

Deaths, Dollars, and Diverted Resources: Examining the Heavy Price of the Opioid Epidemic

HIGHLIGHTS

- › The Economic Burden of the Opioid Epidemic on States: The Case of Medicaid
- › Estimated Costs to the Pennsylvania Criminal Justice System Resulting From the Opiate Crisis
- › Considering the Child Welfare System Burden From Opioid Misuse: Research Priorities for Estimating Public Costs
- › The Opioid Epidemic, Neonatal Abstinence Syndrome, and Estimated Costs for Special Education
- › Opioid Misuse, Labor Market Outcomes, and Means-Tested Public Expenditures: A Conceptual Framework

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OVERVIEW

This special edition of *The American Journal of Managed Care*[®] examines the impact and implications of the opioid epidemic, with a particular emphasis on cost. Composed of original research in addition to commentaries, this publication provides an in-depth view of opioid misuse and its effects on society.

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Preventing the Next Crisis: Six Critical Questions About the Opioid Epidemic That Need Answers

Dennis P. Scanlon, PhD, and Christopher S. Hollenbeak, PhD

The articles and commentaries in this special issue of *The American Journal of Managed Care*[®] add to a growing body of literature on the opioid epidemic that has plagued the United States since extended-release oxycodone hydrochloride (OxyContin) was approved by the FDA in 1995.¹ Although other published studies have focused on various aspects of the epidemic, including the clinical efficacy and addictive properties of opioids or strategies to prevent addiction and treat opioid use disorder,²⁻¹⁴ the articles in this issue focus on the costs to state governments. Although the policy that ushered in the opioid epidemic was established at the national level, state governments and associated municipal governments, along with families and individuals, have borne the brunt of the costs. States, counties, cities, towns, and villages are ground zero for the epidemic, representing the political boundaries within which overdose occurs and where services are delivered to those who are harmed by opioids. As illustrated in the articles presented in this supplemental publication, the services provided by state and local governments are significant and costly, spanning well beyond healthcare for treatment¹⁵ and prevention.¹⁶ Other costs are associated with policing, judicial services, and corrections¹⁷; administering programs for children and families impacted by the epidemic¹⁸; the education system, including the provision of special education services for children born with neonatal abstinence syndrome¹⁹; reductions in revenues that are received from states in the form of income and sales taxes due to work force exits; and additional expenses for administering other means-tested programs, such as food or income support programs.²⁰

Aggregate data speak volumes, with alarming trends in mortality, morbidity, healthcare, and social program costs well documented in the collection of articles published in this supplemental issue and elsewhere.²¹⁻²⁶ In this commentary, we raise several important, broader questions that we believe have not received sufficient attention but are critically important for learning from the current opioid epidemic and preventing the potential burdens that could be associated with the next epidemic.

“At the forefront, we should not lose sight of the damage the epidemic has wrought on entire communities and on families who have lost loved ones or have struggled to help those addicted to prescription opioids.”

What Are the Real Opportunity Costs of the Opioid Epidemic?

Economists use the term “opportunity cost” to acknowledge that using resources for one purpose reduces or eliminates the ability to use those resources for a different purpose. This concept, which has enormous societal implications, is perhaps best understood in the context of an individual family’s budget. If the refrigerator breaks and needs to be replaced, then the funds used for the replacement are no longer available for other purposes, such as paying for meals or gas for the car. The same is true in society, where governments operate within fixed budgets but face unexpected circumstances that require the immediate expenditure of resources, such as responding to a natural disaster.

The opioid epidemic is one of those circumstances in which the crisis has required an immediate response by state and local governments to “pick up the pieces” through the provision of social services at a magnitude and cost that were unthinkable prior to 1995. The amount of money spent on first responders and medical treatments and the number of children left parentless because of the epidemic is enormous.²⁷⁻³⁰ Few individuals question whether state governments should be responding to the social needs of their constituents; however, less has been written about what has been relinquished—that is, the true opportunity costs—because of this response, along with the broader impact that this has on states and their citizenry. This is an important omission and one that needs to be discussed, not only to compensate states, but also to engage more constituents in understanding how those who are not directly affected by the epidemic lose out as a result.

Every taxpayer should realize that the opportunity cost of having to expend resources on providing services related to the opioid epidemic has resulted in fewer or inferior services that add value and enhance the well-being of society. For example, with state budget money being diverted to the epidemic, less has been spent on repairing aging transportation infrastructure. Additionally, less money has been spent on public education, including the amount spent on teachers and students, likely exacerbating the large gap in education and performance that exists compared with other industrialized countries in areas like science, technology, engineering, and mathematics. Moreover, fewer resources have undoubtedly been available for economic development and investments in job creation for the future.

In short, much of the press coverage and public discourse about the opioid epidemic has been focused disproportionately on assigning blame and highlighting the direct costs, such as the most recent death count or the latest attempt to make naloxone treatment available to the public without a prescription. Much less attention has been placed on the fact that because of the opportunity costs, every American has borne the brunt and will continue to withstand the harmful effects of resources being diverted to the epidemic—funds that could have been made available for a more productive societal use if the opioid epidemic had been avoided. These damages are currently being considered in the pending multidistrict legislation in the Cleveland District,³¹ as well as in the myriad other lawsuits and settlements, such as in Oklahoma, where the state government is trying to recover expenditures from those alleged to have created the epidemic—primarily drug manufacturers and distributors—in efforts that are reminiscent of the tobacco settlement of 1998.³²⁻³⁷ Regardless of the outcome of these lawsuits, it seems certain that any damages that are awarded will not come close to covering the opportunity costs of the epidemic. In this sense, it is critical that constituents, community leaders, and politicians learn from this disaster and do everything in their power to ensure that the next similar preventable epidemic does not occur and further divert public resources that should otherwise be used to advance society.

Has the Federal Government Failed States by Inadequately Performing Its Fiduciary Responsibility?

Federalism in the United States means that the power and authority to govern are intentionally divided between the federal and state governments, with specific responsibilities delegated to each governmental unit. This concept is critical when we think about responsibilities in the opioid epidemic and whether various governmental entities charged with oversight have adequately performed their fiduciary responsibilities. Although state governments are responsible for certain areas, such as medical professional licensure

and the regulation of health insurance within the state's borders, other responsibilities related to the opioid epidemic fall to the federal government to organize and regulate on behalf of all states.

For example, rather than having 50 states independently regulate the safety and efficacy of pharmaceuticals, which would be quite costly, individual commonwealths, instead, defer to the FDA. In the case of the opioid epidemic, criticism has been directed at the FDA for the initial decision to approve prescription opioids; there was additional criticism for delaying to act after the addictive properties of these compounds became clear. The FDA has also been disparaged for failing to take action against drug manufacturers for the allegedly unethical and deceptive advertising that was used to market drugs.³⁸ In response to this, a 2017 Consensus Report released by the National Academies to address prescription opioid abuse recommended that the FDA adopt stricter policies regarding how opioids are advertised to the public and to prescribers.³⁹

Has the FDA failed in its fiduciary responsibility to the states by not providing the appropriate oversight required? Equally important is the question of whether the FDA is capable of making the right decisions to prevent the next looming epidemic, which has the potential to wreak similar havoc on the states. These are complex questions that cannot be answered in this commentary; however, they are critical questions, and answering them will require the balanced consideration of several important points, 3 of which will be highlighted below.

First, as part of the scientific process for drug approval, historically, the FDA has focused on efficacy and safety.³⁹ Addictive properties should certainly be considered part of a drug's safety profile before it reaches market, but it is unclear whether the FDA's approval process includes appropriate and durable mechanisms to account for the likelihood of patient addiction, particularly with such controlled substances as narcotics.⁴⁰ The FDA did not identify these significant addictive risks and associated sequelae prior to the release of each opioid drug to market.⁴¹

Second, as the alarming mortality rate rose, the devastation brought about by these drugs became clear, and the deceptive nature of opioid drug advertising by industry became more obvious.⁴² If the FDA becomes aware of drug advertising that is inconsistent with FDA-approved product labeling, it issues the drug manufacturer a written notice requesting that the material be withdrawn.³⁹ However, beyond that, drug advertisements are not required to receive preapproval from the FDA prior to the release of the promotional material to the public. To prevent the next epidemic, a serious conversation about the FDA approval process, as well as about postapproval drug monitoring and management, is critically needed. In fact, it has been suggested and outlined in the 2017 consensus statement of the National Academies.³⁹

Third, the FDA has been criticized for being “captured” by the very industry it is supposed to regulate—the pharmaceutical

industry—based on how the FDA receives its financial resources from industry and the perceived favors associated with relationships between FDA regulators and industry.⁴³ For example, news stories have documented how FDA employees who worked on opioid regulation accepted high-paying jobs with Purdue—the company at the epicenter of current lawsuits.⁴⁴ This raises the question of whether appropriate procedures and firewalls are in place to prevent the ethical compromises that can occur when the regulator is “captured” by industry. Since states rely on the federal government to perform these critical roles, it is important to assess whether that will prevent the next epidemic.

Because all prescription opioid pain medications are subject to Automation of Reports and Consolidated Orders System reporting by distributors, the Drug Enforcement Administration (DEA) has rich data on the flow of opioids to pharmacies across the country. As reports have shown, these medications were flowing to pharmacies that were facilitating their illegal use or flooding certain communities with significantly higher volumes of pain medications than could be justified based on the health needs of the patient populations in these communities.⁴⁵ Former senior administrators within the DEA argue that the agency had gathered thorough evidence documenting that certain opioid distributors were not in compliance with the Federal Controlled Substances Act,⁴⁶ allegedly turning a blind eye to knowledge that the drugs they were distributing were being used for illegal purposes, thus catalyzing opioid addiction across the United States.⁴⁷⁻⁴⁹

Can Professionals Be Trusted to Do the Right Thing?

Much of the criticism and blame for the opioid epidemic have been aimed at individuals and organizations that society generally holds in high regard as trusted professionals, tasked with protecting the health and welfare of patients and populations. For example, a New York State survey conducted by Siena College Research Institute in February 2018 demonstrated that most New Yorkers blame physicians for exacerbating the opioid epidemic by overprescribing opioid medications.⁵⁰ News stories and reports from ongoing legal disputes report that some high-profile physicians took money from the pharmaceutical industry in exchange for promoting the long-term safety of opioids; that safety claim has subsequently been proved false.⁵¹

Many physicians face a difficult decision when weighing the necessity of treating a patient’s pain symptoms with the possibility of addiction if the patient is prescribed an opioid. Many still believe, however, that physician organizations at both the community and the national levels have not done enough to slow down or stop the epidemic.^{49,52,53} Some argue that these organizations had the expertise to recognize the addiction, mortality, and morbidity that were occurring in their communities, yet they failed to recognize the issue and act in an organized, timely fashion.⁵⁴ This raises the

important question of whether we can trust professionals to identify and detect problems of this magnitude early on and act in the best interests of the health of the patients and the population at large.

Other trusted professional organizations that are afforded autonomy by the government and the healthcare industry have been denounced. Most notable is the Joint Commission on Accreditation of Healthcare Organizations (JCAHO). JCAHO accredits hospitals to ensure that they practice safe and high-quality medicine. JCAHO accreditation is required for hospitals and other healthcare facilities to receive reimbursement through the federal government’s Medicare and Medicaid health insurance programs. Thus, hospitals tend to respond quickly and completely when JCAHO implements standards or requirements. With respect to the opioid epidemic, JCAHO has been criticized for pushing pain as a “fifth vital sign,” allegedly based on research and reports about pain that were funded by the manufacturers of opioids.⁵⁵ Many, including state attorneys general, have argued that it was JCAHO’s focus on the need to measure, treat, and monitor pain, similar to measuring, treating, and monitoring hypertension, that created an excess demand for opioid medications that otherwise would not have been prescribed.^{56,57}

Why Haven’t States Invested in Better Data and Surveillance to Facilitate a More Rapid Response to Emerging Epidemics?

One federal entity that has been commended for its work on the opioid epidemic is the CDC. The CDC is credited with tracking and monitoring data regarding mortality due to opioid overdose, thus allowing the magnitude of the problem to be acknowledged and reported. The CDC also issued its first guidelines on prescribing opioids in 2016, making it clear that opioids are not typically indicated for long-term use associated with chronic pain that is not related to cancer or palliative, end-of-life care. The guidelines also stated that there were alternatives, such as non-narcotic pain medications or other non-drug-based therapies, that have been shown to be effective and associated with less risk.⁵⁸

The CDC monitors infectious disease outbreaks, working with state and local public health departments to monitor the same issues regionally. In this capacity, the CDC reports on and cautions about problems as they arise in communities, which could spread across the country. For example, the CDC’s Wide-ranging Online Data for Epidemiologic Research (WONDER) database has been used to track cause of death in communities and associate it with drug overdose and opioid overdose.⁵⁹ This data set is not perfect, as there are many challenges associated with obtaining accurate and comparable cause of death information from coroners’ offices across the United States. Nonetheless, the CDC’s efforts have shed light on the impact of the opioid epidemic.

Unfortunately, state-level data and surveillance systems vary significantly and are often not as accurate or useful for recognizing

the magnitude of a brewing epidemic or producing reliable, real-time estimates of the impact of an ongoing epidemic. As the articles in this supplemental issue illustrate, there are many reasons state data systems often do not connect the dots and provide actionable intelligence by linking, for example, data from a variety of sources, such as coroners' reports; criminal justice records; children, youth, and family services records; and health insurance claims data. Improved systems are possible by incorporating the concept of Integrated Data Systems, as described by the group Actionable Intelligence for Social Policy at the University of Pennsylvania.⁶⁰ As this group and others have documented, many important data points are often stored in silos, thus preventing linkage across different sectors of state and local governments and precluding a more holistic picture of the relationship between one social issue (eg, illegal drug prescription and use) and another (eg, an increased demand for foster care due to a higher prevalence of children with drug-addicted parents). Although the need for the privacy of confidential data and personal records is paramount, the societal benefits of states investing in integrated data systems are likely to be huge, and, in the case of the opioid epidemic, it may have resulted in an earlier, more effective response to the epidemic.

Is It Possible to Effectively Regulate the Conflicts of Interest in American Healthcare, Including the Drug Industry?

Relevant to the discussion of many of the issues above is the fact that healthcare in the United States is "big business," with many professionals, organizations, health systems, insurers, and product and service suppliers making significant profits. This includes the often-criticized pharmaceutical industry, including specific manufacturers and distributors directly involved in the opioid prescription business. Because in the United States we have accepted a multiparty health system with a significant profit motive, and the associated responsibility of regulating appropriate business and ethical behavior to ensure that patients and society are not exploited, it is important to determine whether the multilayered system we have created is meeting the needs of society in this regard. Given the ongoing legal cases alleging that the owners of privately held and publicly traded companies have made billions of dollars by peddling addictive prescription pain medications, the question is now more important to answer than ever before. Specifically, society should examine whether appropriate regulatory mechanisms are in place and whether the model of federalism in the United States is working to protect the health, safety, and well-being of its citizens.

Why Is Substance Abuse So Common? What Are the Underlying Factors?

Finally, the question that must be addressed is: What drives substance abuse and addiction? Although using government or regulatory

mechanisms to prevent or significantly curb the supply of addictive narcotics is certainly valuable, there is also value in preventing or reducing addiction at its core. This is a complex topic that involves expertise across many disciplines, including neurology, substance abuse and addiction, and social distress and economic inequalities. As highlighted in the recent work by Case and Deaton,⁶¹ which discusses the rise in the rate of "deaths of despair" in the United States, particularly among middle-aged white men—a group previously thought to be relatively privileged—the explanations are likely multifaceted, including social justice concerns, economic equality, and the current social stigmas associated with mental illness. Substance abuse and addiction existed long before the current opioid epidemic, but the destruction they wreak has never been as damaging and as costly as now. This, in turn, spurs the need to further commit to research to better understand the key drivers of addiction and what can be done to prevent future epidemics.

Conclusions

Much of the discussion about opioids has focused on very specific topics, including industry liability in a number of high-profile lawsuits. It is important to take a step back and think about this epidemic more broadly. At the forefront, we should not lose sight of the damage the epidemic has wrought on entire communities and on families who have lost loved ones or have struggled to help those addicted to prescription opioids.

Admittedly, although our commentary is heavy on questions and light on answers, we believe that the citizens of the United States deserve to have these questions asked. They are critical to learning from the existing epidemic and helping prevent the next one. We offer the questions in this commentary as a starting point, and we encourage Congress, the National Governors Association, and the National Academy of Medicine to prioritize and provide leadership and resources to appoint a qualified, unbiased panel of experts and citizens to pursue the answers. ■

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REFERENCES

1. Timeline of selected FDA activities and significant events addressing opioid misuse and abuse. FDA website. [fda.gov/drugs/information-drug-class/timeline-selected-fda-activities-and-significant-events-addressing-opioid-misuse-and-abuse](https://www.fda.gov/drugs/information-drug-class/timeline-selected-fda-activities-and-significant-events-addressing-opioid-misuse-and-abuse). Updated May 30, 2019. Accessed July 1, 2019.
2. Walsh SL, Babalonis S. The abuse potential of prescription opioids in humans—closing in on the first century of research. *Curr Top Behav Neurosci*. 2017;34:33-58. doi: 10.1007/7854_2016_448.
3. Fields HL, Margolis EB. Understanding opioid reward. *Trends Neurosci*. 2015;38(4):217-225. doi: 10.1016/j.tins.2015.01.002.
4. Holbeck M. The impact of the opioid epidemic and overcoming addiction. *S D Med*. 2017;70(10):437.
5. Salsitz EA. Chronic pain, chronic opioid addiction: a complex nexus. *J Med Toxicol*. 2016;12(1):54-57. doi: 10.1007/s13181-015-0521-9.
6. Shipton EA, Shipton EE, Shipton AJ. A review of the opioid epidemic: what do we do about it? *Pain Ther*. 2018;7(1):23-36. doi: 10.1007/s40122-018-0096-7.

