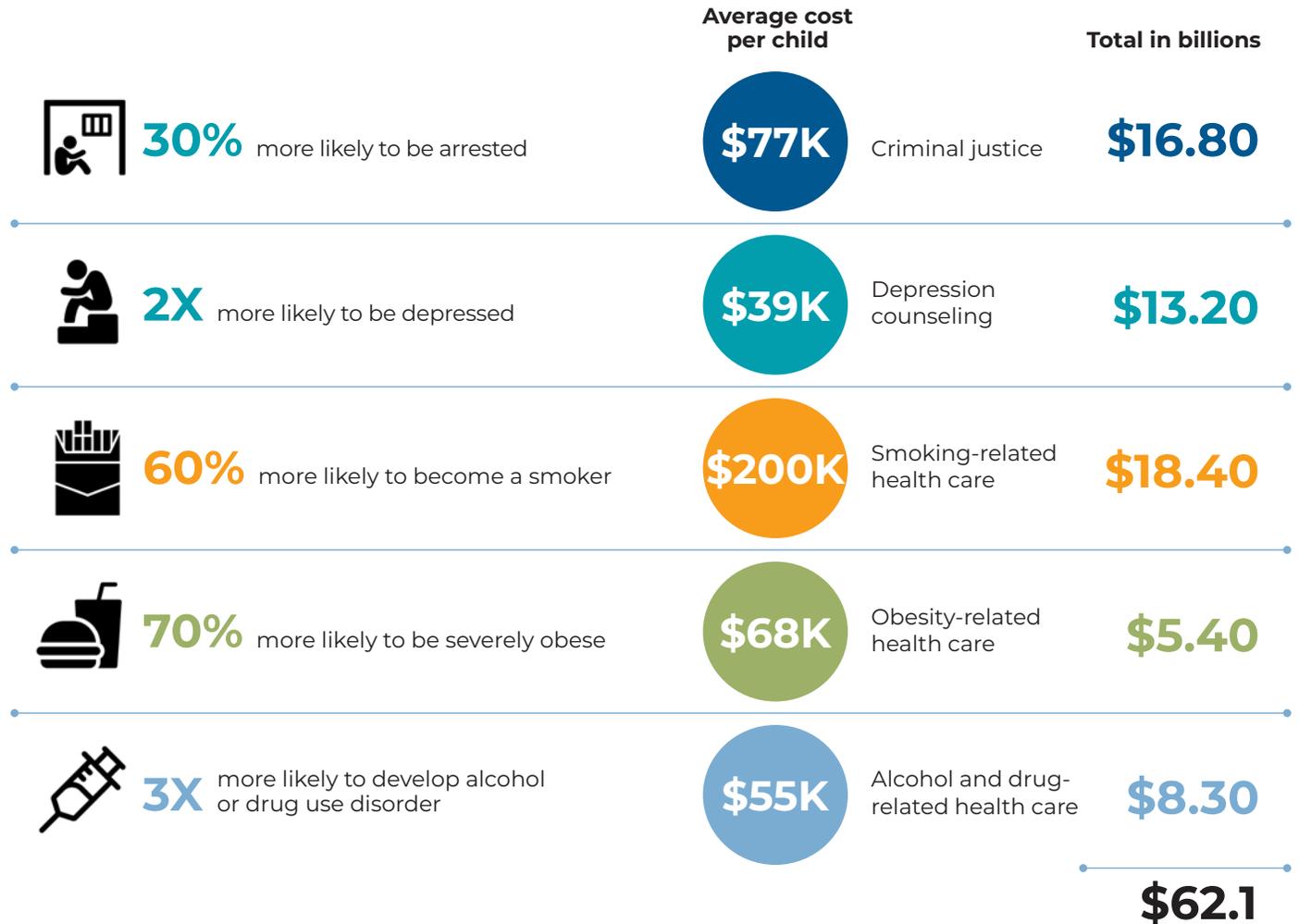
Long-term societal cost

(based on 2.2 million children affected in 2017)

The effects of adverse childhood experiences (ACEs) can be long-lasting and extend into adulthood. It is estimated that children of parents with substance use disorders have an average of 2.1 ACEs. A greater number of ACEs during childhood has been associated with increased risky behaviors, such as smoking and alcohol/drug use, in adulthood, and chronic disease, including depression. All told, the long-term cost due to adverse childhood experiences accounts for more than \$62 billion out of the total estimated societal cost of \$180 billion over the lifetime of these children.

The two sets of estimates provided—a per-child cost and a total cost across the population—are intended to assist policymakers in shaping appropriate interventions.

Total estimated lifetime societal cost
\$180 billion



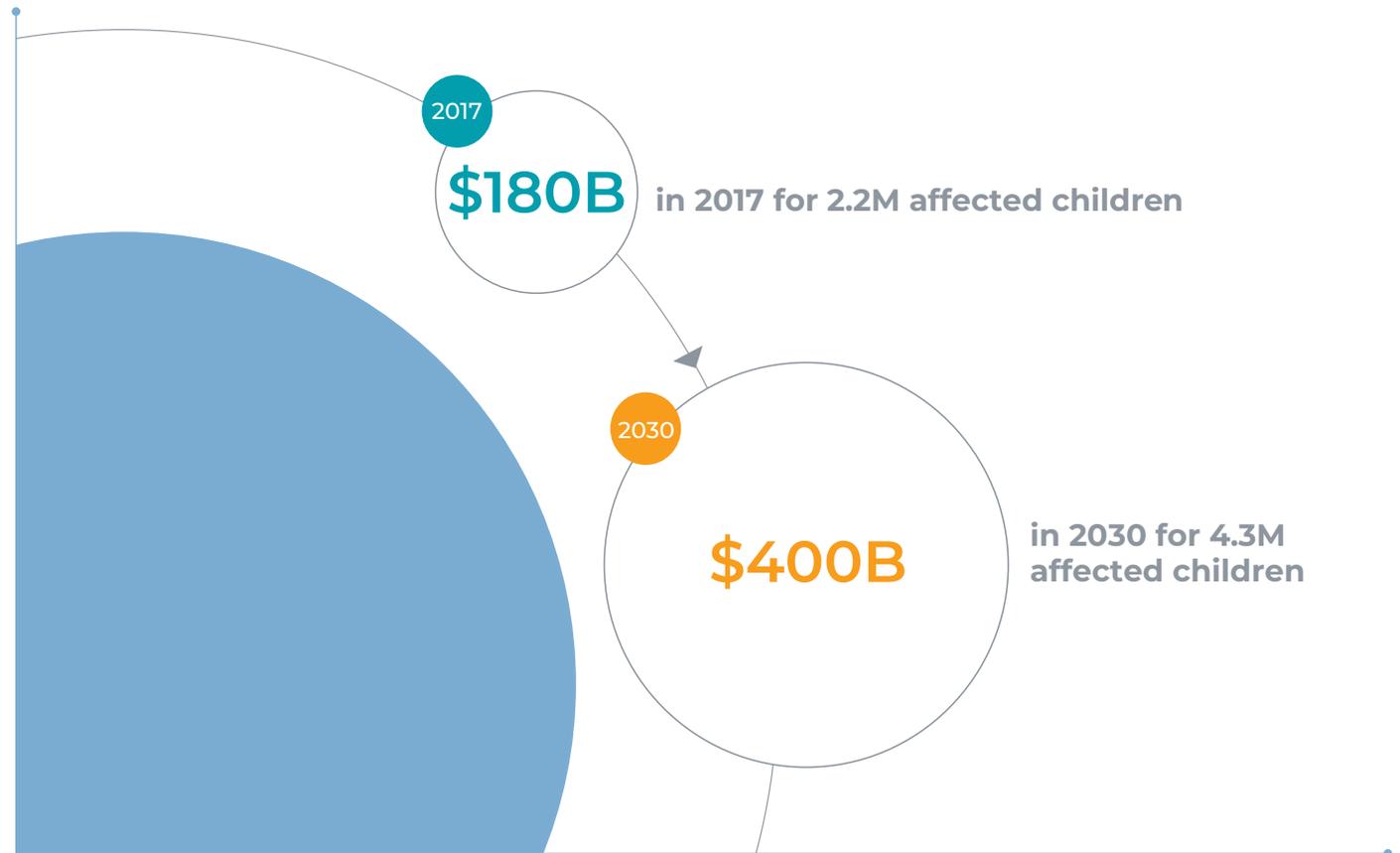
NOTE:

1. Lifetime cost means the aggregate cost over 50 years.

Figure 9

Lifetime societal cost of the opioid epidemic's impact on children in 2030

By 2030 the societal cost of the opioid epidemic's impact on children could increase to \$400 billion. This includes the estimated lifetime cost of the impact on children already identified in the 2017 estimate plus the estimated lifetime costs of children projected to be newly affected between 2018 and 2030. While not all children will be equally affected, the findings suggest that, on a national level, the ripple effect will be enormously expensive. But the toll on children, and the economic consequences that could result, are not inevitable. There are several strategies that can reduce some of these expenses: increased upfront investments supporting the health and well-being of children exposed to adverse childhood experiences, including parental SUD; tailored SUD programs for adolescents; and expanded opioid treatment programs that meet the needs of parents.