7. Vowles KE, McEntee ML, Julnes PS, Frohe T, Ney JP, van der Goes DN. Rates of opioid misuse, abuse, and addiction in chronic pain: a systematic review and data synthesis. *Pain*. 2015;156(4):569-576. doi: 10.1097/01.j.pain.0000460357.01998.f1.
8. Webster LR. Risk factors for opioid-use disorder and overdose. *Anesth Analg*. 2017;125(5):1741-1748. doi: 10.1213/ANE.0000000000002496.
9. Kennedy-Hendricks A, Levin J, Stone E, McGinty EE, Gollust SE, Barry CL. News media reporting on medication treatment for opioid use disorder amid the opioid epidemic. *Health Aff (Millwood)*. 2019;38(4):643-651. doi: 10.1377/hlthaff.2018.05075.
10. Langabeer JR, Gourishankar A, Chambers KA, Giri S, Madu R, Champagne-Langabeer T. Disparities between US opioid overdose deaths and treatment capacity: a geospatial and descriptive analysis [published online March 4, 2019]. *J Addict Med*. doi: 10.1097/ADM.0000000000000523.
11. Kiang MV, Basu S, Chen J, Alexander MJ. Assessment of changes in the geographical distribution of opioid-related mortality across the United States by opioid type, 1999-2016. *JAMA Netw Open*. 2019;2(2):e190040. doi: 10.1001/jamanetworkopen.2019.0040.
12. Ruhm CJ. Drivers of the fatal drug epidemic. *J Health Econ*. 2019;64:25-42. doi: 10.1016/j.jhealeco.2019.01.001.
13. Salmund S, Allread V. A population health approach to America's opioid epidemic. *Orthop Nurs*. 2019;38(2):95-108. doi: 10.1097/NOR.0000000000000521.
14. Blanchard J, Weiss AJ, Barrett ML, McDermott KW, Hestlin KC. State variation in opioid treatment policies and opioid-related hospital readmissions. *BMC Health Serv Res*. 2018;18(1):971. doi: 10.1186/s12913-018-3703-8.
15. Leslie DL, Ba DM, Agbese E, Xing X, Liu G. The economic burden of the opioid epidemic on states: the case of Medicaid. *Am J Manag Care*. 2019;25:S243-S249.
16. Fassbender L, Zander GB, Levine RL. Beyond rescue, treatment, and prevention: understanding the broader impact of the opioid epidemic at the state level. *Am J Manag Care*. 2019;25:S239-S240.
17. Zajac G, Aveh Nur S, Kreager DA, Sterner G. Estimated costs to the Pennsylvania criminal justice system resulting from the opiate crisis. *Am J Manag Care*. 2019;25:S250-S255.
18. Crowley DM, Connell CM, Jones D, Donovan MW. Considering the child welfare system burden from opioid misuse: research priorities for estimating public costs. *Am J Manag Care*. 2019;25:S256-S263.
19. Morgan PL, Wang Y. The opioid epidemic, neonatal abstinence syndrome, and estimated costs for special education. *Am J Manag Care*. 2019;25:S264-269.
20. Segel JE, Shi Y, Moran JR, Scanlon DP. Opioid misuse, labor market outcomes, and means-tested public expenditures: a conceptual framework. *Am J Manag Care*. 2019;25:S270-S276.
21. Song Z. Mortality quadrupled among opioid-driven hospitalizations, notably within lower-income and disabled white populations. *Health Aff (Millwood)*. 2017;36(12):2054-2061. doi: 10.1377/hlthaff.2017.0689.
22. Peterson C, Xu L, Florence C, Mack KA. Opioid-related US hospital discharges by type, 1993-2016. *J Subst Abuse Treat*. 2019;103:9-13. doi: 10.1016/j.jsat.2019.05.003.
23. Roland CL, Ye X, Stevens V, Odera GM. The prevalence and cost of Medicare beneficiaries diagnosed and at risk for opioid abuse, dependence, and poisoning. *J Manag Care Spec Pharm*. 2019;25(1):18-27. doi: 10.18553/jmcp.2019.25.1.018.
24. Scholl L, Seth P, Kariisa M, Wilson N, Baldwin G. Drug and opioid-involved overdose deaths — United States, 2013-2017. *MMWR Morb Mortal Wkly Rep*. 2018;67(5152):1419-1427. doi: 10.15585/mmwr.mm675152e1.
25. Haight SC, Ko JY, Tong VT, Bohm MK, Callaghan WM. Opioid use disorder documented at delivery hospitalization — United States, 1999-2014. *MMWR Morb Mortal Wkly Rep*. 2018;67(31):845-849. doi: 10.15585/mmwr.mm6731a1.
26. The Council of Economic Advisors. The underestimated cost of the opioid crisis. Whitehouse.gov website. [whitehouse.gov/sites/whitehouse.gov/files/images/The%20Underestimated%20Cost%20of%20the%20Opioid%20Crisis.pdf](https://www.whitehouse.gov/sites/whitehouse.gov/files/images/The%20Underestimated%20Cost%20of%20the%20Opioid%20Crisis.pdf). Published November 2017. Accessed July 1, 2019.
27. Quast T, Bright MA, Delcher C. The relationship between foster care entries and high-dose opioid prescribing in California. *Addict Behav*. 2019;93:52-58. doi: 10.1016/j.addbeh.2019.01.015.
28. Milliren CE, Gupta M, Graham DA, Melvin P, Jorina M, Ozonoff A. Hospital variation in neonatal abstinence syndrome incidence, treatment modalities, resource use, and costs across pediatric hospitals in the United States, 2013 to 2016. *Hosp Pediatr*. 2018;8(1):15-20. doi: 10.1542/hpeds.2017-0077.
29. Hsu DJ, McCarthy EP, Stevens JP, Mukamal KJ. Hospitalizations, costs and outcomes associated with heroin and prescription opioid overdoses in the United States 2001-2012. *Addiction*. 2017;112(9):1558-1564. doi: 10.1111/add.13795.
30. Wiltz T. Drug-addiction epidemic creates crisis in foster care. PEW website. [pewtrusts.org/en/research-and-analysis/blogs/stateline/2016/10/07/drug-addiction-epidemic-creates-crisis-in-foster-care](https://www.pewtrusts.org/en/research-and-analysis/blogs/stateline/2016/10/07/drug-addiction-epidemic-creates-crisis-in-foster-care). Published October 7, 2016. Accessed July 1, 2019.
31. Gaughan PA, Opacich S. MDL 2804: National Prescription Opiate Litigation. United States District Court Northern District of Ohio website. ohnd.uscourts.gov/mdl-2804. Accessed July 1, 2019.
32. Bernstein L, Zezima K. Purdue Pharma, state of Oklahoma reach settlement in landmark opioid lawsuit. *The Washington Post* website. [washingtonpost.com/national/health-science/purdue-pharma-state-of-oklahoma-reach-settlement-in-landmark-opioid-lawsuit/2019/03/26/69aa5cda-4f11-11e9-a3f7-78b7525a8d5f_story.html?utm_term=.a06432df927f](https://www.washingtonpost.com/national/health-science/purdue-pharma-state-of-oklahoma-reach-settlement-in-landmark-opioid-lawsuit/2019/03/26/69aa5cda-4f11-11e9-a3f7-78b7525a8d5f_story.html?utm_term=.a06432df927f). Published March 26, 2019. Accessed July 1, 2019.
33. State of Oklahoma vs Purdue Pharma (Consent Judgment), Case No. CJ-2017-816; Judge Thad Balkman [cited June 24, 2019]; Oklahoma Attorney General website. oag.ok.gov/Websites/oag/images/Consent%20Judgement.pdf. Published March 26, 2019. Accessed July 8, 2019.
34. Gerszewski A. Attorney General Hunter announces historic \$270 million settlement with Purdue Pharma, \$200 million to establish endowment for OSU center for wellness. Mike Hunter Oklahoma Attorney General website. oag.ok.gov/attorney-general-hunter-announces-historic-270-million-settlement-with-purdue-pharma-200-million-to-establish-endowment-for-osu-center-for-wellness. Published March 26, 2019. Accessed July 1, 2019.
35. Gerszewski A. Attorney General Hunter announces settlement with Teva Pharmaceuticals. Mike Hunter Oklahoma Attorney General website. oag.ok.gov/attorney-general-hunter-announces-settlement-with-teva-pharmaceuticals. Published May 26, 2019. Accessed July 1, 2019.
36. Fortier J. This case will set a precedent: first major opioid trial opens in Oklahoma. National Public Radio website. [npr.org/2019/05/27/724093091/this-case-will-set-a-precedent-first-major-opioid-trial-to-begin-in-oklahoma](https://www.npr.org/2019/05/27/724093091/this-case-will-set-a-precedent-first-major-opioid-trial-to-begin-in-oklahoma). Published May 27, 2019. Accessed July 1, 2019.
37. Oklahoma and Johnson & Johnson face off in the first opioid crisis trial. CNBC website. [cnbc.com/2019/05/28/oklahoma-and-johnson-johnson-face-off-in-the-first-opioid-crisis-trial.html](https://www.cnbc.com/2019/05/28/oklahoma-and-johnson-johnson-face-off-in-the-first-opioid-crisis-trial.html). Published May 28, 2019. Accessed July 1, 2019.
38. Van Zee A. The promotion and marketing of OxyContin: commercial triumph, public health tragedy. *Am J Public Health*. 2009;99(2):221-227. doi: 10.2105/AJPH.2007.131714.
39. Bonnie RJ, Ford MA, Phillips JK, eds. *Opioid approval and monitoring by the U.S. Food and Drug Administration*. In: *Pain Management and the Opioid Epidemic: Balancing Societal and Individual Benefits and Risks of Prescription Opioid Use*. Washington, DC: The National Academies Press; 2017.
40. Meier B. Origins of an epidemic: Purdue Pharma knew its opioids were widely abused. New York Times website. [nytimes.com/2018/05/29/health/purdue-opioids-oxycotin.html](https://www.nytimes.com/2018/05/29/health/purdue-opioids-oxycotin.html). Published May 29, 2018. Accessed July 1, 2019.
41. Lopez G. I used to support legalizing all drugs. Then the opioid epidemic happened. America's worst drug crisis shows what can happen when a dangerous, addictive substance is made easily accessible. Vox website. [vox.com/policy-and-politics/2017/4/20/15328384/opioid-epidemic-drug-legalization](https://www.vox.com/policy-and-politics/2017/4/20/15328384/opioid-epidemic-drug-legalization). Updated September 12, 2017. Accessed July 1, 2019.
42. FDA warns Purdue Pharma over ads. Wired website. [wired.com/2003/01/fda-warns-purdue-pharma-over-ads/](https://www.wired.com/2003/01/fda-warns-purdue-pharma-over-ads/). Published January 22, 2003. Accessed July 1, 2019.
43. Sullivan M. FDA adviser: opioid approvals are controlled by Big Pharma. Fast Company website. [fastcompany.com/90296853/fda-advisor-opioid-approvals-are-controlled-by-big-pharma](https://www.fastcompany.com/90296853/fda-advisor-opioid-approvals-are-controlled-by-big-pharma). Published January 24, 2019. Accessed July 1, 2019.
44. Whitaker B. Did the FDA ignite the opioid epidemic? CBS News website. [cbsnews.com/news/opioid-epidemic-did-the-fda-ignite-the-crisis-60-minutes/](https://www.cbsnews.com/news/opioid-epidemic-did-the-fda-ignite-the-crisis-60-minutes/). Published February 24, 2019. Accessed July 1, 2019.
45. Raby J. Report: Distributors, DEA failed to abate US opioid crisis. Associated Press website. [apnews.com/d05052dcfb0f46468a2b5272473d7aa8](https://www.apnews.com/d05052dcfb0f46468a2b5272473d7aa8). Published December 20, 2018. Accessed July 1, 2019.
46. Gabay M. The Federal Controlled Substances Act: schedules and pharmacy registration. *Hosp Pharm*. 2013;48(6):473-474. doi: 10.1310/hpj4806-473.
47. Whitaker B. Ex-DEA agent: opioid crisis fueled by drug industry and congress. CBS News website. [cbsnews.com/news/ex-dea-agent-opioid-crisis-fueled-by-drug-industry-and-congress/](https://www.cbsnews.com/news/ex-dea-agent-opioid-crisis-fueled-by-drug-industry-and-congress/). Published October 15, 2017. Updated October 17, 2017. Accessed July 1, 2019.
48. Zezima K. Congressional report: Drug companies, DEA failed to stop flow of millions of opioid pills. *The Washington Post* website. [washingtonpost.com/national/congressional-report-drug-companies-dea-failed-to-stop-flow-of-millions-of-opioid-pills/2018/12/18/5bc750ee-0300-11e9-b6a9-0aa5c2fcc9e4_story.html?noredirect=on&utm_term=.bd1a96e91f1b](https://www.washingtonpost.com/national/congressional-report-drug-companies-dea-failed-to-stop-flow-of-millions-of-opioid-pills/2018/12/18/5bc750ee-0300-11e9-b6a9-0aa5c2fcc9e4_story.html?noredirect=on&utm_term=.bd1a96e91f1b). Published December 19, 2018. Accessed July 1, 2019.
49. Bernstein L, Higham S. 'We feel like our system was hijacked': DEA agents say a huge opioid case ended in a whimper. *The Washington Post* website. [washingtonpost.com/investigations/mcconnell-dea-opioids-fine/2017/12/14/ab50ad0e-d5b5-11e7-b1a8-62589434a581_story.html?utm_term=.2ac8917b045b](https://www.washingtonpost.com/investigations/mcconnell-dea-opioids-fine/2017/12/14/ab50ad0e-d5b5-11e7-b1a8-62589434a581_story.html?utm_term=.2ac8917b045b). Published December 17, 2017. Accessed July 1, 2019.
50. Siena College Research Institute. Most responsible for opioid abuse: MD's over-prescribing. Siena College Research Institute website. [siena.edu/2018/04/22/most-responsible-for-opioid-abuse-mds-over-prescribing/](https://www.siena.edu/2018/04/22/most-responsible-for-opioid-abuse-mds-over-prescribing/). Published April 22, 2018. Accessed July 1, 2019.
51. Avoid opioids for most long-term pain: advice from experts. Choosing Wisely website. [choosingwisely.org/wp-content/uploads/2018/03/Avoid-Opioids-For-Long-Term-Pain_8.5x11-Eng.pdf](https://www.choosingwisely.org/wp-content/uploads/2018/03/Avoid-Opioids-For-Long-Term-Pain_8.5x11-Eng.pdf). Published 2017. Accessed July 1, 2019.
52. Bump B. Are doctors to blame for opioid crisis? New Yorkers think so. *Times Union* website. [timesunion.com/local/article/Are-doctors-to-blame-for-opioid-crisis-New-12851255.php](https://www.timesunion.com/local/article/Are-doctors-to-blame-for-opioid-crisis-New-12851255.php). Accessed July 1, 2019.
53. Parker R. Specialists have big roles in combating the opioid crisis. American Association for Physician Leadership website. [physicianleaders.org/news/specialists-have-big-roles-combating-opioid-crisis](https://www.physicianleaders.org/news/specialists-have-big-roles-combating-opioid-crisis). Published July 23, 2018. Accessed July 1, 2019.
54. Hirsch R. The opioid epidemic: it's time to place blame where it belongs. *Mo Med*. 2017;114(2):82-90.
55. Baker DW. History of the Joint Commission's pain standards: lessons for today's prescription opioid epidemic. *JAMA*. 2017;317(11):1117-1118. doi: 10.1001/jama.2017.0935.
56. The opioid epidemic: what was the Joint Commission's role? *Physicians Weekly* website. [physiciansweekly.com/the-opioid-epidemic-what-was-the-joint-commissions-role/](https://www.physiciansweekly.com/the-opioid-epidemic-what-was-the-joint-commissions-role/). Published May 16, 2016. Accessed July 1, 2019.
57. Blau M. 'This is just the beginning': scope of opioid lawsuits widens to include hospital accreditor. STAT website. <https://www.statnews.com/2017/11/07/opioid-lawsuit-hospital-accreditor/>. Published November 7, 2017. Accessed July 1, 2019.
58. CDC reiterates limits of opioid prescribing guideline. PT in Motion website. [apta.org/PTinMotion/News/2019/04/10/CDCClarificationGuideline/](https://www.apta.org/PTinMotion/News/2019/04/10/CDCClarificationGuideline/). Published April 10, 2019. Accessed July 1, 2019.
59. Multiple Cause of Death 1999 - 2017. Centers for Disease Control and Prevention (CDC) WONDER website. wonder.cdc.gov/wonder/help/mcd.html#ICD-10%20Changes. Updated February 22, 2019. Accessed July 1, 2019.
60. Integrated Data Systems (IDS). Purpose of an IDS. Actionable Intelligence website. [aisp.upenn.edu/integrated-data-systems/](https://www.aisp.upenn.edu/integrated-data-systems/). Accessed July 1, 2019.
61. Case A, Deaton A. Mortality and morbidity in the 21st century. *Brookings Pap Econ Act*. Spring 2017;2017:397-476.

The Opioid Epidemic: The Cost of Services Versus the Costs of Despair

Alonzo L. Plough, PhD, MPH

The United States is in the midst of a serious opioid epidemic. Driven largely by an explosion of prescribed pain medications, opioid misuse has significantly increased in recent years. In fact, overdose-related deaths have quadrupled since 1999, according to the CDC.¹ As a result, the opioid epidemic now has the attention of nearly every sector of society that can play a role in addressing the problem, including law enforcement; local, state, and federal health departments; drug treatment programs; community groups; and healthcare delivery. Although healthcare providers are under particular pressure to improve assessment of the need for pain medication and the risk of addiction, it is clear that no single or simple solution to the current crisis exists.

Federal and State Measures to Combat Opioid Misuse

Congress has authorized appropriations totaling an estimated \$7.9 billion for programs to address the opioid epidemic in the United States, distributed among the CDC, Substance Abuse and Mental Health Services Administration, Office of the Secretary of HHS, Administration for Children and Families, and other agencies within HHS.²

Many states are now working intensively to limit supplies of prescription painkillers and illicit drugs, such as heroin and fentanyl. This encompasses enhanced law enforcement efforts to track drug trafficking and use shared data systems to identify where illicit opioids are being sold; this is often done in partnership with public health officials and local healthcare providers, who are frequently the first to see overdose spikes. States are also increasingly focused on tracking opioid prescriptions, educating prescribers about the risks of opioid-based medications, and identifying medical providers who overprescribe and patients who seek prescriptions from multiple sources. These efforts have involved the development of prescription drug monitoring programs (PDMPs), which feed prescriptions into state-maintained databases to identify overprescribers. In 2017 alone, states enacted 42 laws to strengthen PDMPs, according to a tally by the National Conference of State Legislatures.

“If we, as a nation, are to better understand the systemic nature of the opioid crisis, it is imperative that we study the place-based and other contextual factors that can improve prevention, treatment, and recovery, potentially reducing criminal justice and other downstream costs.”

At the same time, states are setting standards for how opioids are used to treat pain, in many cases building from the 2016 CDC guidelines for safe opioid prescribing.³ Twenty-three states now have laws that set guidelines or limits on how long opioid-based painkillers should be prescribed to patients, often with exceptions for certain medical care, such as cancer treatment or palliative care. Some states, including Oregon and Ohio, have also begun implementing policies to encourage the use of nonopioid treatments for pain, often through their Medicaid programs. In addition to controlling the supply of opioids, most states are actively bolstering their emergency response capacity to reduce the death toll from drug overdose. Much of this work has focused on increasing access to naloxone kits to revive overdose victims; kits are becoming available not only to emergency response personnel but also directly to members of the public in some cases. Several states are experimenting with over-the-counter distribution of naloxone or, as in Massachusetts, coprescribing naloxone kits to the family members of individuals who use opioid-based medication for chronic pain. Health officials in many states are also working to develop better opioid surveillance systems that will allow emergency responders to see where drug overdoses are happening in real time and deploy resources accordingly.

Finally, states are increasingly looking to expand access to medical treatment for those with substance use disorders, while working to overcome the stigma associated with addiction. This reflects, in part, a realization that addiction is a chronic disease,

like diabetes, that requires ongoing medical attention. The interest in treatment also comes out of an emerging body of evidence that medication-assisted therapies, including methadone and buprenorphine, can be very effective in controlling opioid addiction and helping people return to normal lives.

RWJF's Approach to the Opioid Epidemic

It is critical for states and communities to engage and align all actors to create systems that prevent new individuals from becoming dependent on opioids, while supporting the recovery of those who are already dependent. The structural and social determinants of health framework is widely understood to be critical in responding to public health challenges. Therefore, to help turn the tide of the opioid crisis, the Robert Wood Johnson Foundation (RWJF) is taking initial steps and encouraging others to adopt this framework. Some examples of a systems approach include RWJF's work with complex-care patients (including opioid-dependent patients), trauma-informed care, and healthcare access (Medicaid expansion).

RWJF is supporting activities that can enhance opioid-surveillance systems, and policy analyses to improve treatment through health insurance coverage. The foundation is also coordinating efforts with a number of private funders and federal agencies to ensure that we maximize resources to be most impactful. Most recently, we supported the Mayors Institute on Opioids developed by the National League of Cities, which included 6 mayors and their teams to discuss challenges and opportunities that have arisen along with the opioid epidemic in their communities. A report from Manatt Health ("Communities in Crisis: Local Responses to Behavioral Health Challenges") explores how cities and counties have launched local initiatives to address the human and economic impact of untreated serious mental illness and substance abuse disorder (SUD).⁴ The report provides detailed profiles of 13 local programs and a comprehensive taxonomy that categorizes program elements and features.

Finally, RWJF is supporting peer-to-peer learning among researchers who are studying the impact of Medicaid SUD 1115 waivers. As of March 2018, 19 states are using Section 1115 waivers to provide enhanced behavioral health services (mental health and/or SUD services) to targeted populations, expand Medicaid eligibility to additional populations with behavioral health needs, and/or fund delivery system reforms, such as the integration of physical and behavioral health services. RWJF is also a sponsor of and an active participant in the National Academy of Medicine's Action Collaborative on Countering the U.S. Opioid Epidemic.