NOTES:

1. Estimated costs in 2030 are derived from the "base scenario" assumptions from Figure 2.

Figure 10

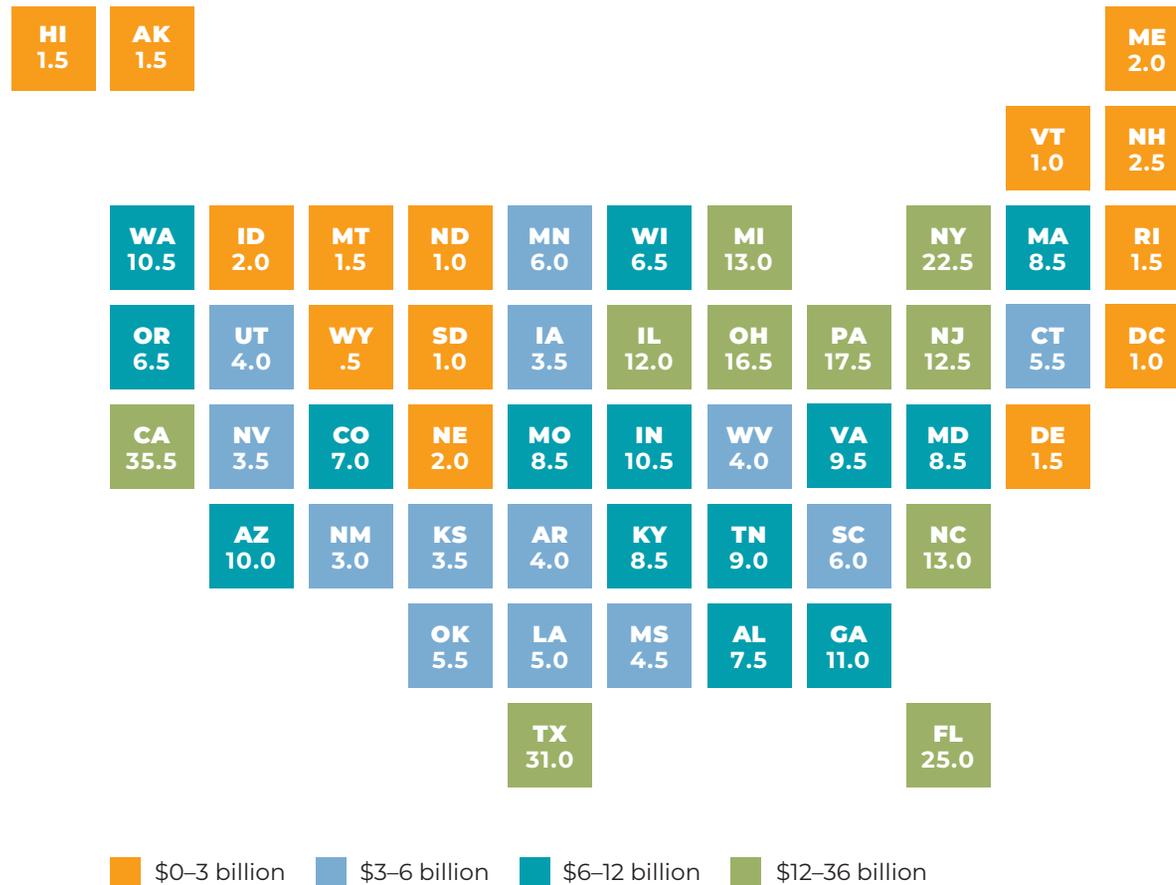
Projected societal cost of the opioid epidemic by state

(based on estimated 4.3 million children affected as of 2030)

Projected 2030 costs are attributed to states based on each state's proportion of affected children in 2017.

California, with the largest number of affected children, is projected to face a cost of \$35.5 billion. The average cost for a state is projected to be \$5 billion.

Total cost
\$400 billion



NOTES:

1. The state costs in 2030 are based on the national average cost in 2018. They do not consider regional variances in health care, social service, or other sector costs.

Conclusion

The estimates presented in this report suggest that the opioid epidemic's costs are substantial and wide-ranging. These include financial consequences, of course, but they also include a steep human toll—lives cut short and families disrupted. As succeeding generations of children are swept up in the turmoil of the opioid crisis, it is also starkly clear that the cost of doing something to help them is far less than the cost of doing nothing.

Fortunately, there are solutions. The bipartisan SUPPORT Act of 2018 and the Family First Prevention Services Act both include resources and programs that policymakers and community leaders can draw upon to minimize the impact of the epidemic on children. Below is a list of 10 priority strategies* that can help children affected by opioids:

- Reduce stigma and misunderstanding of opioid use and treatment, particularly among people interacting with pregnant women and parents
- Coordinate the response across health care, law enforcement, child welfare agencies, and schools, so families struggling with substance use disorder receive a “no-wrong-door” approach to evidence-based services
- Create protocols for emergency responders to connect children on the scene of potentially traumatic events to appropriate recovery services

- Provide kinship caregivers and foster parents with tools for responding to trauma in children
- Encourage schools to practice trauma-informed care
- Research the needs of youth caregivers and develop programs to support them
- Increase the availability of family-based mental health services
- Invest in evidence-based programs for youth development
- Encourage integrated health and social services that simultaneously meet the needs of parents and children
- Reduce geographic and racial/ethnic disparities in access to services

To make these strategies work, policymakers, providers, and other stakeholders must pay closer attention to children and families affected by substance use disorders. They must also commit to a vigorous response and a new collaborative spirit to reduce harm to our nation's youth from the long-lasting consequences of the opioid epidemic.

* These strategies are described in greater detail in [The Ripple Effect: The Impact of the Opioid Epidemic on Children and Families](#) by Suzanne Brundage and Carol Levine.

Appendix A. Detailed state estimates for 2017 and projected state costs for 2030

State	Rate per 1,000	Total number of children affected	Residing in household with parent with OUD	Loss of parent due to death or incarceration	Removal from home for foster or kinship care	OUD as adolescent or accidental ingestion as child	Cost in 2030 (\$B)
Alabama	37	42,000	27,000	3,000	9,000	3,000	7.5
Alaska	39	7,500	4,500	700	2,000	500	1.5
Arizona	31	54,000	35,500	6,000	8,000	4,500	10.0
Arkansas	30	22,000	12,500	1,500	6,000	1,500	4.0
California	20	196,000	144,500	21,500	12,500	17,500	35.5
Colorado	29	39,000	27,000	4,500	4,500	3,000	7.0
Connecticut	39	31,000	22,500	4,000	2,000	2,500	5.5
Delaware	41	9,000	6,500	1,000	400	800	1.5
District of Columbia	37	4,500	3,500	700	400	400	1.0
Florida	31	138,000	80,000	19,000	30,000	9,500	25.0
Georgia	23	60,500	38,000	6,000	11,500	4,500	11.0
Hawaii	24	8,000	5,000	600	1,500	600	1.5
Idaho	25	11,500	8,000	1,000	1,000	1,000	2.0
Illinois	21	67,500	48,000	10,500	3,000	6,000	12.0
Indiana	35	57,500	34,000	5,000	14,000	4,000	10.5
Iowa	24	18,000	11,500	1,000	4,000	1,500	3.5
Kansas	25	18,500	12,000	1,500	3,500	1,500	3.5
Kentucky	42	45,500	26,000	6,500	10,000	3,000	8.5
Louisiana	24	28,000	21,000	3,500	1,000	2,500	5.0
Maine	38	10,500	7,000	1,500	1,000	1,000	2.0
Maryland	32	47,000	32,000	8,000	3,000	4,000	8.5
Massachusetts	31	47,000	31,500	8,500	3,000	4,000	8.5
Michigan	31	71,000	49,500	9,000	6,500	6,000	13.0
Minnesota	24	32,500	22,500	2,500	4,500	2,500	6.0
Mississippi	34	25,500	13,500	1,500	9,000	1,500	4.5
Missouri	32	47,000	28,500	5,500	9,500	3,500	8.5

Appendix A. Detailed state estimates for 2017 and projected state costs for 2030 (continued)

State	Rate per 1,000	Total number of children affected	Residing in household with parent with OUD	Loss of parent due to death or incarceration	Removal from home for foster or kinship care	OUD as adolescent or accidental ingestion as child	Cost in 2030 (\$B)
Montana	31	7,500	5,000	600	1,500	600	1.5
Nebraska	22	11,000	7,500	500	1,500	1,000	2.0
Nevada	27	20,000	13,000	3,500	1,500	1,500	3.5
New Hampshire	51	14,000	10,500	1,500	800	800	2.5
New Jersey	32	68,500	47,000	7,500	8,000	5,500	12.5
New Mexico	30	16,500	8,500	3,000	4,000	1,000	3.0
New York	28	125,000	90,000	13,500	10,500	11,000	22.5
North Carolina	30	71,500	46,500	8,500	11,000	5,500	13.0
North Dakota	27	4,500	3,500	200	700	400	1.0
Ohio	32	90,000	57,500	15,000	10,500	7,000	16.5
Oklahoma	30	30,500	17,000	4,000	7,500	2,000	5.5
Oregon	39	35,000	22,000	3,000	7,500	2,500	6.5
Pennsylvania	33	95,500	65,000	14,500	8,000	8,000	17.5
Rhode Island	35	8,000	5,500	1,500	600	700	1.5
South Carolina	29	33,000	22,500	3,500	4,000	2,500	6.0
South Dakota	25	5,500	4,000	300	1,000	500	1.0
Tennessee	31	50,000	32,000	6,500	7,000	4,000	9.0
Texas	23	171,000	93,000	12,500	54,000	11,000	31.0
Utah	24	23,500	15,000	3,500	3,500	2,000	4.0
Vermont	46	5,500	4,500	500	500	500	1.0
Virginia	27	52,500	37,000	6,000	5,000	4,500	9.5
Washington	34	58,000	39,500	6,500	7,500	4,500	10.5
West Virginia	54	22,000	12,000	4,000	4,500	1,500	4.0
Wisconsin	25	34,500	24,500	4,500	2,500	3,000	6.5
Wyoming	28	4,000	2,500	400	500	300	0.5

NOTE:

Figures might not add up to total due to rounding.