Putting a Price on Cost

The articles in this special issue delve deeply into the question of the costs of the opioid epidemic to the nation, particularly at the state level.⁵⁻⁹ Each presents a methodologically solid analysis of estimated financial costs, while clearly recognizing that the challenges of cost analysis of a problem like opioids, which reverberates through a state and each of its localities in complex ways, is not fully captured by existing state-level data sets. For instance, state-level criminal justice cost data, in most cases, do not include city- and county-level criminal justice costs. Further, county jail costs, local-level costs for diversion programs, and locally funded treatment costs are not captured in state-level data. The costs of a parent incarcerated for opioid use to their children, who might be placed in foster care, are not included, and these costs include the emotional stress of the child (with life-course implications, economic and otherwise) and the direct cost of the foster care system. If we, as a nation, are to better understand the systemic nature of the opioid crisis, it is imperative that we study the place-based and other contextual factors that can improve prevention, treatment, and recovery, potentially reducing criminal justice and other downstream costs.

This special volume makes an important contribution, as the papers represent solid research using available data and studies. However, each paper points to the need for a deeper level of analysis that goes beyond documenting the financial impact of opioids and provides enhanced understanding for prevention and recovery. ■

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REFERENCES

1. Hedegaard H, Warner M, Miniño AM. Drug overdose deaths in the United States, 1999-2016. CDC website. [cdc.gov/nchs/products/databriefs/db294.htm](https://www.cdc.gov/nchs/products/databriefs/db294.htm). Updated December 21, 2017. Accessed June 8, 2019.
2. Watson E. Senate passes comprehensive opioids bill. CBS News website. [cbsnews.com/news/senate-passes-comprehensive-opioids-bill/](https://www.cbsnews.com/news/senate-passes-comprehensive-opioids-bill/). Published September 17, 2018. Accessed June 8, 2019.
3. Dowell D, Haegerich TM, Chou R. CDC guideline for prescribing opioids for chronic pain – United States, 2016 [published correction appears in *MMWR Recomm Rep*. 2016;65(11):295]. *MMWR Recomm Rep*. 2016;65(1):1-49. doi: 10.15585/mmwr.rr6501e1.
4. Robert Wood Johnson Foundation. Communities in crisis: local responses to behavioral health challenges. Manatt Health website. [manatt.com/Manatt/media/Media/PDF/White%20Papers/REL-Manatt-Communities-in-Crisis-10-26-FINAL.PDF](https://www.manatt.com/Manatt/media/Media/PDF/White%20Papers/REL-Manatt-Communities-in-Crisis-10-26-FINAL.PDF). Published October 2017. Accessed June 8, 2019.
5. Leslie DL, Ba DM, Agbese E, Xing X, Liu G. The economic burden of the opioid epidemic on states: the case of Medicaid. *Am J Manag Care*. 2019;25:S243-S249.
6. Zajac G, Aveh Nur S, Kreager DA, Sterner G. Estimated costs to the Pennsylvania criminal justice system resulting from the opiate crisis. *Am J Manag Care*. 2019;25:S250-S255.
7. Crowley DM, Connell CM, Jones D, Donovan MW. Considering the child welfare system burden from opioid misuse: research priorities for estimating public costs. *Am J Manag Care*. 2019;25:S256-S263.
8. Morgan PL, Wang Y. The opioid epidemic, neonatal abstinence syndrome, and estimated costs for special education. *Am J Manag Care*. 2019;25:S264-269.
9. Seget JE, Shi Y, Moran JR, Scanton DP. Opioid misuse, labor market outcomes, and means-tested public expenditures: a conceptual framework. *Am J Manag Care*. 2019;25:S270-S276.

Beyond Rescue, Treatment, and Prevention: Understanding the Broader Impact of the Opioid Epidemic at the State Level

Laura Fassbender, BPH; Gwendolyn B. Zander, Esq; and Rachel L. Levine, MD

In 2017, a total of 70,237 fatal drug overdoses occurred in the United States. This equates to about 175 individuals per day who are losing their lives as a result of drug overdoses.¹ Regrettably, the age-adjusted rate alone in the Commonwealth of Pennsylvania was more than double the national average, at 44.3 per 100,000 individuals (as compared with the national average of 21.7 deaths per 100,000 individuals).² Although the number of lives lost to this epidemic is colossal, the population impacted is even greater, and the burden is felt across many areas of society, specifically among children, the economy, government, and criminal justice and healthcare systems.

In response to the realities of the opioid epidemic, Pennsylvania Governor Tom Wolf signed a 90-day disaster declaration to bolster resources. The declaration has generated unprecedented collaboration and innovation among state agencies and stakeholders, with renewals every 90 days since the initial signing on January 10, 2018.³ A major success of this declaration has been the Opioid Command Center. The program consists of 17 state agencies who meet weekly to review opioid-related data to execute coordinated responses to the growing epidemic. Because the effects of the opioid crisis are not confined to one specific area, all state agencies have taken a hit. The state has initiated a 3-tiered approach focused on prevention, rescue, and treatment.³

Unfortunately, an increasing number of children continue to be affected and displaced due to their parents' opioid misuse.⁴ The consequences that the youth face from opioid abuse include poisoning or overdose, use in pregnancy, impaired parenting and attachment, material deprivation, and extended separation from parents. Often, these effects result in an increase in adverse childhood events and impose long-term negative health outcomes.⁵ In 2016, more than 2300 babies, whose births were paid for by Medicaid, were diagnosed with neonatal abstinence syndrome.³

In response, the Department of Human Services (DHS), Department of Health (DOH), Department of Drug and Alcohol Programs (DDAP), and community partners developed a guidance system for the arrangement of safe care that is required for infants who have been born substance-exposed, as defined by the Child Abuse Prevention and Treatment Act and Pennsylvania Act 54 of 2018.⁶ This guidance

“With more information about the extent of the opioid epidemic, states will be better prepared to address the challenges of the opioid epidemic and minimize the societal burden it has caused.”

was created to ensure that every substance-exposed baby born is provided with a plan of safe care prior to discharge from the hospital, and to ultimately minimize long-term health consequences.⁷

Similarly, a seamless process when discharging individuals with opioid use disorder (OUD) from the hospital to a treatment center is vital. This handoff is an essential step in recovering from addiction. Recognizing this importance, the DDAP requires county drug and alcohol agencies to set up organized procedures to facilitate this smooth transition process. The DOH and DHS have also worked to connect patients to treatment by developing OUD Centers of Excellence (COEs) and the Pennsylvania Coordinated Medication Assisted Treatment Program (PacMAT).

In 2017, more than 119,500 individuals enrolled in Pennsylvania's Medical Assistance program had an OUD diagnosis.³ In addition to providing OUD treatment services to these individuals, the DHS responded to this epidemic in multiple ways, as the cornerstone of their response to the opioid crisis has been the development and funding of 45 OUD COEs across the commonwealth. COEs have 3 stated goals: integrating and coordinating physical health care with behavioral health care to treat the whole person; engaging individuals across the continuum of care by using community-based care management teams; and increasing access to Medication Assisted Treatment (MAT). PacMAT is another effort to increase access to MAT. PacMAT functions through a hub-and-spoke model to ensure that patients in both rural and urban areas have access to the treatment and resources that they need. Through this collaborative model, Pennsylvania has widely increased the treatment capacity for OUD.

Although it is most natural to focus our response on rescue and treatment, it is important that public health prevention strategies

are leveraged to reduce the number of individuals who develop an addiction. A broader focus on prevention would minimize the need for rescue and treatment, ultimately mitigating the negative effects that the opioid epidemic imposes upon educational systems, criminal justice, economics, health care, and communities.

The overall cost of the crisis in Pennsylvania is still unknown, but it is important to recognize how multifaceted it is. Studies such as those contained within this publication⁸⁻¹² are necessary to monetize the crisis and consider how prevention efforts focused on the social determinants of health would slow the epidemic. With more information about the extent of the opioid epidemic, states will be better prepared to address the challenges of the opioid epidemic and minimize the societal burden it has caused. ■

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REFERENCES

1. Mitchell J. With 175 Americans dying a day, what are the solutions to the opioid epidemic? *Clarion Ledger* website. clarionledger.com/story/news/2018/01/26/opioid-epidemic-solutions-naloxone-overprescribing-overdose-deaths/964288001/. Published January 26, 2018. Accessed May 7, 2019.
2. Drug overdose deaths. CDC website. cdc.gov/drugoverdose/data/statedeaths.html. Updated December 19, 2018. Accessed May 7, 2019.
3. Pennsylvania opioid data dashboard. Open Data PA website. data.pa.gov/stories/s/9q45-nckt/. Accessed May 7, 2019.
4. Charumilind S, Latkovic T, Razili L, Mendez-Escobar E. Why we need bolder action to combat the opioid epidemic. McKinsey & Company website. healthcare.mckinsey.com/sites/default/files/Why-we-need-bolder-action-to-combat-the-opioid-epidemic.pdf. Published September 2018. Accessed May 7, 2019.
5. Fittl MA, Miller AM, Wilkinson RH, et al. Educational disabilities among children born with neonatal abstinence syndrome. *Pediatrics*. 2018;142(3). pii: e20180562. doi: 10.1542/peds.2018-0562.
6. 2018 Act 54. Pennsylvania General Assembly website. legis.state.pa.us/cfdocs/legis/li/uconsCheck.cfm?yr=2018&sessInd=0&act=54. Accessed May 7, 2019.
7. Pennsylvania Department of Health; Pennsylvania Department of Drug and Alcohol Programs; Pennsylvania Department of Human Services. Pennsylvania plan of safe care guidance. Pennsylvania Department of Human Services website. keepkidssafe.pa.gov/cs/groups/webcontent/documents/document/c_287154.pdf. Published March 2019. Accessed May 7, 2019.
8. Leslie DL, Ba DM, Agbese E, Xing X, Liu G. The economic burden of the opioid epidemic on states: the case of Medicaid. *Am J Manag Care*. 2019;25:S243-S249.
9. Zajac G, Aveh Nur S, Kreager DA, Sterner G. Estimated costs to the Pennsylvania criminal justice system resulting from the opiate crisis. *Am J Manag Care*. 2019;25:S250-S255.
10. Crowley DM, Connell CM, Jones D, Donovan MW. Considering the child welfare system burden from opioid misuse: research priorities for estimating public costs. *Am J Manag Care*. 2019;25:S256-S263.
11. Morgan PL, Wang Y. The opioid epidemic, neonatal abstinence syndrome, and estimated costs for special education. *Am J Manag Care*. 2019;25:S264-269.
12. Segel JE, Segel JE, Shi Y, Moran JR, Scanlon DP. Opioid misuse, labor market outcomes, and mean-tested public expenditures: a conceptual framework. *Am J Manag Care*. 2019;25:S270-S276.

The Cost of the Opioid Epidemic, In Context

Sarah Kawasaki, MD, and Joshua M. Sharfstein, MD

Research studies that place a price tag on the opioid epidemic complement news stories that reveal the human face of the crisis.¹ The direct costs to the healthcare, criminal justice, foster care, and educational systems are substantial, and yet they still represent only a part of the vast economic damage caused by the loss of tens of thousands of people in the prime of their lives every year. The articles in this supplement to the *American Journal of Managed Care*[®] contribute significantly to understanding the epidemic's impact on society, and they provide additional justification for major investments in solutions.

At the same time, economic analyses require context—specifically, the context of evidence about what works to help people with opioid use disorder. Context permits an understanding not only of economic costs, but also of where these costs are inevitable and where they are not.

For example, Zajac et al find enormous expenditures related to the opioid epidemic in the criminal justice system, including the cost of incarcerating many thousands of Pennsylvania residents.² The study is particularly striking in the context of a growing recognition that traditional law enforcement approaches to drugs may not be necessary and may even be counterproductive. A consensus committee of the National Research Council found in 2014 that “there is little evidence that enforcement efforts have been successful” in reducing the consumption of illicit drugs.³ States that make greater use of prison for drug crimes, according to the Pew Charitable Trusts, do not have less drug use or fewer overdose deaths.⁴ Arrest in and of itself often triggers withdrawal, which can be fatal without medical attention.⁵ There is very little use of medications for opioid use disorder in detention,⁶ and the loss of tolerance in detention is associated with very high rates of fatal overdose upon release.⁷ A criminal conviction may reduce access to jobs and housing, both often critical to an individual's recovery.⁸ Beyond simply documenting the costs of the opioid epidemic to the criminal justice system, the research by Zajac et al supports the pursuit of alternative approaches to incarceration that are associated with less expense and improved outcomes.⁹

Crowley et al identify the burden of opioid use disorder on the foster care system and make important recommendations for

“The direct costs to the healthcare, criminal justice, foster care, and educational systems are substantial, and yet they still represent only a part of the vast economic damage caused by the loss of tens of thousands of people in the prime of their lives every year.”

ongoing surveillance.¹⁰ However, also deserving of examination in this context are mitigation strategies that have been demonstrated to improve outcomes and reduce costs to the foster care system. The use of the opioid agonists methadone and buprenorphine for ongoing treatment has been associated with reductions in fatal overdoses of 50% or more,¹¹ more employment,¹² less criminal behavior,¹³ and decreased transmission of chronic infectious diseases such as HIV and hepatitis C.¹⁴ Some foster care systems discourage parents from receiving treatment with medications, or even use treatment as the basis of child removal.¹⁵ Yet fewer adverse outcomes for families and child welfare systems arise when parents receive this effective care.¹⁶ Tracking adoption of treatment with medications in child welfare programs can help drive understanding of smarter policy directions and their associated costs.

Leslie et al find major and rising health costs associated with addiction in the Medicaid program.¹⁷ The paper's most striking finding is the tiny increase in the expense of treatment for people with substance use disorder between 2006 and 2013. Rather, costs have increased as the result of medical illnesses associated with or neglected due to the disease of addiction. Placing the data in context helps clarify that these dual findings are no coincidence. For instance, effective treatment reduces endocarditis and HIV risk¹⁸ and is associated with lower healthcare costs.¹⁹ The study by Leslie et al lends support to Medicaid expansion, the integration of addiction treatment into mainstream healthcare, and rapid access to pharmacotherapy for opioid use disorder, especially for those at high risk for major complications.

Segel et al illustrate the enormous economic impact of the opioid epidemic on the labor market, including both lower income and

greater use of means-tested state and federal programs.²⁰ A critical piece of context for this study is what happens when workers are found to be misusing opioids: Are they fired, triggering the economic effects, or are they offered treatment, which may allow them to remain gainfully employed? Employer-based insurance has historically provided inadequate coverage for addiction treatment; the United States Surgeon General reported on a 2013 analysis which indicated that only 7% of privately insured individuals with substance use disorders received treatment from a specialty addiction provider.²¹ A better approach is for employers to offer coverage that provides parity with mental and medical illnesses and allows for the reimbursement of outpatient medical, pharmacologic, and counseling treatment services that may be minimally disruptive to employment obligations.

Morgan and Yang find substantial expenditures associated with increases in neonatal abstinence syndrome, which is the transient and treatable withdrawal period experienced by many newborns exposed in utero to opioids.²² Beyond the costs of hospitalization, major expenses that are associated with infants who have experienced neonatal abstinence syndrome include special education and services that address developmental delay. A key piece of context is the question of causality: What is responsible for these developmental impacts? It is not the transient withdrawal period itself. The authors note that that neonatal abstinence syndrome may either “be a marker for the neurobiological effects of opioid exposure” or reflects “the social impacts of...addiction and substance misuse more generally.” If the former, and the die is cast by the moment of birth, then women might be advised not to take opioid agonist treatments during pregnancy; if the latter, such treatment might be essential to avoid child harm both before and after pregnancy. Recently, the Substance Abuse and Mental Health Services Administration found that the medications “methadone and buprenorphine are not associated with birth defects and have minimal long-term developmental impact on infants.”²³ Their use during pregnancy is recommended by the American College of Obstetricians and Gynecologists²⁴ and the American Academy of Pediatrics.²⁵ Offering effective treatment, as well as providing other support and resources to stabilize the home environment, are likely to be critical steps to reducing these costs.

The economic costs documented in this supplement to the *American Journal of Managed Care*[®] reflect not only the scale of the epidemic but also the legacy of counterproductive policy. The articles provide more than an accounting of damages; they also quantify society’s failure to provide alternatives to incarceration, more comprehensive insurance coverage, greater access to effective treatment, and more resources and social support for affected families. Overcoming the stigma of addiction (as well as the stigma attached to certain types of treatment) is critical to improvement.

As states like Pennsylvania take steps forward, economic evaluation will remain a critical tool to measure and support progress. ■

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REFERENCES

1. Armstrong D. 52 weeks, 52 faces: obituaries narrate lives lost to the opioid epidemic. *Stat* website. statnews.com/feature/opioid-epidemic/obituaries/. Published December 20, 2016. Accessed May 18, 2019.
2. Zajac G, Aveh Nur S, Kreager DA, Sterner G. Estimated costs to the Pennsylvania criminal justice system resulting from the opiate crisis. *Am J Manag Care*. 2019;25:S250-S255.
3. National Research Council of the National Academies. *The Growth of Incarceration in the United States: Exploring Causes and Consequences*. Washington, DC: The National Academies Press; 2014.
4. Gelb A, Stevenson P, Fifield A, et al. More imprisonment does not reduce state drug problems. The Pew Charitable Trusts website. pewtrusts.org/-/media/assets/2018/03/pssp_more_imprisonment_does_not_reduce_state_drug_problems.pdf. Published March 2018. Accessed May 18, 2019.
5. Lurie J. Go to jail, die from drug withdrawal. welcome to the criminal justice system. *Mother Jones* website. motherjones.com/politics/2017/02/opioid-withdrawal-jail-deaths/. Published February 5, 2017. Accessed May 18, 2019.
6. Krawczyk N, Picher CE, Feder KA, Saloner B. Only one in twenty justice-referred adults in specialty treatment for opioid use receive methadone or buprenorphine. *Health Aff (Millwood)*. 2017;36(12):2046-2053. doi: 10.1377/hlthaff.2017.0890.
7. Binswanger IA, Stern MF, Deyo RA, et al. Release from prison – a high risk of death for former inmates [published correction appears in *N Engl J Med*. 2007;356(5):536]. *N Engl J Med*. 2007;356(2):157-165. doi: 10.1056/NEJMs064115.
8. Alexander M. *The New Jim Crow: Mass Incarceration in the Age of Colorblindness*. New York, NY: The New Press; 2010.
9. Brinkley-Rubinstein L, Zaller N, Martino S, et al. Criminal justice continuum for opioid users at risk of overdose. *Addict Behav*. 2018;86:104-110. doi: 10.1016/j.addbeh.2018.02.024.
10. Crowley DM, Connell CM, Jones D, Donovan MW. Considering the child welfare system burden from opioid misuse: research priorities for estimating public costs. *Am J Manag Care*. 2019;25:S256-S263.
11. Sordo L, Barrio G, Bravo MJ, et al. Mortality risk during and after opioid substitution treatment: systematic review and meta-analysis of cohort studies. *BMJ*. 2017;357:j1550. doi: 10.1136/bmj.j1550.
12. Hsiao CY, Chen KC, Lee LT, et al. The reductions in monetary cost and gains in productivity with methadone maintenance treatment: one year follow-up. *Psychiatry Res*. 2015;225(3):673-679. doi: 10.1016/j.psychres.2014.11.023.
13. Rastegar DA, Sharfstein Kawasaki S, King VL, Harris EE, Brooner RK. Criminal charges prior to and after enrollment in opioid agonist treatment: a comparison of methadone maintenance and office-based buprenorphine. *Subst Use Misuse*. 2016;51(7):803-811. doi: 10.3109/10826084.2016.1155608.
14. Tsui JI, Evans JL, Lum PJ, Hahn JA, Page K. Association of opioid agonist therapy with lower incidence of hepatitis C virus infection in young adult injection drug users. *JAMA Intern Med*. 2014;174(12):1974-1981. doi: 10.1001/jamainternmed.2014.5416.
15. Gotbaum R. In New Hampshire, even mothers in treatment for opioids struggle to keep children. Kaiser Health News website. khn.org/news/in-new-hampshire-even-mothers-in-treatment-for-opioids-struggle-to-keep-children/. Published June 15, 2018. Accessed May 19, 2019.
16. Hall MT, Wilfong J, Huebner RA, Posze L, Willauer T. Medication-assisted treatment improves child permanency outcomes for opioid-using families in the child welfare system. *J Subst Abuse Treat*. 2016;71:63-67. doi: 10.1016/j.jsat.2016.09.006.
17. Leslie DL, Ba DM, Agbese E, Xing X, Liu G. The economic burden of the opioid epidemic on states: the case of Medicaid. *Am J Manag Care*. 2019;25:S243-S249.
18. MacArthur GJ, Minozzi S, Martin N, et al. Opiate substitution treatment and HIV transmission in people who inject drugs: systematic review and meta-analysis. *BMJ*. 2012;345:e5945. doi: 10.1136/bmj.e5945.
19. Murphy SM, Polsky D. Economic evaluations of opioid use disorder interventions. *Pharmacoeconomics*. 2016;34(9):863-887. doi: 10.1007/s40273-016-0400-5.
20. Segel JE, Shi Y, Moran JR, Scanlon DP. Opioid misuse, labor market outcomes, and means-tested public expenditures: a conceptual framework. *Am J Manag Care*. 2019;25:S270-S276.
21. HHS. Facing addiction in America: the Surgeon General’s report on alcohol, drugs, and health. Office of the Surgeon General website. Published November 2016. Accessed June 14, 2019.
22. Morgan PL, Wang Y. The opioid epidemic, neonatal abstinence syndrome, and estimated costs for special education. *Am J Manag Care*. 2019;25:S264-269.
23. Substance Abuse and Mental Health Services Administration (SAMHSA). TIP 63: medications for opioid use disorder. SAMHSA website. Published 2018. Accessed June 14, 2019.
24. Opioid use and opioid use disorder in pregnancy: ACOG Committee Opinion. American College of Obstetricians and Gynecologists website. acog.org/Clinical-Guidance-and-Publications/Committee-Opinions/Committee-on-Obstetric-Practice/Opioid-Use-and-Opioid-Use-Disorder-in-Pregnancy?isMobileSet=false. Published August 2017. Accessed May 18, 2019.
25. Patrick SW, Schiff DM; Committee on Substance Use and Prevention. A public health response to opioid use in pregnancy. *Pediatrics*. 2017;139(3). pii: e20164070. doi: 10.1542/peds.2016-4070.