Appendix B. Data sources

Figure 1

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Substance Abuse and Mental Health Services Administration. *National Survey on Drug Use and Health (NSDUH) from 2015-17*. <https://www.datafiles.samhsa.gov/study-series/national-survey-drug-use-and-health-nsduh-nid13517>

U.S. Census Bureau. 2019. *Current Population Survey Annual Social and Economic Supplement (2009-2018)*. <https://www.census.gov/programs-surveys/cps/data-detail.html>

Figure 2

Chen Q, et al. 2019. Prevention of Prescription Opioid Misuse and Projected Overdose Deaths in the United

Appendix B. Data Sources

(continued)

States. *JAMA Netw Open*. 2(2):e187621. doi:10.1001/jamanetworkopen.2018.7621

National Survey on Drug Use and Health (NSDUH) from 2015-17. (See Figure 1.)

Figure 3

American Diabetes Association. 2018. *Statistics About Diabetes*. <https://www.diabetes.org/resources/statistics/statistics-about-diabetes>

Centers for Disease Control and Prevention. 2019. *Data & Statistics on Autism Spectrum Disorder*. <https://www.cdc.gov/ncbddd/autism/data.html>

National Center for Health Statistics, Centers for Disease Control and Prevention. 2017. *Asthma*. <https://www.cdc.gov/nchs/fastats/asthma.htm>

Figure 4

State-level data from sources in Figure 1.

U.S. Census Bureau. 2017. *ACS Demographic and Housing Estimates, 2013-2017 American Community Survey 5-Year Estimates*. https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_17_5YR_DP05&prodType=table

Figure 5

State-level data from sources in Figure 1.

U.S. Census Bureau. 2017. *ACS Demographic and Housing Estimates, 2013-2017 American Community Survey 5-Year Estimates*. https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_17_5YR_DP05&prodType=table

Figure 6

National Survey on Drug Use and Health (NSDUH) from 2015-17; Adoption and Foster Care Analysis and Reporting System (2017). (See Figure 1.)

Figures 7 and 8

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Figure 9

Same sources as Figures 2, 7, and 8.

Figure 10

Same sources as Figures 1, 7, and 8.

Appendix C. Methodology

METHODOLOGY OVERVIEW

Boston Consulting Group (BCG) constructed the following model, informed by peer-reviewed literature (key sources listed below) and expert interviews to develop the estimates in this chartbook.

BCG began by creating a “snapshot” of children under age 18 in 2017 who had been affected by the opioid epidemic. To do this, they developed estimates of the number in each of five different categories:

1. Those living with a parent with OUD
2. Those who had a parent die due to an opioid overdose ever in their lifetime
3. Those with a parent in prison due to a heroin-related offense
4. Those removed from home and living in foster care or with relatives due to household opioid use
5. Adolescents (ages 12–17) with OUD and children (ages 0–12) who accidentally ingested an opioid

These estimates were then adjusted (lowered by 30%) to remove double-counting between the categories. BCG further increased the estimates for categories 1 and 5 to reflect known undercounting in these two groups because the data is self-reported. The resulting estimates were summed across the five groups to reach the 2017 2.2 million figure.

Second, 10 types of costs associated with the different ways a child may be affected by the opioid epidemic were identified and an average cost per person calculated for each.

The average per-person costs were multiplied by the estimated number of children to whom the costs would apply (roughly aligning with the five categories listed in step 1). These costs were summed to calculate the total lifetime cost for children affected in 2017.

BCG then estimated what the total number of affected individuals would be by 2030 under three different scenarios: base, pessimistic, and optimistic.

Using the base-year case assumption for the total number of affected individuals, the average per-person cost for each of the 10 cost types was multiplied by the new projected numbers as of 2030. The sum of those numbers is the 2030 cost estimate.

To calculate the state estimates for the number of children affected in 2017, the same steps were followed, substituting state-specific data for the numbers affected. State variation in health care or other sector costs was not taken into account. The state-by-state cost projections for 2017 and 2030 were derived by using each state’s percentage of the national number of children affected in 2017 and multiplying that share by the estimated national cost for the respective year.

Key academic literature:

- Biemer P and Brown G. 2005. *Model-based Estimation of Drug Use Prevalence Using Item Count Data*.
- Buchanich JM, et al. 2018. *The Effect of Incomplete Death Certificates on Estimates of Unintentional Opioid-Related Overdose Deaths in the United States, 1999-2015*.
- Chen Q, et al. 2019. *Prevention of Prescription Opioid Misuse and Projected Overdose Deaths in the United States*.
- Clemans-Cope L, et al. 2019. *Opioid and Substance Use Disorder and Receipt of Treatment Among Parents Living With Children in the United States, 2015-2017*.
- Fang X, et al. 2012. *The economic burden of child maltreatment in the United States and implications for prevention*.
- Felitti VJ, et al. 1998. *Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. The Adverse Childhood Experiences (ACE) Study*.

DETAILED METHODOLOGY

Figure 1. Children affected by the opioid epidemic in 2017

The total figure is the sum of estimates in five categories:

1. **Children residing in a household with a parent with opioid use disorder.** A national estimate of the number of parents living with OUD was obtained from

Lisa Clemans-Cope et al., and the NSDUH 2015-2017 three-year average was used. Using NSDUH 2017 state-level demographic data on the age of parents with OUD and the average number of children per age bracket, a preliminary estimate of the number of children was calculated. Using U.S. Census Bureau data, this figure was adjusted to account for household composition, taking into account the probability of households being a single-parent female-led household, a single-parent male-led household, or a two-parent household, and also considering the average number of children per household type. The estimate of the number of children residing in a household with a parent with OUD was then corrected downward to account for potential co-occurrence of OUD in two-parent households (estimated to be 15% based on expert interviews). The estimate was then adjusted upward by 30% to account for underreporting in NSDUH data (based on Biemer and Brown's [Model-based Estimation of Drug Use Prevalence Using Item Count Data](#) which reviewed underreporting in the NSDUH of cocaine use prevalence). Research on underreporting of self-reported opioid use suggests underreporting could be as high as 57%, so 30% is a conservative assumption.

State-based estimates were calculated by multiplying the national estimate (1.44 million) by the state's share of national prescription-based OUD and non-prescription opioid use.

2. **Have a parent who died due to opioids.** National and state-level data on opioid overdose deaths between 1999 and 2017 were obtained from the CDC. Based on [The Effect of Incomplete Death Certificates on Estimates of Unintentional Opioid-Related Overdose](#)

Appendix C. Methodology

(continued)

Deaths in the United States, 1999-2015, opioid overdose deaths were corrected for underreporting on death certificates by adding a percentage of “non-specified” drug overdose deaths to the opioid-overdose deaths. The percentage of non-specified drug deaths attributed to opioids was the same percentage, at national and state-levels, of opioid-related deaths attributed to overall drug overdose deaths. By comparing the total number of adults with OUD to the number of parents with OUD in the NSDUH 2015–2017, it was estimated that 35% of overdose deaths were of parents. The number of children affected was calculated using the average fertility rate, adjusted for demographic data (age and gender) of the overdose population. The figure was corrected to exclude an estimated 40,000 children who were counted in categories 1 or 4 based on likely household composition.

3. **Have a parent who has been incarcerated due to opioids.** The current national inmate population for drug possession offenses with sentences greater than one year was obtained from the Bureau of Justice Statistics. Based on Uniform Crime Reporting statistics, an estimated 3% of these were related to heroin possession. The percentage of this population estimated to be parents, and therefore the number of children affected, was calculated using methods comparable to categories 1 and 2. To avoid potentially double-counting children who would likely appear in categories 1 or 4, only criminal sentences greater than 12 months were included in this estimate. State-level estimates were derived by applying the state share of the national correctional population to the national estimate of children who have a parent incarcerated due to opioids.

4. **Have been removed from home due to household opioid misuse.** The number of children in foster care because of parental drug use on September 30, 2017, was obtained from the 2018 Adoption and Foster Care Analysis and Reporting System (AFCARS) report using state-level data. The share of these cases with opioid involvement was estimated to be 31%, based on prevalence of opioid use compared to all substance use in NSDUH results. To account for children living in unofficial kinship care, state-level ratios of unofficial kinship care to foster care were applied, resulting in a national average ratio of six children in unofficial kinship care for every one child in foster care (2009-2018 Current Population Survey Annual Social and Economic Supplement). The figure was corrected to account for children who enter and exit foster care during the same year to avoid double-counting with category 1.

5. **Have OUD or have accidentally ingested opioids.** The number of adolescents ages 12–17 with OUD was obtained from NSDUH 2015–2017 (three-year average) and corrected for an estimated 30% in underreporting. The estimate was also corrected for double-counting with category 1 by factoring in the percentage of adolescents who sourced their opioids from relatives (30%) or who have relatives with OUD (20%). The number of children ages 0–12 hospitalized for opioid ingestion in 2015, obtained from *Prescription Opioid Exposures Among Children and Adolescents in the United States: 2000–2015*, was added to the figure.