The Economic Burden of the Opioid Epidemic on States: The Case of Medicaid

Douglas L. Leslie, PhD; Djibril M. Ba, MPH; Edeanya Agbese, MPH; Xueyi Xing, PhD; and Guodong Liu, PhD

Overview

The opioid epidemic is a public health crisis that affects all levels of society. As the prevalence of opioid use disorder increases, the associated costs also rise. In this study, we focus on the costs to state Medicaid programs as they pertain to the opioid epidemic.

We used data from the Medicaid Analytical eXtract (MAX) files from 17 states that had complete data from 1999 to 2013 to examine the costs to state Medicaid programs associated with opioid use disorder (OUD). We included inpatient, outpatient, and prescription medication costs related to the treatment of OUD, as well as excess costs for other healthcare services (eg, general medical care) for individuals with OUD relative to a comparison group matched on age, gender, and state. We examined the changes that occurred over the study period in Medicaid enrollees with OUD and the total costs to Medicaid for these individuals. Finally, we extrapolated our results from the 17 states in the sample to the entire United States Medicaid population. All costs were adjusted for inflation and are reported in 2017 US dollars:

- Although several studies have examined healthcare costs that are attributable to OUD, few have explicitly taken the perspective of state Medicaid. Results from previous studies indicate that the total state Medicaid spending on substance use disorder services, the medications used to treat OUD, and the treatment of newborns with prenatal exposure to opioids is considerable.
- In our 17-state sample, the total Medicaid costs associated with OUD have more than tripled between 1999 and 2013, reaching more than \$3 billion in 2013. After extrapolating these results to all 50 states, state Medicaid costs associated with the opioid epidemic totaled more than \$8.4 billion in 2013.
- Although the cost of OUD treatment increased over time, most of the growth was driven by the rise in costs for other healthcare services. By 2013, costs for other healthcare services comprised 70.1% of total Medicaid costs associated with OUD, compared with 52.4% in 1999.
- Further research is needed to determine what factors have contributed to the increase in state health insurance costs that are attributed to OUD.

ABSTRACT

The societal burden of opioid use disorder (OUD) is considerable and contributes to increased healthcare costs and overdose deaths. However, the burden is not well understood. The purpose of this analysis is to estimate the state Medicaid programs' costs for treating OUD and how these costs have changed over time. We used data from the Medicaid Analytic eXtract files from 17 states between 1999 and 2013 to examine the healthcare costs associated with OUD. Inpatient, outpatient, and prescription medication costs related to the treatment of OUD were included, as were excess costs for other healthcare services (eg, general medical care) for individuals with OUD relative to a comparison group of individuals without OUD matched on age, sex, and state. We then extrapolated our results to the entire US Medicaid population using population-based sample weights. All costs were adjusted for inflation and are reported in 2017 US dollars. During our study period, the number of patients who were diagnosed with OUD increased 378%, from 39,109 (0.21% of total Medicaid enrollment) in 1999 to 186,979 (0.60% of total Medicaid enrollment) in 2013 in our 17-state sample. Even after adjusting for inflation, total Medicaid costs associated with OUD more than tripled during this time, reaching more than \$3 billion in 2013, from \$919 million in 1999. Most of this growth was due to excess non-OUD treatment costs for patients with OUD, which increased 363% over the period; the rate of growth is triple the expenditures for OUD treatment services. When the results were extrapolated to the entire United States, the Medicaid costs associated with OUD increased from more than \$2 billion in 1999 to more than \$8 billion in 2013. The total cumulative costs that were associated with OUD for this extrapolated 50-state sample over a 15-year time period amounts to more than \$72.4 billion. OUD imposes considerable financial burden on state Medicaid programs, and the burden is increasing over time.

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For author information and disclosures, see end of text.

Summary Of Background Prevalence and Economic Impact of Opioid Use Disorder

OUD affects 2.5 million Americans¹ and is prevalent across all age groups and backgrounds. It has contributed to increasing injection drug use as well as the spread of infectious diseases, such as HIV and hepatitis C.²⁻⁴ The growth of OUD has resulted in increases of healthcare costs and of opioid overdose deaths.⁵ Estimates of overall societal costs (ie, healthcare, criminal justice, and workplace costs) associated with OUD have risen from \$11.8 billion in 2001,⁶ to \$55.7 billion in 2007,⁷ and \$78.5 billion in 2016.⁸

Individuals with OUD are more likely than those without OUD to use medical services, such as physician outpatient visits, emergency department (ED) services, and inpatient hospital stays.⁹ They also have a higher prevalence of comorbid conditions, such as other substance use disorders, psychiatric disorders, and pain-related diagnoses.¹⁰ Hospitalization rates for patients with OUD have more than doubled, from 117 admissions per 100,000 in 1993 to 296 admissions per 100,000 in 2012.¹¹ The Agency for Healthcare Research and Quality estimates that OUD-related ED visits have grown at a rate of 8% per year since 2005,¹² while the rate of overdose deaths involving opioids increased 200% between 2000 and 2014.¹³ Undiagnosed OUD is also expensive, with estimated costs equal to 80% of the costs of diagnosed OUD.¹⁴

Medicaid beneficiaries are at a greater risk for substance use disorders, including OUD,¹⁰ with approximately 12% of beneficiaries aged between 18 and 64 years diagnosed.¹⁵ Medicaid beneficiaries also have 50% to 100% higher rates of mental and substance use disorders compared with the general population.¹⁶ These rates exceed those of other insurance groups.¹⁶ A Kentucky study found that 60% of Medicaid recipients with chronic pain both used illicit drugs and misused prescription drugs.¹⁷ In addition, Medicaid pays an estimated mean cost of \$18,511 per OUD-related ED visit.¹⁸ Because Medicaid also pays for one-fourth to one-third of all OUD treatment episodes,^{19,20} costs are a critically important component of the current opioid crisis in the United States.

Cost of Medication-Assisted Treatment for Opioid Use Disorder

Treatment options for OUD include medication and counseling. Medication-assisted treatment, a combination of medications and counseling, is associated with fewer relapses than medication alone.^{21,22} Medications used to treat OUD include methadone, buprenorphine, and naltrexone (the long-acting injectable form of naltrexone, Vivitrol, is most common). Buprenorphine, an opioid agonist, is associated with a high cost and limited prescribing capacity.²³ Wen et al examined whether the Medicaid expansion of 2014 and the increased prescribing capacity affected buprenorphine use that is covered by Medicaid. The authors found that the

expansion was associated with a 70% increase in Medicaid-covered buprenorphine prescriptions and a 50% increase in buprenorphine spending.²³ Additionally, although the expansion greatly improved access to OUD medication therapy, it also increased Medicaid expenditures for OUD treatments.²³

Almost one-third of patients who receive treatments for substance use disorder are covered by Medicaid.²⁴ Medicaid expenditures related to substance use disorders rose from 9% of the total spending on substance use disorders in 1986 to 21% in 2009.²⁵ In 2009 alone, Medicaid accounted for 21% of the \$24 billion that health insurers spent treating substance use disorders,²⁵ although this amounted to slightly less than 1% of total Medicaid spending.²⁶ Between 2011 and 2016, Medicaid spending on buprenorphine, naltrexone, and naloxone (a medication that blocks the effects of opioids and is used in overdose situations) increased 136%, from \$394.2 million to \$929.9 million.²⁷ An estimated 14.6% of people with OUD received medication therapy in 2014.²⁸ With the annual excess healthcare costs for individuals with OUD ranging from \$5874 to \$15,183,⁹ the already high costs of treating individuals with OUD will likely continue to grow, and the burden on Medicaid will likely continue to increase.

Pregnancy, Delivery, Maternal, and Child Outcomes Related to Opioid Use

Prenatal exposure to opioids also poses physiological risks and complications for newborns, such as cleft lip and palate, low birth weight, preterm labor, placental abruption, and neurological problems.^{29,30} Infants exposed to opiates prenatally have a 50% to 80% chance of developing neonatal withdrawal,³¹⁻³³ known as neonatal abstinence syndrome (NAS). The opioid epidemic has caused NAS to become a public health challenge, with a 5-fold increase in the incidence of NAS between 2000 and 2012.³⁴⁻³⁷ This increase in incidence accounts for an estimated \$1.5 billion in annual hospital expenditures across the United States.^{34,37} Although state Medicaid programs provide 78% of medical coverage for pregnant women³⁴⁻³⁶ and 77.6% of NAS costs are attributed to state Medicaid programs,³⁸ we do not examine these costs in this paper, but instead leave them for other companion articles in this special issue (see pages S264 and S270).^{39,40}

Based on this literature, it is clear that state Medicaid programs bear a particularly large economic burden of the opioid epidemic. In 2015, Medicaid covered 3 of 10 people with OUD.⁵ With a higher rate of mental and substance use disorders, the Medicaid population is more vulnerable to OUD. The magnitude of this burden and how it has changed over time, however, has not been well documented. The objective of this study was to use data from the Medicaid programs in multiple states over several years to document the economic burden of OUD on state Medicaid programs nationally.

Conceptual Framework

Based on the literature and the various components that make up OUD expenditures, we developed the following framework to describe how OUD could drive up state Medicaid expenditures. Although some states may have other programs that provide treatment for OUD, the current study focuses only on state Medicaid programs. As illustrated in **Figure 1**, patients with pain conditions may begin using prescribed opioid medications. As patients continue using their medications, they may become addicted and switch to heroin as access to additional opioid pain medications becomes more difficult; their medications may be intentionally or unintentionally diverted to other people. All of these paths end with a diagnosis of OUD. Often, treatment for individuals with OUD is initiated in the ED and leads to further healthcare service use that is reimbursed by health insurance. In the conceptual model, insurance-covered treatments for OUD consist of inpatient services (eg, hospitalizations and residential rehabilitation services), outpatient services (eg, counseling services), and prescription medications (ie, methadone, buprenorphine, and naltrexone). Because the perspective of the cost analysis is that of the state, we include only state expenditures and do not include patient out-of-pocket payments.

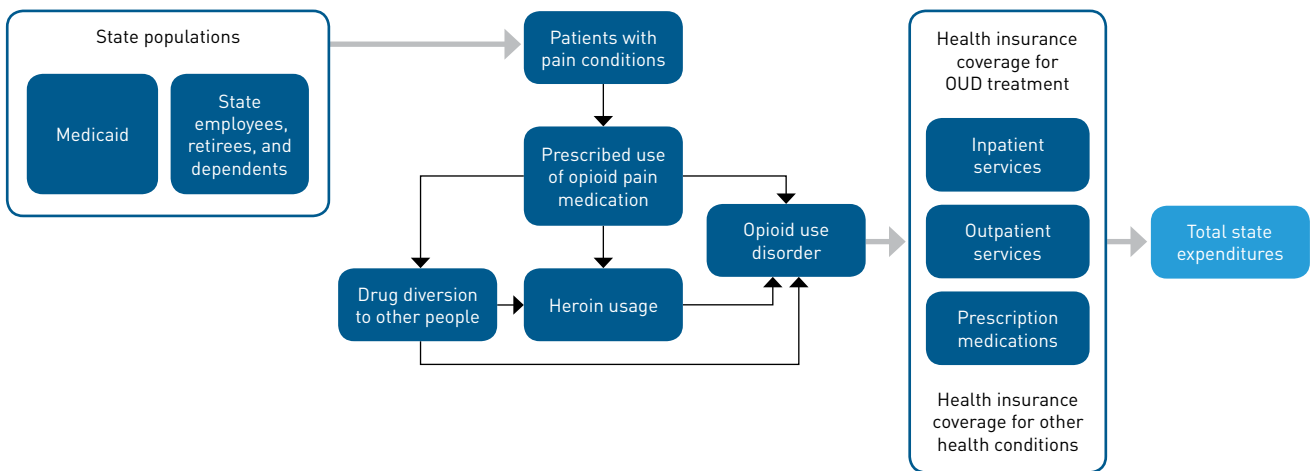
Below, we estimate the costs to state Medicaid programs, which provide the bulk of care for OUD, that are attributable to the opioid epidemic. Expenditures associated with OUD have 2 components. First, we identify all inpatient, outpatient, and prescription medication services that have an associated diagnosis code or Food and Drug Administration indication corresponding to OUD. Then, we add the Medicaid expenditures for these services to derive the total cost of OUD treatment to the state Medicaid program. Because

individuals with OUD may be more likely to have other health problems, such as infections, injuries/accidents, and poor control of chronic conditions (eg, diabetes or hypertension), we also compare the total Medicaid healthcare expenditures for individuals with OUD with an age-, sex-, and state-matched comparison group of patients who do not have a diagnosis of OUD. This approach allows us to capture both the expenditures directly related to OUD treatment and the expenditures associated with other poor health outcomes that may be related to OUD.

Gross Cost Estimates

For this analysis, we used data from MAX files, which is a set of person-level data files with information on Medicaid eligibility, service utilization, and payments that was developed by Centers for Medicare and Medicaid Services (CMS) to support research and policy analysis about Medicaid populations. The claims data contain both fee-for-service and Medicaid managed care claims. Managed care contracts have become increasingly common in Medicaid, and managed care encounter claims have been shown to be complete and of comparable quality with fee-for-service claims.⁴¹ Until recently, information about treatments for substance use disorders was not available from Medicaid databases after the redaction of such claims under federal law.⁴² When this rule was changed in 2017, it allowed CMS to include substance use disorder claims in MAX data for every year.^{43,44} MAX data are available through the Pennsylvania State University Virtual Research Data Center. Seventeen states (California, Georgia, Idaho, Iowa, Louisiana, Michigan, Minnesota, Mississippi, Missouri, New Jersey, Pennsylvania, South Dakota, Tennessee, Utah, Vermont, West Virginia, and Wyoming) had complete MAX data from 1999 to 2013 that were available for the analysis.

FIGURE 1. Conceptual Framework for Paths That Lead to OUD Expenditures



OUD indicates opioid use disorder.

The analytic sample included individuals with a diagnosis of OUD. Following previous studies,⁴⁵ we used a broad definition of OUD that included any inpatient or outpatient visit with a diagnosis of opioid (prescription pain medications or heroin) abuse, dependence, poisoning, or adverse effects (*International Classification of Diseases, Ninth Revision* codes 304.0, 304.7, 305.5, 965.0, E850.0-E850.2, E935.0-E935.2) but excluded self-inflicted poisoning (E950.0-E950.5) and assault by poisoning (E962.0). We also identified a comparison group of individuals without a diagnosis of OUD, matched 1-to-1 with the OUD sample by state, age, and sex.

For both the OUD and comparison cohorts, Medicaid expenditures were computed per individual per year by adding the “Medicaid payment amount” variable across all claims (inpatient, long-term care, outpatient, and prescription drug) during the year. The “Medicaid payment amount” indicates the total amount of money paid by Medicaid for the service. Medicaid expenditures for OUD treatment were computed by adding 1) the Medicaid payment amount across all claims (inpatient, long-term care, and outpatient) that had an associated diagnosis code of OUD, and 2) prescription drug claims for medications used to treat OUD (methadone, buprenorphine, and long-acting injectable naltrexone). Some managed care claims for OUD rehabilitation services were set to zero because Medicaid managed care plans are paid a capitated amount per enrollee rather than per service provided, as in a fee-for-service plan. We replaced

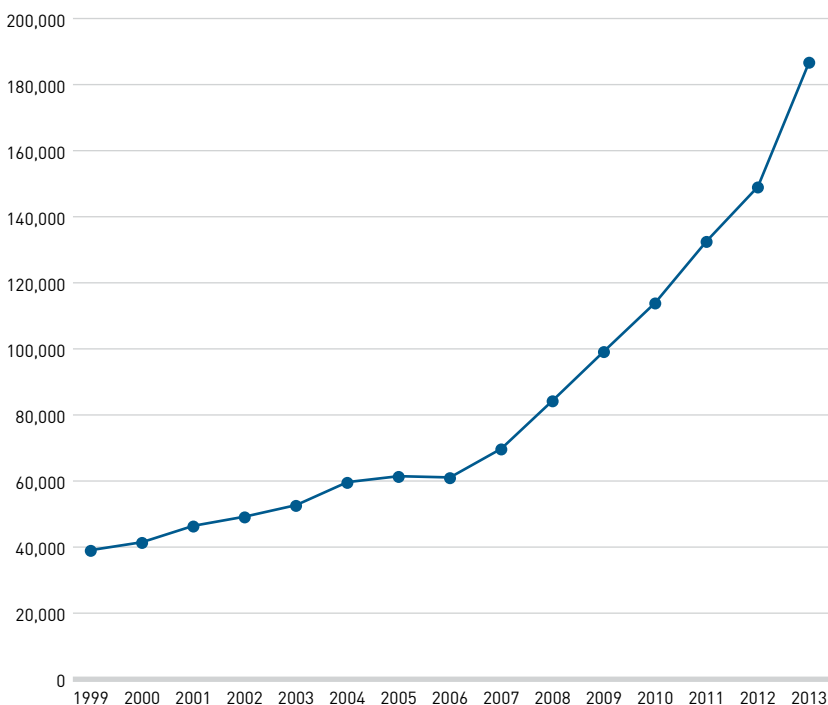
the zero cost of these claims with the average payments among the fee-for-service claims. Because patients with OUD may also have higher healthcare costs for other conditions (eg, infections or poor adherence to treatment for chronic conditions), we also computed Medicaid expenditures for non-OUD services for both the OUD and comparison cohorts. Total OUD-related Medicaid expenditures were then defined as the sum of the OUD treatment costs and the excess non-OUD costs (non-OUD costs in the OUD group minus the non-OUD costs in the comparison group). Expenditures were then Winsorized at the first and 99th percentiles to reduce the influence of outliers.⁴⁶ All expenditures were adjusted for inflation using the Medical Care component of the Consumer Price Index and are reported in 2017 US dollars.

As shown in **Figure 2**, the number of patients with OUD increased substantially over time in our 17-state sample, from 39,109 in 1999 to 186,979 in 2013; this is an increase of 378%. Average annual Medicaid expenditures per patient for patients with OUD and the matched comparison group of patients without OUD are presented in the **Table**, and total Medicaid expenditures are presented in **Figure 3**. The total OUD-related Medicaid expenditures (the sum of OUD treatment costs and excess non-OUD costs) had an increase of 246%, from \$919 million in 1999 to \$3.18 billion in 2013. OUD treatment expenditures increased 118%, from \$438 million in 1999 to \$952 million in 2013. Excess non-OUD costs increased more (363%) from

\$482 million in 1999 to \$2.23 billion in 2013. In 1999, OUD treatment expenditures represented 47.6% of total OUD-related Medicaid expenditures, but by 2013, this percentage had fallen to 29.9%, indicating that the burden of non-OUD expenditures for patients with OUD grew over time.

We used the results from our sample states to extrapolate to national estimates. For each of the 17 states in our sample, we created a sampling weight equal to the inverse of the ratio of the number of Medicaid enrollees in the state to the total US Medicaid enrollment. Based on these weights, we estimate that nationally, the number of individuals with OUD who were treated in state Medicaid programs increased 440%, from approximately 91,613 in 1999 to 494,569 in 2013. Total OUD-related Medicaid expenditures for these patients nearly quadrupled, from \$2.15 billion in 1999 to \$8.42 billion (or 3.2% of total Medicaid spending) in 2013.

FIGURE 2. Number of Medicaid Enrollees Diagnosed With OUD



OUD indicates opioid use disorder.

Limitations

Our analysis shows that costs to state Medicaid programs pertaining to the opioid epidemic

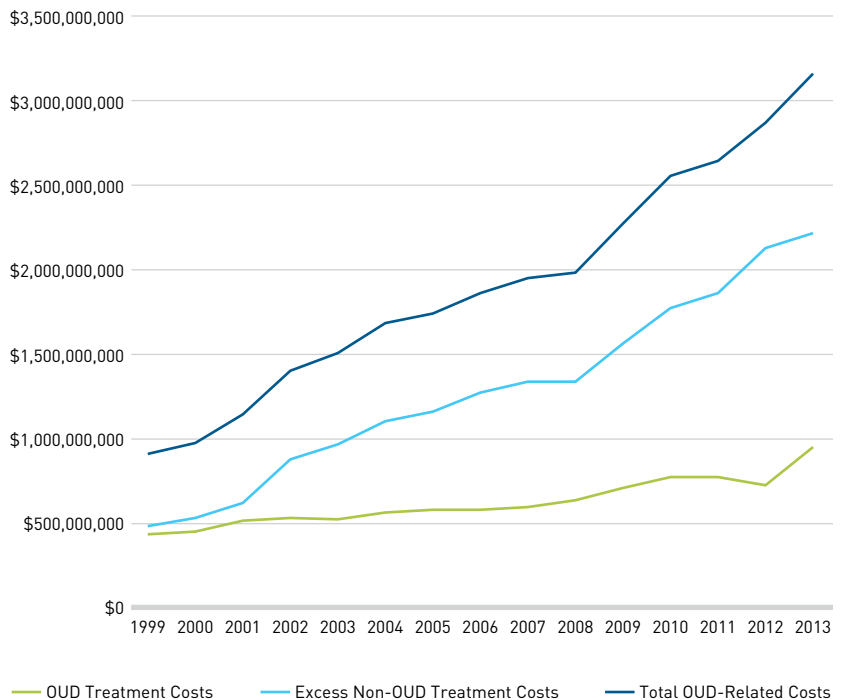
TABLE. Average Annual Medicaid Expenditures per Patient for Patients With OUD and a Matched Comparison Group of Patients Without OUD (2017 US dollars)

Year	Inpatient				Outpatient				Prescription Drug				Total			
	OUD		No OUD		OUD		No OUD		OUD		No OUD		OUD		No OUD	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1999	3024	9853	563	4837	5123	6736	2145	5942	1718	5320	666	3415	9865	15,250	3374	9337
2000	3121	10,314	520	3961	5333	7401	2217	6336	1999	5931	745	2850	10,452	16,159	3482	8907
2001	3311	10,970	543	4526	5624	7341	2365	6634	2193	5632	836	3216	11,128	16,722	3745	9570
2002	3791	13,404	581	4842	6210	8224	2519	6975	2373	5416	927	2809	12,375	19,382	4027	10,049
2003	4034	13,941	624	4764	6332	7951	2687	7481	2844	6418	1153	3325	13,210	20,313	4464	10,686
2004	4081	14,932	598	4567	6634	8419	2783	7756	3270	7221	1285	3553	13,984	21,764	4666	11,003
2005	4188	15,374	637	5116	6865	24,685	2896	8262	3183	6494	1301	3698	14,236	32,547	4834	11,716
2006	4673	16,725	695	6624	7124	26,127	2943	8580	2403	7818	652	2605	14,200	38,472	4290	12,298
2007	4403	17,558	721	6451	7339	9468	3264	9278	2353	6327	677	2759	14,096	24,441	4663	12,739
2008	3687	15,794	725	5968	7521	9099	3480	9907	2260	5851	672	3100	13,468	22,570	4877	13,194
2009	3452	15,524	676	6030	7869	9467	3716	10,091	2315	6471	638	3530	13,635	22,636	5029	13,346
2010	3489	19,374	631	5913	8058	11,741	3881	10,702	2362	15,915	618	3472	13,909	31,066	5131	13,712
2011	3150	15,996	617	6070	7745	9213	3854	10,822	2087	7045	573	3635	12,981	22,867	5044	13,885
2012	2561	14,766	534	5511	8522	48,944	4309	14,434	1799	62,935	482	3122	12,882	99,666	5326	16,494
2013	1912	14,076	503	5528	8803	26,116	4481	13,627	1175	4086	420	3638	11,889	33,200	5404	15,898

OUD indicates opioid use disorder; SD, standard deviation.

have increased considerably over the past 15 years and reached \$8.42 billion in 2013, the most recent year of data available at the time of the study. However, the results must be considered in the context of the study's limitations. The most significant limitation is that complete MAX data were available for only 17 states and were limited to the period from 1999 to 2013. If Medicaid data were obtained directly from the states (or a selection of states) instead of from CMS, more recent cost estimates could be computed and patterns of treatment and costs over a long period of time could be examined. In addition, there may also be other costs to the state Medicaid programs that are attributable to OUD that we are not able to observe. For example, children of parents with an OUD may be more likely to become undernourished, suffer from chronic conditions, or become victims of accidents and injuries. Because we are not able to link family members in the MAX database, we cannot identify the children of parents with OUD and are not able to include these costs in the analysis.

FIGURE 3. Health Insurance Costs for Medicaid Enrollees Diagnosed With OUD



OUD indicates opioid use disorder.

Finally, the study is limited to Medicaid expenditures. States also incur costs related to the opioid epidemic among their employees and retirees. Although we are not aware of studies that specifically focus on state employees and retirees, there are studies of privately insured individuals. OUD greatly affects the working-age population, and studies report the highest rates of nonmedical use of opioids and overdose deaths in the group of adults aged 18 to 49 years.^{13,47} Rice et al estimated the incremental annual healthcare cost of OUD to an employer to be \$10,627 per patient. In addition, an employee with OUD had \$1244 excess annual work-loss costs.⁴⁸

Future Directions

The analyses presented provide a general overview of the cost of the opioid epidemic to state Medicaid plans. A more robust analysis would involve developing cost models that control for state-level and patient characteristics. In addition, future studies should explore factors that may be related to the increase in OUD costs. For example, data on promotional activities by pharmaceutical firms, both direct-to-consumer and provider-targeted, could be included,^{49,50} which would allow for the estimation of the potential effects of industry behavior on Medicaid expenditures for the opioid epidemic.

In addition to the enhancements of the Medicaid analysis, future studies could examine insurance costs for state employees and retirees. The analyses described here could be applied to private health insurance claims data to estimate the cost to private insurers of the opioid epidemic and determine an annual cost per enrollee. As state employees are likely to yield results similar to those of other privately insured individuals, the estimates could be used to derive the cost associated with OUD to the states among state employees, to develop cost models and to estimate the effects of industry behaviors, as in the Medicaid analyses.

As the current analysis shows, the states' economic burden from the opioid epidemic is considerable. However, the results likely underestimate this burden. Future studies could further refine our estimates to include non-Medicaid expenditures, and they could estimate the burden on infants, children, and adolescents associated with having parents with an OUD. Understanding these costs is important for developing targeted prevention and treatment programs and policies to help mitigate this public health crisis. ■

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important intellectual content (EA, GL); statistical analysis (DB, DLL, GL, XX); administrative, technical, or logistic support (EA, XX); supervision (DLL).

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REFERENCES

- National Institute on Drug Abuse website. Effective treatments for opioid addiction. drugabuse.gov/publications/effective-treatments-opioid-addiction/effective-treatments-opioid-addiction. Published 2016. Accessed March 01, 2018.
- McCance-Katz EF. Treatment of opioid dependence and coinfection with HIV and hepatitis C virus in opioid-dependent patients: the importance of drug interactions between opioids and antiretroviral agents. *Clin Infect Dis*. 2005;41(Suppl 1):S89-S95.
- Murphy SM, Dweik D, McPherson S, Roll JM. Association between hepatitis C virus and opioid use while in buprenorphine treatment: preliminary findings. *Am J Drug Alcohol Abuse*. 2015;41(1):88-92. doi: 10.3109/00952990.2014.983274.
- HIV and substance use in the United States. CDC website. cdc.gov/hiv/risk/substanceuse.html. Published 2018. Accessed February 10, 2019.
- Young K, Zur J. Medicaid and the opioid epidemic: enrollment, spending, and the implications of proposed policy changes. Henry J. Kaiser Family Foundation website. kff.org/medicaid/issue-brief/medicaid-and-the-opioid-epidemic-enrollment-spending-and-the-implications-of-proposed-policy-changes/. Published July 14, 2017. Accessed February 10, 2019.
- Birnbaum HG, White AG, Reynolds JL, et al. Estimated costs of prescription opioid analgesic abuse in the United States in 2001: a societal perspective. *Clin J Pain*. 2006;22(8):667-676.
- Strassels SA. Economic burden of prescription opioid misuse and abuse. *J Manag Care Pharm*. 2009;15(7):556-562.
- Florence CS, Zhou C, Luo F, Xu L. The economic burden of prescription opioid overdose, abuse, and dependence in the United States, 2013. *Med Care*. 2016;54(10):901-906. doi: 10.1097/MLR.0000000000000625.
- Meyer R, Patel AM, Rattana SK, Quock TP, Mody SH. Prescription opioid abuse: a literature review of the clinical and economic burden in the United States. *Popul Health Manag*. 2014;17(6):372-387. doi: 10.1089/pop.2013.0098.
- McAdam-Marx C, Roland CL, Cleveland J, Oderda GM. Costs of opioid abuse and misuse determined from a Medicaid database. *J Pain Palliat Care Pharmacother*. 2010;24(1):5-18. doi: 10.3109/15360280903544877.
- Owens PL, Barrett ML, Weiss AJ, Washington RE, Kronick R. Hospital inpatient utilization related to opioid overuse among adults, 1993-2012: Statistical Brief #177. Healthcare Cost and Utilization Project website. hcup-us.ahrq.gov/reports/statbriefs/sb177-Hospitalizations-for-Opioid-Overuse.jsp. Published August 2014. Accessed February 21, 2018.
- Weiss AJ, Elixhauser A, Barrett ML, Steiner CA, Bailey MK, O'Malley L. Opioid-related inpatient stays and emergency department visits by state, 2009-2014: Statistical Brief #219. Healthcare Cost and Utilization Project website. Published December 2016. Accessed March 1, 2018.
- Rudd RA, Aleshire N, Zibbell JE, Gladden RM. Increases in drug and opioid overdose deaths—United States, 2000-2014. *MMWR Morb Mortal Wkly Rep*. 2016;64(50-51):1378-1382. doi: 10.15585/mmwr.mm6450a3.
- White AG, Birnbaum HG, Rothman DB, Katz N. Development of a budget-impact model to quantify potential cost savings from prescription opioids designed to deter abuse or ease of extraction. *Appl Health Econ Health Policy*. 2009;7(1):61-70. doi: 10.2165/00148365-200907010-00006.
- Mann C, Frieden T, Hyde PS, Volkow ND, Koob GF. *Medication Assisted Treatment for Substance Use Disorders*. Baltimore, MD: CMS; 2014.
- Adelmann PK. Mental and substance use disorders among Medicaid recipients: prevalence estimates from two national surveys. *Adm Policy Ment Hlth*. 2003;31(2):111-129.
- Manchikanti L, Fellows B, Damron KS, Pampati V, McManus CD. Prevalence of illicit drug use among individuals with chronic pain in the Commonwealth of Kentucky: an evaluation of patterns and trends. *J Ky Med Assoc*. 2005;103(2):55-62.
- Chandwani HS, Strassels SA, Rascati KL, Lawson KA, Wilson JP. Estimates of charges associated with emergency department and hospital inpatient care for opioid abuse-related events. *J Pain Palliat Care Pharmacother*. 2013;27(3):206-213. doi: 10.3109/15360288.2013.803511.
- Becker WC, Fiellin DA, Merrill JO, et al. Opioid use disorder in the United States: insurance status and treatment access. *Drug Alcohol Depend*. 2008;94(1-3):207-213. doi: 10.1016/j.drugalcdep.2007.11.018.
- Saloner B, Karthikeyan S. Changes in substance abuse treatment use among individuals with opioid use disorders in the United States, 2004-2013. *JAMA*. 2015;314(14):1515-1517. doi: 10.1001/jama.2015.10345.
- Carroll KM, Ball SA, Nich C, et al. Targeting behavioral therapies to enhance naltrexone treatment of opioid dependence: efficacy of contingency management and significant other involvement. *Arch Gen Psychiatry*. 2001;58(8):755-761.
- McLellan AT, Arndt IO, Metzger DS, Woody GE, O'Brien CP. The effects of psychosocial services in substance abuse treatment. *JAMA*. 1993;269(15):1953-1959.
- Wen H, Hockenberry JM, Borders TF, Druss BG. Impact of Medicaid expansion on Medicaid-covered utilization of buprenorphine for opioid use disorder treatment. *Med Care*. 2017;55(4):336-341. doi: 10.1097/MLR.0000000000000703.
- Substance Abuse and Mental Health Services Administration (SAMHSA). Behavioral Health Treatments and Services: samhsa.gov/treatment/substance-use-disorders. Updated January 30, 2019. Accessed March 1, 2019.
- Substance Abuse and Mental Health Services Administration (SAMHSA). *National Expenditures for Mental Health Services and Substance Abuse Treatment, 1986-2009*. Rockville, MD: Substance Abuse and Mental Health Services Administration; 2013.
- Bouchery E, Harwood R, Malsberger R, Caffery E, Nysenbaum J, Hourihan K. *Medicaid Substance Abuse Treatment Spending: Findings Report*. Washington, DC: HHS; 2012.
- Clemans-Cape L, Epstein M, Kenney GM. *Rapid Growth in Medicaid Spending on Medications to Treat Opioid Use Disorder and Overdose*. Washington, DC: Urban Institute; 2017.

28. Substance Abuse and Mental Health Services Administration (SAMHSA). Federal guidelines for opioid treatment programs. 2015; <https://store.samhsa.gov/system/files/pep15-fedguideotp.pdf>. Published January, 2015. Accessed April 23, 2019.
29. Jansson LM, Velez M. Neonatal abstinence syndrome. *Curr Opin Pediatr*. 2012;24(2):252-258. doi: 10.1097/MOP.0b013e32834f4dc3a.
30. Narkowicz S, Plotka J, Polkowska Z, Biziuk M, Namieśnik J. Prenatal exposure to substance of abuse: a worldwide problem. *Environ Int*. 2013;54:141-163. doi: 10.1016/j.envint.2013.01.001.
31. Coyle MG, Ferguson A, Lagasse L, Oh W, Lester B. Diluted tincture of opium (DTO) and phenobarbital versus DTO alone for neonatal opiate withdrawal in term infants. *J Pediatr*. 2002;140(5):561-564.
32. Chiriboga CA. Fetal effects. *Neural Clin*. 1993;11(3):707-728.
33. van Baar AL, Fleury P, Soepatmi S, Ultee CA, Wesselman PJ. Neonatal behavior after drug dependent pregnancy. *Arch Dis Childh*. 1989;64(2):235-240.
34. Patrick SW, Davis MM, Lehmann CU, Cooper WO. Increasing incidence and geographic distribution of neonatal abstinence syndrome: United States, 2009 to 2012 [published correction appears in *J Perinatol*. 2015;35(8):667]. *J Perinatol*. 2015;35(8):650-655. doi: 10.1038/jp.2015.36.
35. Patrick SW, Dudley J, Martin PR, et al. Prescription opioid epidemic and infant outcomes. *Pediatrics*. 2015;135(5):842-850. doi: 10.1542/peds.2014-3299.
36. Patrick SW, Schumacher RE, Benneyworth BD, Krans EE, McAllister JM, Davis MM. Neonatal abstinence syndrome and associated health care expenditures: United States, 2000-2009. *JAMA*. 2012;307(18):1934-1940. doi: 10.1001/jama.2012.3951.
37. Corr TE, Hollenbeak CS. The economic burden of neonatal abstinence syndrome in the United States. *Addiction*. 2017;112(9):1590-1599. doi: 10.1111/add.13842.
38. Grim K, Harrison TE, Wilder RT. Management of neonatal abstinence syndrome from opioids. *Clin Perinatol*. 2013;40(3):509-524. doi: 10.1016/j.clp.2013.05.004.
39. Morgan PL, Wang Y. The opioid epidemic, neonatal abstinence syndrome, and estimated costs for special education. *Am J Manag Care*. 2019;25:S264-269.
40. Segel JE, Shi Y, Moran JR, Scanlon DP. Opioid misuse, labor market outcomes, and means-tested public expenditures: a conceptual framework. *Am J Manag Care*. 2019;25:S270-S276.
41. Byrd VL, Dodd AH. Assessing the usability of MAX 2008 encounter data for comprehensive managed care. *Medicare Medicaid Res Rev*. 2013;3(1). pii: mmrr.003.01.b01. doi: 10.5600/mmrr.003.01.b01.
42. Rough K, Bateman BT, Paterno E, et al. Suppression of substance abuse claims in Medicaid data and rates of diagnoses for non-substance abuse conditions. *JAMA*. 2016;315(11):1164-1166. doi: 10.1001/jama.2015.18417.
43. Redaction of Substance Abuse Claims. 2017; <https://www.resdac.org/articles/redaction-substance-abuse-claims>. Accessed June 15, 2017.
44. Final Rule: 42 CFR Part 2, Confidentiality of Substance Use Disorder Patient Records. American Psychiatric Association website. psychiatry.org/psychiatrists/practice/practice-management/hipaa/42-cfr-part-2. Published 2017. Accessed June 15, 2017.
45. Naeger S, Mutter R, Ali MM, Mark T, Hughey L. Post-discharge treatment engagement among patients with an opioid-use disorder. *J Subst Abuse Treat*. 2016;69:64-71. doi: 10.1016/j.jsat.2016.07.004.
46. Wilcox RR. *Introduction to Robust Estimation and Hypothesis Testing*. 3rd ed. San Diego, CA: Academic Press; 2012.
47. Jones CM. Frequency of prescription pain reliever nonmedical use: 2002-2003 and 2009-2010. *Arch Intern Med*. 2012;172(16):1265-1267. doi: 10.1001/archinternmed.2012.2533.
48. Rice JB, Kirson NY, Shei A, et al. Estimating the costs of opioid abuse and dependence from an employer perspective: a retrospective analysis using administrative claims data. *Appl Health Econ Health Pol*. 2014;12(4):435-446. doi: 10.1007/s40258-014-0102-0.
49. Chang HY, Murimi I, Daubresse M, Qato DM, Emery SL, Alexander GC. Effect of direct-to-consumer advertising on statin use in the United States. *Med Care*. 2017;55(8):759-764. doi: 10.1097/MLR.0000000000000752.
50. Kornfield R, Donohue J, Berndt ER, Alexander GC. Promotion of prescription drugs to consumers and providers, 2001-2010. *PLoS One*. 2013;8(3):e55504. doi: 10.1371/journal.pone.0055504.