Figure 2. Number of children affected by opioid epidemic by 2030: Three scenarios

2030 estimates were developed using a dynamic system model that simulates year-by-year changes in nonmedical opioid use in the United States. Using methods from Chen et al., *Prevention of Prescription Opioid Misuse and Projected Overdose Deaths in the US, 2019*, the model consisted of three subgroups of the population: those using prescription opioids nonmedically without an OUD; those with prescription-based OUD; and those using illicit opioids. Individuals can enter and exit the model based on changes in their opioid use. New entrants include individuals who go from misusing prescription drugs to developing a prescription-based OUD; individuals who go from misusing prescription drugs to misusing illicit opioids; and those who go directly to misusing illicit opioids. Individuals can exit the model if they stop using opioids or die from an overdose. Since the most recent data from Chen et al. was from 2015, the model was adjusted to include observed trends in prescription-based OUD and non-prescription-based OUD up to 2017.

Three future scenarios were simulated to arrive at an estimate of total new cases of OUD between 2018 and 2030.

- **Base case:** assumes prescription-based OUD incidence is decreasing based on current trends and assumes illicit OUD reached inflection point in 2016–2017.
- **Pessimistic case:** assumes prescription-based OUD is decreasing at half the rate of current trends and illicit OUD reaches an inflection point in 2020.
- **Optimistic case:** assumes prescription-based OUD is decreasing at twice the rate of current trends and illicit OUD also decreases at twice the rate of current trends.

Each of these scenarios resulted in an estimated number of new OUD cases between 2018 and 2030. Using a method similar to that used in Figure 1 and drawing upon NSDUH 2017 data, BCG calculated how many of the new OUD cases would likely be among parents and how many children they have (a weighted average fertility rate of 1.9 was used). Added to this estimate was the number of additional children born to parents with OUD in 2017 (estimated to be 146,000) and children who themselves are projected to develop an OUD between 2018 and 2030 (estimated to be 115,000).

Figure 3. Opioid epidemic's impact on children in 2017 compared to common childhood health conditions

Figure compares estimates to existing data sources. No methods to report.

Figure 4 (Rate of children affected by the opioid epidemic in 2017 by state) and Figure 5 (State rankings by rate of children affected by the opioid epidemic and total number per state in 2017)

The total number of children affected in each state is the sum of state-level estimates for Figure 1. The state rate was calculated by dividing this total by the state's under age 18 population as reported in the American Community Survey's "Demographic and Housing Estimates 2013–2017 5-year Estimates."

Figure 6. Number of children affected by the opioid epidemic in 2017 by age

Estimated age ranges for categories 1–3 were calculated using household demographic data from the NSDUH 2015–2017. These estimates: 42% of children of parents

Appendix C. Methodology

(continued)

with OUD are ages 0–5; 34% are 6–11; and 24% are 12–17. Age ranges for children in category 4 were calculated using AFCARS data. Category 5 age ranges only include children ages 12–17 with OUD, sourced from the NSDUH 2015–2017. These numbers were adjusted for underreporting and double-counting between categories, as they were in Figure 1.

Figure 7. Societal cost during childhood (based on 2.2 million children affected in 2017)

Incremental health care costs during childhood refer to the health care costs resulting from parental OUD that occurs in childhood. Costs were calculated drawing upon the work of Fang et al. 2012 and an analysis by Peterson et al. of the economic burden of child maltreatment. For this cost analysis, which used an adverse childhood experiences perspective, the effects of parental opioid use disorder on a child are assumed to be similar to the effects of child maltreatment. Child maltreatment results in additional health care costs during childhood, including additional inpatient and outpatient visits, prescription medications, and counseling. For a full list of included costs, see Florence et al., 2012. Fang et al. estimated a \$33,000 incremental cost (2010 dollars) for health care received between ages 6 and 17. This estimate was adjusted to 2018 dollars using the personal consumption expenditure (PCE) price index. These costs are applied to children in categories 1–4.

NAS-related treatment costs. The source is Winkelman et al., *Incidence and Costs of Neonatal Abstinence Syndrome Among Infants With Medicaid: 2004–2014*, which found that the average Medicaid cost of hospitalizing an infant with NAS was approximately \$19,000 (vs. about \$4,000 without) due to longer stays post birth; this resulted in

an incremental additional birth cost of approximately \$15,000. These costs apply only to children born with NAS, estimated to number 32,000 in 2017.

OUD treatment-related costs for adolescents include medication and office visits. The source for cost data is *Medications to Treat Opioid Use Disorder: How Much Does Opioid Treatment Cost?*, NIH National Institute on Drug Abuse. It assumes 75% of teenagers with OUD are treated every year from now until 2030 and an average length of treatment that is 6–8 years, with 97% of adolescents on Buprenorphine, 2% on Naltrexone, and 1% on Methadone. These costs only apply to children in category 5.