Estimated Costs to the Pennsylvania Criminal Justice System Resulting From the Opioid Crisis

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Background And Existing Research

The current opioid epidemic in the United States has forced nearly every institution within the criminal justice system (CJS) to adapt rapidly to the much-increased ranks of illicit opioid users. Opioid use disorder (OUD) costs the CJS a considerable amount of money each year, ranging from the costs of arrests of opioid distributors to the medical and carceral costs of individuals with OUD who are imprisoned for substance-related offenses. Although the literature monetizing the damages of prescription opioids has typically been sparse,¹ the OUD epidemic has motivated researchers to explore the issue in greater depth. These studies utilize a “cost of illness” approach in figuring costs, operationalizing the societal illness costs associated with OUD.

An early analysis of the economic impact of OUD² compared individuals who had been diagnosed with OUD with a non-OUD control group. The results indicated that those with OUD had a mean annual health cost that was 8 times greater than that of the controls. Birnbaum et al (2006) expanded this analysis by extending their research into areas outside of private insurers and analyzing the impact of OUD on different social services.³ Estimates were calculated by multiplying the relevant number of prescription OUD cases (on the basis of national surveys) by the estimated per-person cost, or, alternately, taking overall costs of OUD for a particular component, such as police costs, and apportioning the OUD share on the basis of the prevalence of prescription OUD relative to overall drug misuse. Data were collected from the following sources: the National Survey on Drug Use and Health; Treatment Episode Data Sets; the Drug Abuse Warning Network; a database of private insurance claims of 600,000 individuals from 1998 to 2001; the database of the Bureau of Justice Statistics (BJS) on Criminal Justice Expenditures and Employment Extracts; the Federal Bureau of Investigation’s Uniform Crime Reports (UCR); the National Forensic Laboratory Information System; the BJS’s Prison and Jail Inmates at Mid-Year report; the Office of National Drug Control Policy’s (ONDCP) Drug Enforcement Administration Budget Summary for 2001; the ONDCP’s Budget Strategy for 2003; the National Association of State Alcohol and Drug Abuse Directors’ Analysis Report of State Alcohol and

ABSTRACT

The opioid crisis has made financial impacts across all levels of the public sector. This report focuses on costs related to the criminal justice system (CJS) in Pennsylvania. Costs impacting 3 principal areas of the CJS are examined: opioid-related arrests, court costs, and incarceration. Analysis of the state-level CJS is our main focus; no local-level costs are included. Through this examination, costs of the opioid crisis for the period of 2007 to 2016 were estimated using opioid costs for 2006 as a baseline. Total costs to the Pennsylvania CJS during this period were over \$526 million, with most of that accounted for by state corrections. Opioid-related trends in arrests, court proceedings, and incarceration were not sufficiently well documented to allow for rigorous analysis in earlier periods, and this was the primary limitation to our analysis.

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For author information and disclosures, see end of text.

Drug Abuse for 1998 and 1999; and the Substance Abuse and Mental Health Services Administration's Office of Applied Studies. Many of these data sources remain central to subsequent studies analyzing economic impacts of prescription OUD, especially the Uniform Crime Reports and Criminal Justice Expenditures and Extracts.³

The limitations of available data caused Birnbaum et al (2006) to assume that the costs of prescription and nonprescription OUD were the same.³ Furthermore, they stated that many costs associated with the CJS were omitted due to lack of data, such as fraudulent prescriptions, pharmacy theft, selling of prescription drugs by patients for whom they were prescribed, private legal defense, and property crime involving OUD. The estimated CJS-specific costs amounted to \$438.4 million for policing, \$221.2 million for courts, \$201.6 million for county incarceration, \$499.2 million for state incarceration, and \$70.5 million for federal incarceration. Total costs incurred by the CJS were \$1.4 billion in 2001, which amounts to 17% of the total costs of prescription OUD in the United States.³

Birnbaum et al conducted another analysis in 2011, evaluating impacts of OUD upon various social services nationally. Prescription OUD in 2007 accounted for \$2.3 billion in correctional costs, two-thirds of which occurred at the state level. Policing costs were calculated at \$1.5 billion, court costs at \$726 million, and property damage at \$625 million. In total, \$5.1 billion was incurred by the CJS, amounting to 9.2% of total US societal costs of prescription OUD in 2007.¹ Although this analysis is an extension of a previously conducted study, data sets were used with various methodologies and definitions, making comparisons and calculations among data sets difficult.³ The study also utilized the same apportionment approach as the 2006 study, which has garnered heavy criticism.^{4,5} Birnbaum et al (2006) also noted that the conflation of heroin and prescription opioids into the same category created uncertainty in their final analysis.³

In an earlier study, Hansen et al tallied direct CJS expenditures and capital outlays made in 2003.⁶ This cost was then stratified into drug law expenditures versus expenditures for all other crimes. Expenses for prescription opioids were based on the relative percentage of confiscations compared with all other drugs that had been seized that year. Using this method, the authors found that in 2006, nonmedical prescription OUD costs were \$3.4 billion for policing, \$1.7 billion for courts, and \$2.5 billion for incarceration, with a cost to victims at \$618 million.⁶ Another analysis, from Florence et al, quantified the economic effects of prescription OUD and its impact on the CJS.⁷ As with past studies, a major source of data used in figuring CJS costs was the Justice Expenditure and Employment Extracts Primary report. The methodology was based on the 2011 apportionment method of Birnbaum et al, in which total CJS expenditures on drug crimes were tallied and then multiplied by the share of cases represented by prescription opioids, as reported from National Survey on Drug Use and Health.^{1,7} Investigators did not attribute costs to specific

drugs if multiple drugs were used. The calculation summarizing the economic burden of prescription OUD on the CJS for 2013 was \$7.7 billion, with \$7.3 billion of the costs borne by agencies within local and state governments.⁷ The most recent evaluation of CJS costs associated with OUD, published in 2018, calculated an annual national cost of \$2.9 billion for policing, \$1.3 billion for courts, \$3.3 billion for corrections, and \$300 million in property losses associated with OUD—a collective \$7.8 billion in 2016.⁸ Results of an analysis by Rhyan suggest that annual costs associated with combating the opioid epidemic will have approximately doubled across all sectors, including the CJS, by 2020.⁹

The results of the study from Hansen et al point to inflation and increased opioid misuse for the increased cost found in their analysis, compared with the 2011 analysis by Birnbaum et al.^{1,6} Hansen et al found greater costs than that suggested by subsequent studies.^{6,7,9} This discrepancy may be due to the inclusion by Hansen et al of lost productivity costs from incarceration or polydrug users in their CJS costs analysis.⁶

Several analyses utilize the apportionment method to calculate percentages of each major crime due to OUD. This method received criticism from Reuter, who cited previous findings arguing that it is impossible to calculate the amount of homicides for which drugs have been responsible, as homicide detectives themselves could not determine whether drugs were a factor in one-third of the cases investigated in New York City.^{5,10} The uncertainty of nonmedical prescription OUD is further compounded by the lack of current data, as several studies must rely on data sets that go as far back as 1996.⁶ For example, the last Drug Abuse Warning Network survey conducted was in 2011 and was then discontinued. The lack of recent data is complicated further by the conflation of natural and synthetic opioids merged into the same category that is used to measure OUD.¹

Although the research mandate of literature reviewed in this article is limited to estimating costs related to the operations of state government, much of this literature examines the broader range of state and local costs (often combining them) and also extends into the estimation of broader societal costs, including some costs to individuals. Thus, the approach here is more parsimonious and may, to some extent, underestimate the full range of costs.

Conceptual Framework

Our estimate of the costs attributable to the opioid crisis uses data from 2006 (which is the earliest year for which reliable opioid-specific data were available) to establish a baseline of opioid-related costs, and to be compared with changes that occurred between 2007 to 2016. The counterfactual baseline shown in the figures below was estimated by projecting the trend and accounting for inflation. The difference between baseline projections from 2007 to 2016 and the actual observed costs for that period were interpreted to represent yearly changes in opioid-related cases and attendant

costs associated with the opioid crisis. Yearly differences were summed over the years following 2006 and multiplied by the cost-per-case estimates (adjusted for inflation) to calculate total state funds associated with the crisis.

Estimation of costs incurred in policing were based upon opioid-related drug arrests by the Pennsylvania State Police (PSP) from 2007 to 2016, against the baseline year of 2006, following the analytical approach discussed above. The expense associated with what the PSP considers a “typical” drug arrest was used as the unit of cost. It should be noted that the per-arrest unit cost supplied by PSP represents a “bare minimum” arrest cost, approximating the cost for an uncomplicated arrest by a trooper for simple possession of opioids for personal use. Costs for arrests resulting in more intensive investigation activities would undoubtedly be higher, but are at this point unknown. Thus, the arrest costs calculated are likely underestimated. Again, arrest costs incurred by local law enforcement agencies are excluded.

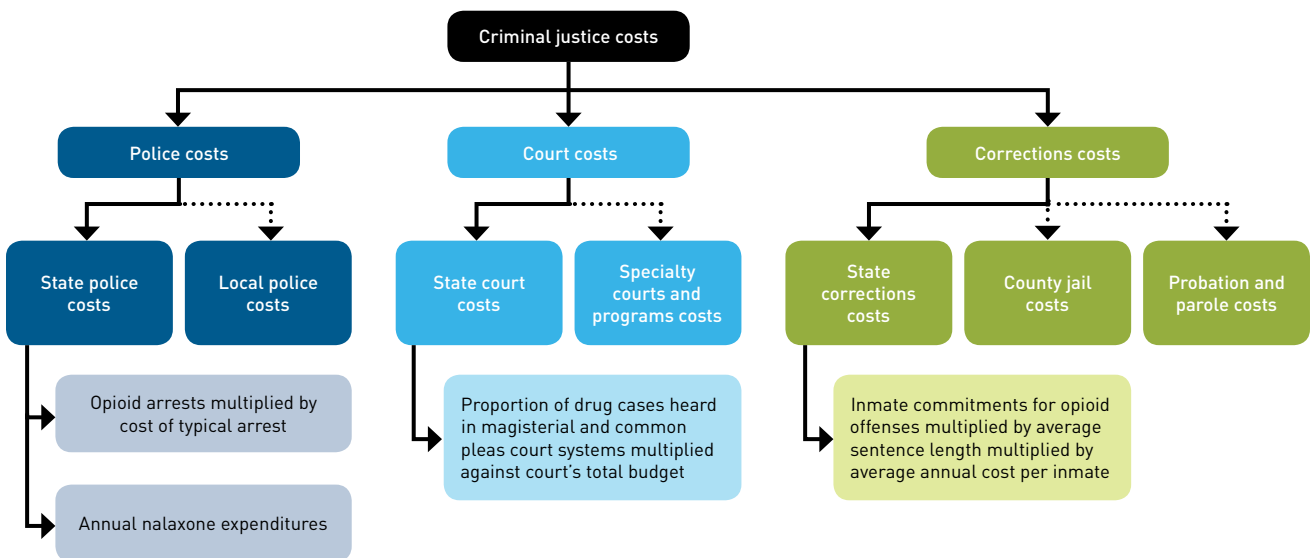
Estimation of increased costs incurred by the courts is based upon court hearings and proceedings related to OUD at the Court of Common Pleas and Magisterial District Court levels from 2007 to 2016, against baseline. These courts were selected for analysis because they are the primary adjudicators of cases relating to OUD and are state-funded. Total convictions relating to OUD are compared with the total convictions, drug-related and not drug-related, adjudicated by the courts for the period being examined to estimate the proportion of all convictions, and thus of the total state court budgets, associated specifically with OUD. Conviction and

court costs, along with related information, were collected from the Pennsylvania Commission on Sentencing and the Administrative Office of Pennsylvania Courts. Future analyses may be able to rely on a per-case unit cost derived from fees assessed to those convicted of drug crimes, which in theory represent the cost of such a case, but these fees are complex and beyond the scope of the current project.

Estimation of increased costs incurred by state corrections is based upon the estimated number of inmate commitments related to opioid-related drug convictions and the average length of stay of such inmates from 2007 to 2016, against the baseline year of 2006. The unit of cost used was the average annual prison expenditure per inmate (which includes costs related to treatment programs) multiplied by the average length of stay for the opioid-related crimes. This information was collected from the Pennsylvania Department of Corrections (PADOC).

We tallied and summed the difference in the projected baseline and actual costs for 2007 to 2016 from each of these sectors to create a final preliminary estimation of state costs incurred by the CJS in combating costs attributable to the opioid crisis during this period. All amounts have been inflation-adjusted to reflect costs in 2017 dollars. Our analysis differs from the reviewed literature in several respects (Figure 1). First, we analyzed costs across a 10-year period. Second, the ambit of our analysis were state-specific costs rather than municipal, county, or federal costs. Third, only data collected directly from Pennsylvania state CJS agencies themselves were included; we did not use the national surveys utilized in the prior studies.

FIGURE 1. Summary of Approach to Opioid-Related CJS Costs



The dotted lines indicate possible avenues of future research that address local-level costs. CJS indicates criminal justice system.

Gross Cost Estimates

The following section presents the findings on state-related CJS costs resulting from the opioid crisis in Pennsylvania. We present the results in the usual order in which an offender would proceed through the CJS, from arrest to trial to incarceration. We focus on these 3 domains of costs because they represent the major cost sectors of the CJS. There may well be other special and ad hoc costs that arise from a challenge such as the opioid crisis, including special programs or investigative efforts implemented by the state to deal with it, but those costs would need to be addressed in future research.

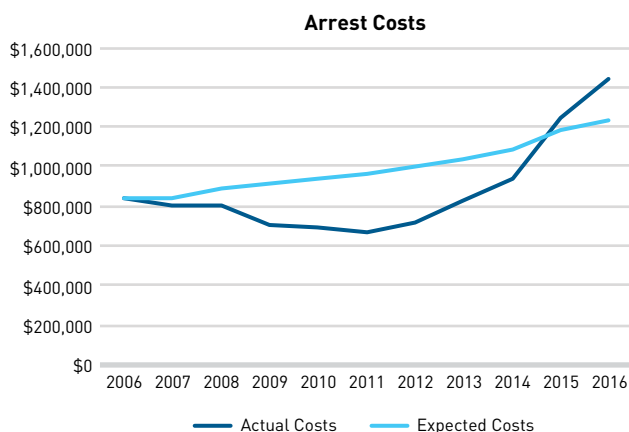
Arrest-Related Costs

Our analysis of the impact of the opioid crisis on the operations of the PSP over the period 2007 to 2016 revealed a cumulative net cost (actual over baseline) of -\$1,230,396. These costs are represented graphically in **Figure 2**.

Costs were lower than what was expected, even with the opioid crisis. As explained earlier, PSP was able to provide only a minimal cost estimate based on the expenses incurred from a simple possession arrest. Arrests related to complex drug trafficking cases were found to be considerably higher in cost but are not calculable at this point. The arrest data, provided by PSP, included both possession and sales offenses. Thus, the negative figure reported would almost certainly become positive if the costs for the more complex sales cases could be figured. As will be seen, these “savings” are easily washed out by the net costs to the courts and corrections sectors.

The other factor worth noting is that relatively few of these arrests occur at the state level. The yearly opioid-related arrests by PSP crested at approximately 2000 during this period, suggesting that most opioid-related law enforcement activity is occurring within local police departments, which is beyond the scope of the current report.

FIGURE 2. Pennsylvania Arrest-Related Costs Due to the Opioid Crisis: 2007-2016



Court-Related Costs

Our analysis of the impact of the opioid crisis on the operations of the state courts in Pennsylvania reveals a cumulative net cost (actual over baseline) of \$73,959,475, or approximately \$7.4 million per year over the study period. These costs are represented in **Figure 3**.

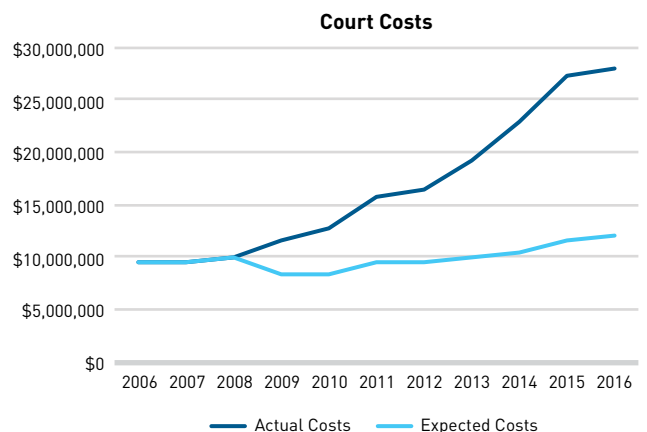
This is based on an assumption of parity in case-processing costs among different types of cases. Of course, it is likely that, for example, a capital murder case would typically consume more court resources than a simple drug possession case, but no practical way exists of sorting that out. However, other than in the 2 largest counties, Philadelphia and Allegheny, capital cases are rare, and simple drug cases vastly outnumber cases like capital murders that would more commonly require an extended jury or bench trial. Approximately 90% of adjudications result from a plea, rather than a trial, so it seems a reasonable supposition to treat most cases as being similar in terms of costs. Moreover, a typical day on a court docket will witness proceedings for many cases being processed in succession, and even in parallel, thus further complicating efforts to discretely cost out a specific case. One potential avenue for future research is the examination of court costs and fees that are levied against defendants as part of criminal convictions as a measure of individual case-processing costs. However, these fees can be complex and are beyond the scope of the present study.

Incarceration-Related Costs

Our analysis of the impact of the opioid crisis on the operations of the state prison system in Pennsylvania revealed a cumulative net cost (actual over baseline) of \$453,577,239, or approximately \$45 million per year over the study period. These costs are represented graphically in **Figure 4**.

Prison-related costs are, unsurprisingly, higher than those for the courts. Providing care, custody, and control of a state prison

FIGURE 3. Pennsylvania Court-Related Costs Due to the Opioid Crisis: 2007-2016

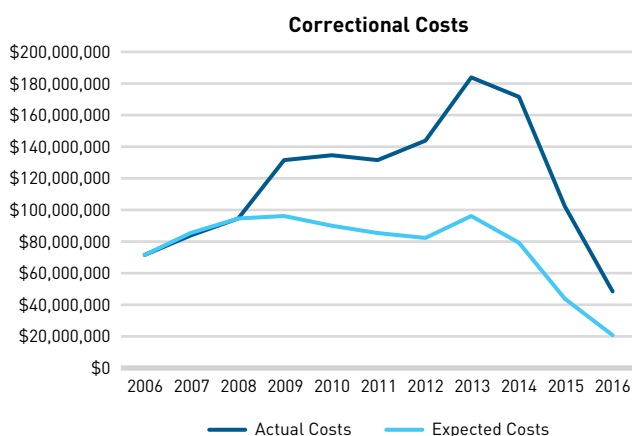


inmate is among the most expensive propositions in the entire CJS. The current annual per-inmate cost in Pennsylvania approaches \$50,000. The involvement of an individual offender with the courts is a much less intensive and less expensive activity. And, as with the court cost estimates, the prison cost estimates are based on an average cost per inmate, as calculated routinely by the PADO. The costs may likely vary among inmates (although not necessarily driven by offense type, but more by factors such as inmate health and age), but these differences are not readily calculable.

In addition to the opioid-related corrections operating costs projections discussed above, the opioid crisis is having more discrete impacts on PADO. During the calendar year 2017, PADO experienced 180 overdoses leading to 18 fatalities in their Community Corrections Centers. Newly committed inmates, who indicated opioids as being a drug of choice for them, doubled from 6% of all new admissions in 2010 to 12% in 2015. The crisis has greatly driven PADO's use of medication-assisted treatment (MAT) over the past several years. The use of MAT in general correctional settings and within PADO was traditionally a nonstarter. These MAT products were traditionally seen as risky within a correctional setting and were often seen as a "crutch" by many corrections drug counselors.

The opioid crisis has served as a watershed, leading to a shift in culture and to the more widespread use of MAT in the PADO. The PADO now employs a dedicated MAT coordinator to oversee the efforts. During 2017, PADO administered 307 doses of naloxone and 468 doses of vivitrol, and employed 13 MAT social worker positions, for a combined expenditure of \$1.1 million. Moreover, PADO, during fiscal year 2016-2017, awarded grants of \$1.5 million of state funds to 11 county jails to assist them with their own nascent MAT efforts. The PADO has also established 6 new therapeutic communities in the state correctional institutions that will be dedicated specifically to the treatment of OUD.

FIGURE 4. Pennsylvania Prison-Related Costs Due to the Opioid Crisis: 2007-2016



Limitations And Future Directions

We conclude that the total costs to the state CJS in Pennsylvania attributable to the opioid crisis for the period 2007 to 2016 are \$526,306,318, or approximately \$53 million per year, adjusted to 2017 dollars. This covers the primary domains of state arrests, courts, and corrections. The cost estimates related to the opioid crisis that are reported here reflect direct effects, or offenses that are clearly coded in the criminal justice system data as being drug-related.

Several caveats are worth noting. First, regarding the state corrections data, many of the drug-related commitments are likely to be for drug selling (eg, possession with intent to deliver, [PWID]), not drug use. Some of those convicted of offenses such as PWID are not necessarily using drugs. The great majority of convictions for simple possession (ie, for personal use) result in a nonincarcerative sanction such as probation, which in Pennsylvania is a county-level function. Still, drug selling is part and parcel of the opioid crisis and is rightly included in our estimates. The assumption here is that the prescription opioid crisis resulted in more illegal drug dealers to meet the demand. This limitation pertains less to our arrest and court cost estimates, as all levels of drug offenders will have proceeded through those 2 phases of the criminal justice process, whereas only the more serious convictions terminate in state corrections.

Second, the growth in costs for courts and corrections are likely driven both by increased misuse of prescription opioids and by increases in (nonprescription opioid) heroin cases. The operating assumption is that over-prescription and misuse of prescription opioids directly contributed to growth in the heroin market.

Third, many convictions for offenses that are not drug-related may well be fueled in part by OUD. For example, a person with an OUD may commit burglaries to support their OUD and may sell drugs for the same reason. Dorsey and Middleton, with the Bureau of Justice Statistics, examined this connection more closely and reported that nationally in 2004, 17% of state-prison inmates indicated that they committed their current offense in order to acquire money for drugs. This rate was much higher for property offenders, at 30.3%.¹¹ Moreover, the National Crime Victimization Survey from 2007 found that 26% of victims of violent crime indicated that they believed their attackers were under the influence of substances. The 2004 BJS Survey of Inmates in State and Federal Correctional Facilities found that 32% of state inmates reported being under the influence of substances while committing their current offense, and again, this was higher for property offenders, at 39%. Substance use is also considered to be 1 of the "Central 8" risk factors for recidivism.¹²

The PADO conducted a survey of approximately 1800 newly committed inmates over a 2-month period, asking them how drugs interacted with and influenced their criminal offending, regardless of their current committing offense. Results showed that

that 22.2% of the inmates were under the influence of opioids at the time of their most recent offense, with 14.1% indicating that opioids were the only substance they were using. Moreover, 15.2% indicated that they committed their current crime to acquire funds to support their OUD.¹³ This type of study does not always break out the impact of opioids specifically on crimes not related to drugs, but they do establish that substance use plays an important role in the commission of crime writ large. Although we are not able to estimate the costs related to crime overall in the current report, future work should examine this aspect of the opioid crisis more closely and make a preliminary effort to factor in such costs.

The analysis presented here represents an initial attempt to estimate the costs of the opioid epidemic on the operations of the CJS at the state level in a single state. It remains unclear whether the specific findings reported here are representative of the states more generally, as each state's CJS operates differently. For example, the court system in Pennsylvania is operated and funded at the state level, but in other states (eg, Texas), it is more of a state/county hybrid, which would have different ramifications for cost estimation. In terms of policing, Pennsylvania is 1 of about a dozen states in which state police provide policing coverage to local units of government that do not have their own police forces. In Pennsylvania, this amounts to state police coverage of approximately two-thirds of all municipalities, and more than 90% of rural municipalities.¹⁴ In the remainder of states, coverage of municipalities without their own police departments falls upon county sheriffs. Again, the implications for the type of cost analysis conducted in this report would be considerable. Turning to corrections, although most states maintain a distinction between state prisons and county jails, a few states, such as Rhode Island, have a combined state and local corrections system, thus cost estimation would proceed under a somewhat different set of assumptions than what we used here. Conducting an opioid-related cost estimation would require an approach tailored to the public administrative structure of each state, but it is our hope that our overall approach can serve as a template for such cost estimation in the CJSs in other states.

Regarding the issue of cost estimation at the local level, the concerns we have noted in this report regarding data availability and quality at the state level are amplified when considering the local CJSs nationwide. Looking at policing, approximately 18,000 police agencies exist in the United States, most of which are small-town departments that employ fewer than 10 officers.¹⁵ Their arrest activities are of course reflected in UCR, but with the caveats noted earlier. Local corrections consist principally of county-level jails and probation departments (although some states, such

as Arkansas and Massachusetts, operate probation at the state level). The challenges of accessing data on all of their correctional caseflows would be very large.¹⁶ Because of the heavily local and fragmented nature of the criminal justice system, a considerable effort would be required to estimate opioid-related costs at the local level across the nation. ■

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REFERENCES

- Birnbaum HG, White AG, Schiller M, Waldman T, Cleveland JM, Roland CL. Societal costs of prescription opioid abuse, dependence, and misuse in the United States. *Pain Med*. 2011;12(4):657-667. doi: 10.1111/j.1526-4637.2011.01075.x.
- White AG, Birnbaum HG, Mareva MN, et al. Direct costs of opioid abuse in an insured population in the United States. *J Manag Care Pharm*. 2005;11(6):469-479. doi: 10.18553/jmcp.2005.11.6.469.
- Birnbaum HG, White AG, Reynolds JL, et al. Estimated costs of prescription opioid analgesic abuse in the United States in 2001: a societal perspective. *Clin J Pain*. 2006;22(8):667-676.
- Cohen MA. Alcohol, drugs and crime: is "crime" really one-third of the problem? *Addiction*. 1999;94(5):644-647.
- Reuter P. Are calculations of the economic costs of drug abuse either possible or useful? *Addiction*. 1999;94(5):635-638.
- Hansen RN, Oster G, Edelsberg J, Woody GE, Sullivan SD. Economic costs of nonmedical use of prescription opioids. *Clin J Pain*. 2011;27(3):194-202. doi: 10.1097/AJP.0b013e3181ff04ca.
- Florence CS, Zhou C, Lao F, Xu L. The economic burden of prescription opioid overdose, abuse, and dependence in the United States, 2013. *Med Care*. 2016;54(10):901-906. doi: 10.1097/MLR.0000000000000625.
- Economic toll of opioid crisis in US exceeded \$1 trillion since 2001 [news release]. altarm.org/about/news-and-events/economic-toll-of-opioid-crisis-in-u-s-exceeded-1-trillion-since-2001. Washington, DC: Altarm; February 13, 2018. Accessed February 27, 2019.
- Rhyan CN. The potential societal benefit of eliminating opioid overdoses, deaths, and substance use disorders exceeds \$95 billion per year. Altarm website. altarm.org/sites/default/files/uploaded-publication-files/Research-Brief_Opioid-Epidemic-Economic-Burden.pdf. Published November 16, 2017. Accessed February 27, 2019.
- Goldstein PJ, Brownstein HH, Ryan PJ, Bellucci PA. Crack and homicide in New York City, 1988: a conceptually based event analysis. *Contemp Drug Probl*. 1989;16(4):651-687.
- Dorsey TL, Middleton P. Drugs and crime facts. Bureau of Justice Statistics/US Department of Justice website. bjs.gov/content/pub/pdf/dcf.pdf. Accessed February 27, 2019.
- Bonta J, Andrews DA. *The Psychology of Criminal Conduct*. 6th ed. New York: Routledge; 2017.
- Bucklen B. PA DOC Research/Evaluation Capacity and Substance Abuse Research Agenda: Pennsylvania Department of Corrections, Bureau of Planning, Research and Statistics. Published January 17, 2018. Accessed February 27, 2019.
- Zajac G, Kowalski L. An examination of Pennsylvania state police coverage of municipalities. rural.palegislature.us/documents/reports/state_police_coverage_2012.pdf. Published October 2012. Accessed February 27, 2019.
- Banks D, Hendrix J, Hickman M, Kyckelhan T. National Sources of Law Enforcement Employment Data. Bureau of Justice Statistics/US Department of Justice website. bjs.gov/content/pub/pdf/nsleed.pdf. Published April 2016. Revised October 4, 2016. Accessed February 27, 2019.
- Zajac G, Kowalski L. An Examination of Pennsylvania's Rural County Prison Systems. https://justicecenter.la.psu.edu/research/projects/files/Jails%20Final%20Report%20-%20Justice%20Center%20version.pdf. Published January 2012. Revised April 2012. Accessed February 27, 2019.

Considering the Child Welfare System Burden From Opioid Misuse: Research Priorities for Estimating Public Costs

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and Michael W. Donovan, MA

Introduction

The opioid epidemic has taken the lives of thousands of individuals and devastated the lives of many more.¹ The highly addictive nature of opioids and increased access to both licit and illicit sources, high rates of environmental stress, and societal redefinitions of pain are among several factors that have created the perfect storm for a national epidemic.²⁻⁴ Although much of the initial focus in addressing this crisis was on those who misuse, and on health and criminal justice implications, the negative impact in several areas is now being recognized as well.⁵⁻⁸ Many individuals who misuse opioids are parents or child caregivers. The relationship between substance misuse and child maltreatment has been well established and has resulted in the expansion and creation of child welfare services aimed specifically at protecting the children of substance misusers.⁹⁻¹³ The widespread use of opioids among parents and the resulting impact on parental capacity raise major concerns regarding the well-being and safety of children.¹⁴

Despite the importance of this issue, little research has been conducted that demonstrates the relationship between parental opioid misuse and child welfare involvement, and fewer studies have considered the costs to the child welfare system (CWS) associated with such misuse. The present analyses use publicly available data to provide an initial national estimate of these costs via the use of empirically based estimates of system involvement and CWS costs. These estimates illustrate the potential value of existing data sources while highlighting the potential limitations of existing data and informing data-related needs to provide more accurate estimates that can guide policy and practice in the child welfare field.¹⁵ We begin by reviewing existing research on the relationship between opioid use and CWS involvement. We then present a conceptual model to guide estimates of CWS costs and use publicly available data to project the attributable cost to the CWS from parental opioid misuse. We conclude by discussing data-related needs to improve these estimates that are derived from public data.

ABSTRACT

The negative impact of opioids on those who misuse them has been widely documented. Despite significant spillover effects in the form of elevated rates of child maltreatment and child welfare system (CWS) involvement for children affected by parental opioid misuse, the public costs of opioid misuse to the CWS remain largely undocumented. This work seeks to understand the value and limitations of public data in estimating the costs of the opioid epidemic on the CWS. National data from federal sources are combined with best estimates of the association between opioid misuse and child services system utilization. The limitations of this work are explored, and future research priorities are outlined. Ultimately, this work illustrates the need to (1) improve data quality related to parental opioid misuse and CWS linkages; (2) better estimate the number of children and families coming into contact with the CWS as a result of parental opioid misuse; (3) improve predictions of CWS trajectories, including investigation, service provision, and foster care entry among this population; and (4) better estimate the CWS costs associated with patterns of system involvement resulting from parental opioid misuse. This information is crucial to ensuring the production of high-quality system involvement and cost projections related to the opioid crisis.

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For author information and disclosures, see end of text.

Opioid Misuse and Child Welfare System Involvement

Each year, 7.5 million children are the focus of a child protective services (CPS) investigation for suspected maltreatment, resulting in some level of formal CWS involvement or contact.¹⁶ Although federal data on the specific association between opioid misuse and CWS involvement are limited, ample evidence highlights the role of parental substance misuse as a significant contributing factor to the increased rates of child abuse and neglect, as well as the high rates of foster care entry and poor foster care outcomes.^{8,17,18} National point-in-time estimates of youth in foster care show a decline of more than 20% from fiscal years 2006-2012; however, the subsequent 4-year period through 2016 began to reverse that trend, with a 10% upswing in foster care population numbers.^{16,19-21} More than 70% of states reported increased numbers of youth entering foster placement from 2014 to 2015.²⁰ Although multiple factors may affect rates of CWS involvement (eg, efforts to improve that quality of data reporting), parental substance use is a significant contributing factor to this observed rise: From 2009 to 2016, the percentage of entries submitted to foster care, for which parental substance use was a contributing factor, rose from 26% to 34%, representing the largest percentage increase among reasons for home removal.²¹ State child welfare directors in various localities attributed a significant portion of the rise in foster placement rates to parental substance use, particularly the rise in opioid and methamphetamine use.²¹

Information on referrals for child protection associated with parental substance use are less widely available, in part because these data are not required for federal reporting through the National Child Abuse and Neglect Data System (NCANDS), a federally sponsored national data collection. Between 2015 and 2017, the presence of caregiver drug misuse was a documented risk factor for 27.1% to 30.8% of substantiated or indicated child maltreatment victims; 34 to 35 states provided information.¹⁶ In 2010, using data from the National Survey of Child and Adolescent Well-Being—a nationally representative study of children and youth involved in CPS reports with sample weights to replicate national estimates of system contact and outcomes—Berger and colleagues reported that caseworkers perceived substance use problems in a primary or secondary caregiver in 13% of investigated cases, with approximately 1% having experienced referrals for substance use treatment.²² Caseworker reports of substance use were correlated with significantly higher probabilities of perceived severe risk for harm to children compared with parents with no such indication (24% vs 5%, respectively), receipt of services arranged for or provided to the family (74% vs 43%, respectively), and substantiation (ie, an affirmative maltreatment finding [61% vs 27%, respectively]).²² Further, substance use within this sample was associated with more than twice the risk for out-of-home/foster care placement (38% vs 16%, respectively). These results support

the observation that children in households marked by caregiver substance use are at risk for a more involved system response at 2 phases of investigation—that is, service provision and removal.²²

One factor contributing to the increase in opioid misuse rates has been the access to prescription opioids, particularly among pregnant women and new parents. Prescription opioid use and misuse have increased dramatically among reproductive-age and pregnant women in the United States in recent years.^{23,24} In fact, between 2000 and 2007, overall, 21.6% of Medicaid-enrolled pregnant women filled a prescription for opioids, and 2.5% received opioid prescriptions for an extended period (ie, >30 days).²⁵ Further, between 1992 and 2012, the proportion of pregnant women entering federally funded, facility-based substance use treatment with a history of prescription opioid misuse increased from 2% to 28%.²⁶

The link between opioid use among pregnant women and child welfare reporting is affected by state policy. According to the Guttmacher Institute, statutes in 24 states and the District of Columbia classify substance use during pregnancy as reportable child abuse. A total of 23 states and the District of Columbia require healthcare professionals to report suspected prenatal drug use to child welfare authorities, with 7 states requiring testing for prenatal drug exposure if substance use is suspected. Among 40 states, substance exposure data on risk factors for child maltreatment victims <1 year of age were indicated for 9.8%; for infants <1 month of age, data were indicated for 18.2%; for infants 1 month of age, data were indicated for 3.2%; and for infants between 2 and 11 months of age, data were indicated for 1.5% to 1.9%.²⁷

Neonatal abstinence syndrome (NAS), a related consequence of opioid use among pregnant women, is associated with a negative impact on the developing child across many functional domains. In parallel, with the increased rates of opioid use disorder (OUD), rates of NAS or neonatal withdrawal symptoms from opioids or other drugs have also increased across the United States—from 1.2 cases per 1000 hospital births in 2000 to 5.8 cases per 1000 hospital births in 2012.²⁸ This increase poses a considerable burden on states where prenatal substance exposure must be reported to CPS agencies and can incur significant costs when infants must be placed in special care settings. A recent 10-state study of trends in NAS from 2004 to 2014 revealed a substantial increase in the percentage of reports to CPS for NAS—from 4.72% in 2004 to 9.19% in 2014.²⁹ An Australian study documented that NAS led to a 5.7 times greater likelihood of CPS reporting, an 8.0 times greater likelihood of substantiated child maltreatment, and a 10.5 times greater likelihood of out-of-home placement.³⁰ Finally, a Massachusetts study revealed that, on average, opioid-related NAS resulted in >10,000 hours of additional caseworker activity per month across the statewide system.³¹

Limited data are available that reflect individual- and family-level associations between opioid misuse and CWS involvement.

Several state- and community-level studies provide verification of this association. Wolf and coworkers used community-level hospital discharge data for the state of California to examine the association between prescription opioid overdose and rates of hospitalization for child maltreatment from 2001 to 2011.³² Results demonstrated a significant positive association (relative rate, 1.089; 95% credible interval, 1.004-1.165), indicating that a 1.0% increase in hospital discharges for prescription opioid overdose was associated with an 8.9% increase in hospitalization discharges for child maltreatment.³² Because such cases may represent the most high-risk situations (eg, hospitalization for overdose, hospitalization for maltreatment-related injury), more general population-level research on rates of opioid misuse and CPS referral or foster care placement is needed. In an effort to investigate this association, Quast and colleagues, in a Florida-based study, observed that community-level prescription opioid rates predicted higher rates of foster placements.³³

Nationally, Ghertner and coworkers used county-level data from 2011 to 2016 to determine that rates of overdose-related deaths were related to those of CPS and child welfare involvement: A 10.0% increase in drug overdose deaths was associated with a 2.4% increase in reports of maltreatment to CPS, a 2.4% increase in substantiated reports, and a 4.4% increase in foster care entries.³⁴ Drug-related hospitalizations generated a similar pattern: A 10.0% increase was associated with a 1.7% increase in reports of maltreatment to CPS, a 1.9% increase in substantiated reports, and a 3.0% increase in the foster care entries.³⁴

Substance misuse is a significant contributing factor to increased rates of child abuse and neglect. Over recent decades, greater access to such addictive substances as opioids has increased the probability of long-term substance use and addiction problems and has increased the likelihood of child maltreatment on the part of parents across the country. As child maltreatment rates are affected, so, too, is the probability of formal involvement with the CWS. Next, we consider a conceptual framework for projecting national costs from increased CWS needs attributable to opioids.

Conceptual Framework

The evidence summarized above illustrates how rising rates of substance misuse among parents are linked to increases in problems related to child maltreatment, which require action from the CWS. To provide a conservative estimate of costs for child and family services, specifically those associated with opioid use, modeling the impact on system service utilization is required. Several pathways are followed once child maltreatment is suspected (ie, a referral is made because suspicions exist that a child is in danger). Different pathways are associated with different costs, which involve personnel time and other administrative resources. For the purpose of this initial work, we consider 3 service categories that are likely affected

by increased access due to any form of opioid misuse: prescription opioids, heroin, and fentanyl.

Child Protective Services: CPS can involve intake, screening, family assessment or alternative response, and investigation services, as well as all associated administrative supports. Of these services, the 2 most costly types of CPS are screening and investigation.³⁵ The screening process involves the receipt and processing of child maltreatment referrals, to determine whether a report meets the criteria for further investigation or assessment (“screened-in”) or is below this threshold (“screened-out”). Screened-in reports are then referred for an investigation or an alternative response (eg, family assessment). Investigation, which involves activities that are designed to determine the validity of the child maltreatment allegation, results in a case finding (ie, substantiated/indicated or unsubstantiated/unfounded), as well as the determination of a child’s safety or future risk for harm/maltreatment. Alternative response focuses less on investigating the occurrence of maltreatment but rather on assessing underlying factors that may affect child safety and family-level needs to reduce the likelihood of maltreatment.³⁵

In-Home Services: In-home services are provided when a need is determined after an investigation or a family assessment. These can include the following services: support for parenting, including parental training, coaching, and/or skill building; individual and/or family therapy; referral for substance use treatment and skill building to enhance coping and/or replacement behaviors; referral for mental or behavioral health treatment; support for applying treatment gains to family management and child safety; information on and referral for job training; assistance with child care, transportation, budgeting, and other logistical planning; and concrete assistance, such as food, clothing, furniture, and/or housing.