Child welfare costs. A total child welfare system cost of approximately \$30 billion in 2017 (to serve 680,000 children) was used to calculate a per-child/per-year cost. This figure was multiplied by 73,000, which is the estimated number of children entering child welfare annually due to opioids. The source was AFCARS state foster care data from 2008–2017. These costs only apply to children in foster care and do not include costs of kinship care.

Special education costs. This analysis is based on literature suggesting that child maltreatment is associated with increased entry into special education systems. For this cost analysis, using an adverse childhood experiences perspective and limited additional research, it was assumed the effects of parental opioid use disorder on a child would be similar to the effects of child maltreatment. In a study examining the economic burden of child maltreatment, Fang et al. 2012 assumes a 10.5% incremental increase in special education use due to child maltreatment (24.2% of maltreated children received special education at a mean

age of 8 years, compared with 13.7% of children with no maltreatment record).

Translating this incremental increase in special education use into cost, similar to Fang et al., BCG drew upon Reynolds et al. (2002), who estimated that the average annual cost per child for special education services above and beyond regular instruction was \$7,791 in 1998 dollars. This figure was adjusted upward by 4% per year to an incremental, per-year, per-pupil cost of \$16,000 in 2018 dollars, based on [historical education cost data](#). Assuming twelve years of instruction, the present value of lifetime special education costs per pupil is \$186,000. Assuming a 10.5% incremental increase in special education due to parental opioid use, the per-pupil cost is estimated to be \$19,511. This distributed per-child cost is applied to children in categories 1–4.

Figure 8. Long-term societal cost (based on 2.2 million children affected in 2017)

These costs were calculated on the percent likelihood of increased at-risk behavior over a lifetime (50 years) based on a blended adverse childhood experience score of 2.1 for people affected by parental substance use, the number estimated by Felitti et al. Costs do not account for productivity losses. These costs, because they take into account increased risk across a population, apply to children in categories 1–5.

Criminal justice-related costs. Cost estimate is based on the incremental effect of child maltreatment on criminal justice involvement, using methods from Fang et al., 2012, and Widom and Maxfield, 2001. Widom and Maxfield reported that child maltreatment increases the likelihood of having a juvenile arrest by 10.2 percentage

points, based on a longitudinal analysis of 1994 arrest data from a Midwestern metropolitan area. (That analysis found that 27.4% of maltreated children had a juvenile arrest compared to 17.2% of children in the comparison group.) Using the cost methods of Fang et al., BCG calculated a blended cost in 2018 dollars for juvenile and adult arrests (including expenses for arrests, treatment, probation services, and release) of \$7,732, an amount that was distributed across the 2.2 million affected children.

Depression-related health care costs. The analysis assumes a 14% depression prevalence among individuals with no adverse childhood experiences and a 16 percentage-point increase above that rate among affected children (based on blended ACE scores from Felitti 1998). The cost analysis assumes one counseling session per month at a cost of \$100 per session (the national average). The estimate is the lifetime cost of 50 years in present value.

Smoking-related health care costs. The analysis assumes a 7% smoking prevalence among individuals with no adverse childhood experiences and a 4 percentage-point increase above that rate among affected children (based on blended ACE scores from Felitti 1998). It also assumes an average marginal lifetime health care cost of a smoker to be \$200,000 (source: CDC). The estimate is the lifetime cost of 50 years in present value.

Obesity-related health care costs. The analysis assumes a 5% obesity prevalence among individuals with no adverse childhood experiences and a 4 percentage-point increase above that rate among affected children (based on blended ACE scores from Felitti 1998). Obesity-related costs are estimated to be \$1,980 per year per person in 2015 dollars. The cost was adjusted for PCE inflation. The estimate is the lifetime cost of 50 years in present value.

Increased alcohol and drug use-related health care costs.

The analysis assumes a 3% prevalence of alcohol and drug use disorders among individuals with no adverse childhood experiences and an 11 percentage-point increase above that rate among affected children (based on blended ACE scores from Felitti 1998). Blended alcohol- and drug-related costs are estimated to be \$3,000 per person per year, according to a report from the [U.S. Surgeon General's office](#). The estimate is the lifetime cost of 50 years in present value.

Figure 9. Lifetime societal cost of the opioid epidemic's impact on children in 2030

The cost was calculated by summing the totals for each cost category. The total for each cost category is the result

of multiplying the per-person costs in each category by the estimated number of attributable lives in 2030. 2030 cost estimates take into account inflation and are reported as the net present value in 2018 dollars.

Figure 10. Projected societal cost of the opioid epidemic by state (based on estimated 4.3 million children affected as of 2030)

All cost estimates are based on national average cost in 2018 and do not take into account variances in health care, social service, or other sector costs. Costs are attributed to states based on their proportion of affected children in 2017. Cost estimates take into account future discounting.