Out-of-Home Services: The primary out-of-home service within the CWS involves placement. Children may be temporarily placed in state custody, which leads to placement in a traditional foster home (eg, nonrelative), with a relative (eg, kinship care or relative foster home), in a specialty foster home setting (eg, treatment foster care), or in congregate care settings (eg, shelter care, group home, or residential care facility).

Modeling Child Welfare System Service Utilization

Here, we build on previous works that have simulated the costs of the CWS and the effects of environmental or policy changes.³⁶ We adopt an analogous conceptual framework to capture the major cost drivers, incorporating projections by the Washington State Institute for Public Policy and the RAND Corporation (**Figure 1**).^{34,36,37} A simulation approach for modeling has been used to demonstrate how changes in child maltreatment affect service utilization and consequent costs to the CWS.³⁷

To conduct our analysis, we first obtained annual data on child maltreatment and CWS utilization rates from the NCANDS and the

Adoption and Foster Care Analysis and Reporting System (AFCARS).^{16,20,21} The NCANDS is a voluntary data collection system that gathers information from all 50 states, the District of Columbia, and Puerto Rico on reports of child maltreatment. NCANDS was established in response to the Child Abuse Prevention and Treatment Act of 1988. The NCANDS child file includes information for each child involved in a completed CPS investigation during the fiscal reporting period. Elements include demographics of children and their perpetrators, types of maltreatment, case disposition, child and family risk factors, and postinvestigation services provided to the child and/or his/her family. The data are used to examine trends in child maltreatment across the country, with key findings published in our Child Welfare Outcomes Reports to Congress and annual Child Maltreatment reports. This includes children who receive protective and in-home services.

AFCARS collects case-level information from state and tribal title IV-E agencies on all children in foster care and those who have been adopted with title IV-E agency involvement. Examples of data reported in AFCARS include demographic information on the foster child, as well as the foster and adoptive parents; the number of removal episodes a child has experienced; the number of placements in the current removal episode; and the current placement setting. Title IV-E agencies are required to submit the AFCARS data twice a year based on two 6-month reporting periods.^{16,20,21}

Importantly, neither NCANDS nor AFCARS includes direct information about the role of opioids in the CPS report or foster care entry, although each has indicators related to parental drug use more generally. NCANDS includes information on whether drug use was an identified caregiver risk factor, which is not submitted by all states, and AFCARS includes parental drug use as a reason for foster care placement. Our purpose in using NCANDS and AFCARS

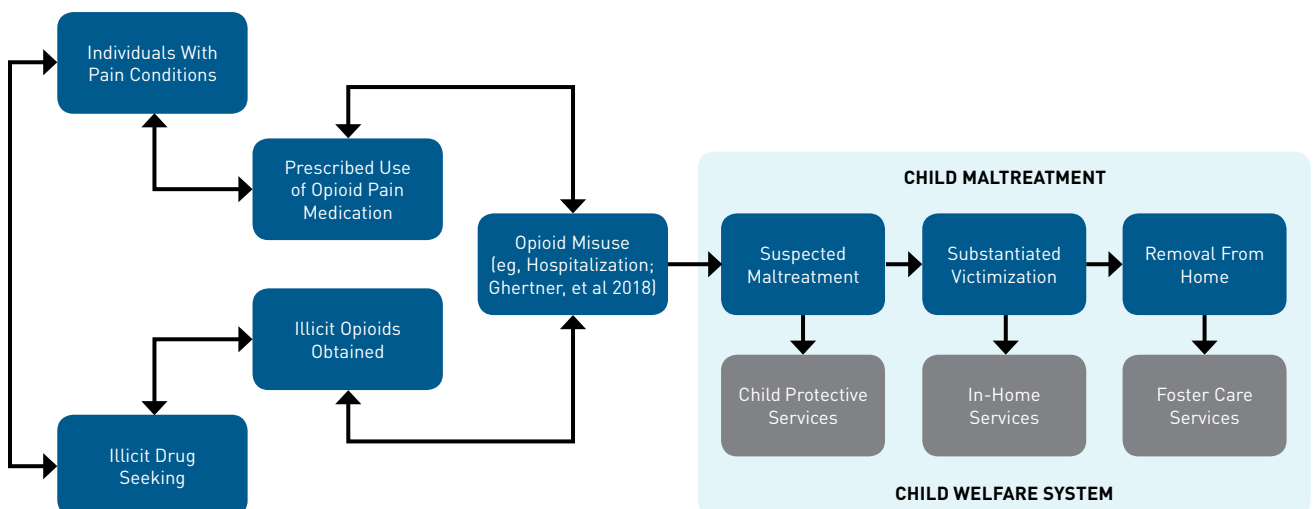
was to estimate national trends in CPS and CWS involvement that may be attributable to opioids based on prior research, as well as to estimate state child welfare costs.

Projecting National Child Welfare Service Utilization

Before estimating the portion of CWS utilization attributable to opioids, we first used annual national data to calculate the total levels and rates of CPS, in-home services, and foster care services provided between 2011 and 2016 (Figure 2).^{21,38} Both the total number of children with CPS involvement and those receiving in-home services were identified from NCANDS data.^{16,20,21} AFCARS collects information on the total number of children entering foster care each year.^{16,20,21} The costs associated with screening, investigation, and foster care were identified from published national estimates. For projections, we used a national per-case average cost in 2014—the most recent year available—of CPS utilization (\$2447), in-home service utilization (\$3680), and foster care (\$33,210).³⁵ All cost estimates were adjusted for inflation.²¹

With the goal of this work intended to highlight what publicly available data indicate the attributable CWS costs of the opioid epidemic to be, these estimates are expected to have key limitations that will serve to inform future research in this area. In particular, this work will be limited by the availability of data (eg, post 2016), as well as by limited information about the direct impact of opioids on rates of child maltreatment and formal CWS involvement. These factors limit precision of the range of the attributable impact of opioids. Additionally, given data limitations, our analysis does not value the downstream costs of child maltreatment attributable to opioids relative to the health and development of the maltreated child, although future work should seek to determine this additional

FIGURE 1. Conceptual Framework Linking Opioid Misuse to Child Maltreatment and Child Welfare System Service Utilization^{34,36,37}



burden for addressing such needs. Greater downstream costs to child and family services are likely to also result from misuse of opioids among pregnant mothers. In this context, estimates derived from public data are likely to be conservative estimates of the total CWS costs from opioid misuse.

Considering Attributable Impact of Opioid Misuse on the Child Welfare System

Limited information is available to determine the exact relationship between opioid availability and changes in child maltreatment, along with the consequent impact on CWS costs. To project the relationship between opioid misuse and CWS, we used the research from Ghertner and colleagues, which estimates the relationship between opioid-related hospitalizations and CWS utilization.³⁴ Specifically, from 2011 to 2016, a 10.0% increase in opioid-specific hospitalizations corresponded with a 1.1% increase in reports of maltreatment, a 1.1% increase in substantiated maltreatment reports, and a 1.2% increase in foster care entry. These numbers represent the only national, peer-reviewed estimates of the relationship between opioid-related hospitalizations and child welfare outcomes. In this context, they represent the best estimates available. Opportunities to improve these estimates are described below. Using data from the Healthcare Cost and Utilization Project, we calculated the projected increase

in child welfare reports, substantiations, and foster care entries attributable to opioid hospitalizations.³⁹ The formula is reflected in **Figure 3**.³⁹ From the projection of the attributable impact of opioid misuse on the CWS, utilization and costs can be estimated. Based on the standard errors for the association of opioid hospitalizations and child welfare utilization reported by Ghertner and colleagues, 95% confidence intervals were constructed to model uncertainty in these estimates.³⁴ These models seek to capture the upper and lower bounds of these estimates.

Projected Child Welfare Resource Utilization and Costs Attributable to Opioid Misuse

The costs presented here represent high and low estimates based on the previously described assumption each year for the 3 key CWS categories. Although these estimates represent rough calculations, they are the best estimates given the currently available public data. Specifically, between 2011 and 2016, the CWS experienced more than \$2.8 billion in costs attributable to opioid misuse, or about 2.1% of all child welfare costs during this time. This approach also demonstrated that in these 5 years, >200,000 reports of suspected child maltreatment, >80,000 victims of substantiated maltreatment, and >95,000 foster care entrants were attributable to opioid misuse.^{21,39} The projected costs attributable to each form of service grew across time (regardless of inflation; **Figure 4**).^{21,39} As expected, foster care services represent the largest driver of child welfare costs attributable to opioids.

Importantly, we sought to explore uncertainty in these estimates. Specifically, this included modeling the uncertainty of the association between opioid misuse (ie, hospitalization) and increases in CWS service needs. Bearing this in mind, we constructed 95% confidence intervals around these estimates. This represented a total attributable cost range between \$2.65 billion and \$3.0 billion. Costs attributable to CPS were between \$852 million and \$900 million, costs attributable to in-home services ranged between \$162 and \$174 million, and costs attributable to foster care were between \$1.6 and \$1.9 billion.

Limitations and Priorities for Future Work

Through this work, we sought to highlight what is known about the attributable costs of opioid misuse to the CWS based on public data.

FIGURE 2. US Child Welfare System Involvement^{21,38}

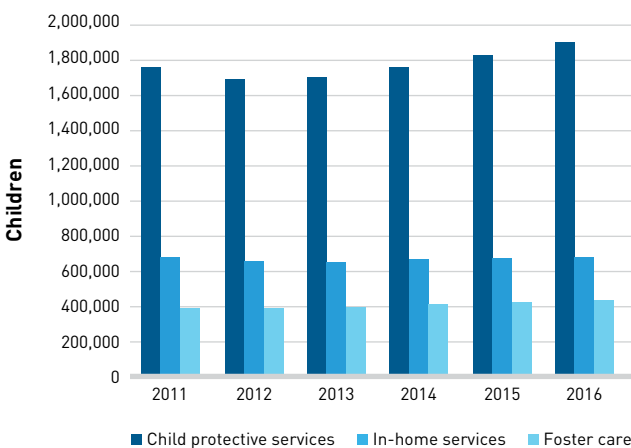


FIGURE 3. Formula for the Projected Increase in Child Welfare Reports, Substantiations, and Foster Care Entries Attributable to Opioid Hospitalizations³⁹

$$\text{Attributable Child Welfare Costs From Opioids} = \sum \text{National Average Cost of Utilization}_A * \{ [\text{Total Service Utilization}_A] * [\text{Associated \% increase in services}_A * \{ \frac{1 - \text{Opioid Hospitalizations}_{2010}}{\text{Opioid Hospitalizations}_x} \}] \}$$

This effort was intended to generate estimates of the costs to the CWS that are attributable to opioids. All assumptions and estimates were intentionally designed to provide an initial estimate of the potential CWS costs that reflected the limitations of the data. This work was limited by the scarcity of data, as well as by the limited information available on the direct impact of opioids on child maltreatment. This, in turn, limited the precision of all estimates of the attributable impact from opioids. Further, they reflect the estimates based on the work of the Administration for Children and Families and the research by Ghertner and coworkers.^{19,34} As described below, further efforts to develop convergent evidence from multiple studies will help to improve the precision and utility of these estimates. Child maltreatment is associated with substantial known costs to the healthcare system and the education system. Additionally, we do not include other potential cost drivers to the CWS that would increase projected cost estimates (eg, adoption services, federal overhead costs). Lacking the availability of better information on these linkages, we provide this initial estimate based on more direct costs.

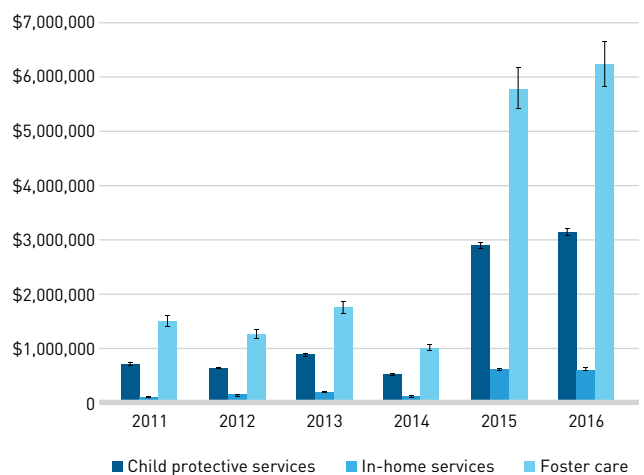
Ultimately, these estimates require several kinds of data to improve precision and capture the full range of costs. This includes individual-level child welfare data, preferably with information that would allow for linkage to perpetrators' medical records. For example, a linkage between Medicaid records and perpetrator records could allow a direct estimation of costs. Additionally, information on the availability of opioids within local geographic areas would allow for an improved understanding of how availability relates to changes in child maltreatment.

Understandably, most of the focus on family and child services affected by the opioid epidemic is related to the CWS. Service utilization for additional family needs, however, should be considered as well. Recent studies have noted trends for necessary treatment and programming to address personal and family dysfunction resulting from opioid addiction that is directly or indirectly related to opioid use.⁴⁰ For example, OUD is associated with a greater risk for intimate partner violence (IPV). Although it is challenging to sort through the reciprocal relationships between OUD and IPV, studies have documented an increased likelihood for IPV following substance use.⁴¹ The family problems resulting from OUDs are likely to coincide with increased rates of IPV, thus requiring effective treatment that can serve collateral issues. Also occurring comorbidly with OUDs are mental health conditions that are exacerbated by long-term problems. Effective treatment for opioid misuse requires resources that address mental health needs concurrently, with some of the burden falling on state governments. The urgent need for adequate mental health support has led several states to seek joint support from the federal government. This is particularly true of children in foster care, whose healthcare costs are, on average, higher than those of children not in foster care.⁴²

The opioid epidemic has led to efforts to implement and fund services that address family issues linked to substance misuse. These include services for treatment and prevention that may not have been required in the past. For example, the state of Wisconsin has developed Project Hope (Heroin, Opiate, Prevention, and Education) to serve families, including treatment and prevention programming, monitoring prescription drug patterns, and increasing the response time of public health officials to reported problems.⁴³ This initiated \$2 million per year to help support treatment and prevention efforts; \$250,000 in additional funds per year through the Child Psychiatry Consultation Partnership was provided for mental health services, and an additional \$5.4 million was allocated in the recent annual budget for the treatment of residential substance use.⁴³ Substantial state costs are linked to personnel and other administrative costs for funding and planning programs to address the problems that arise from opioid misuse. These costs are not captured by estimates provided in publicly available data.

Ultimately, these limitations illustrate what can be accomplished with currently available public data and can underscore the opportunities for future work. Of particular concern is the fact that these data are likely what many policy makers and practitioners rely on to guide their efforts to address the current opioid epidemic. To improve estimates of the full costs of the opioid epidemic for children and families, a clear need exists for more research and strong available data in this area.⁴⁴ From this effort, we identified 4 core priority domains and highlighted illustrative

FIGURE 4. Projected Marginal Child Welfare Expenditures From the Opioid Epidemic (2011-2016)^{21,39}



AFCARS indicates Adoption and Foster Care Analysis and Reporting System; HCUP, Healthcare Cost and Utilization Project; NCANDS, National Child Abuse and Neglect Data System. Error bars provide 95% confidence interval range of projection; projections based on HCUP, NCANDS, and AFCARS data (2011-2016).

examples of what is needed to move the field forward (Table). Specifically, there is a need to (1) improve data quality, (2) better identify the causal relationship between opioid misuse and child maltreatment, (3) increase model sensitivity to heterogeneity, and (4) develop improved price information.

Data Quality: Key to improving our understanding in this area includes improving the quality of data to better reflect a number of key issues. This includes enhanced documentation of the type of opioid misuse tracked in healthcare databases (eg, prescription opioid, heroin, fentanyl), along with the need to link electronic medical records and claims data with CWS records—in particular, perpetrator data. Further, there is a need to enhance the quality of healthcare data from pediatric care providers who capture injury and illness data related to child maltreatment.

Mapping Opioid Misuse and Maltreatment Associations: To strengthen the quality of projection estimates, there is a need for investigators to prioritize our understanding of the specific pathways of opioid misuse that lead to child maltreatment. Our estimates focus on associations between opioid-related hospitalization rates and CPS or CWS involvement, but research also must address the direct link between caregiver misuse and CWS contact. These paths may include prenatal exposure and NAS, as well as the relationships between opioid misuse and the occurrence of child abuse or neglect. Similarly, pathways to foster care placement may be associated with caseworker estimates of increased risk among

households affected by opioid misuse but may also include entry to foster care due to the death of a parent that is attributable to opioid misuse. Moreover, elucidating the differential relationships between opioid misuse and other forms of maltreatment (ie, neglect; physical, sexual, and psychological abuse) and placement trajectories (eg, length of stay, type of placement) is also important. Clearer indicators of the association between parental opioid misuse and the differential pathways of CWS involvement associated with misuse would reduce the uncertainty in estimates and provide more precise cost projections.

Understanding Heterogeneity: Increasing the utility of projection models requires improved understanding of the heterogeneity across geographic locales, as well as key demographic groups. This involves, in particular, more detailed estimates of variation in opioid misuse across gender and racial groups and whether there are subgroup differences in future engagement with the CWS. Further, understanding how contextual factors are related to misuse and maltreatment is also important. For example, regional variation in urbanicity and neighborhood socioeconomic variability are critical aspects to consider.

Cost Information: Ultimately, the success of cost projections requires accurate price estimates to minimize uncertainty.⁴⁵ These data should account for local price information, such that the cost of services will enhance our understanding of how market prices fluctuate over time (eg, inflation). Finally, accurate price information should provide not only average costs of service provision but also marginal price estimates that reflect the costs for local markets (eg, scarcity of child welfare workers, limited foster care sites).

TABLE. Research Priorities for Understanding the Impact of Opioid Use on the Child Welfare System

Research Priority Domain	Key Priorities
Data Quality	<ul style="list-style-type: none"> Improved documentation of type of opioid misused Linkages between healthcare electronic medical records and claims (public, private, managed care) and child welfare system perpetrator data Improved measurement and documentation in pediatric context of maltreatment-related injury or illness Markers of access to treatment and patient refusal when treatment is offered
Mapping Opioid Misuse and Maltreatment Associations	<ul style="list-style-type: none"> Pathways of opioid misuse that lead to child maltreatment (death, injury, financial loss) Relationships of opioid misuse with different forms of maltreatment (neglect; physical, sexual, and psychological abuse) Impact of opioid misuse on parental vs nonparental perpetration Reduced uncertainty in association estimates
Understanding Heterogeneity	<ul style="list-style-type: none"> Understanding of geographic variability in misuse and service utilization Ethnic, racial, and gender variability in opioid misuse Rural vs suburban vs urban variability in misuse and service availability Socioeconomic variability in opioid misuse
Improving Price Information	<ul style="list-style-type: none"> Geographic variability in price information (state, county) Temporal variability in price information (year)

Conclusions

This work sought to understand how publicly available data can inform estimates of the attributable costs of CWS from opioid misuse. Preliminary estimates indicate a substantial burden of different child welfare services from opioid misuse but also illustrate a high degree of uncertainty in terms of magnitude. We identify a number of research priorities that provide a map for future research. In this context, we view these high costs to children and their families from this epidemic as key to motivating not only further inquiry but also strategic investment in evidence-based programs and policies. ■

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REFERENCES

- Rudd RA, Aleshire N, Zibbell JE, Gladden RM. Increases in drug and opioid overdose deaths—United States, 2000–2014. *MMWR Morb Mortal Wkly Rep*. 2016;64(50-51):1378-1382.
- Crowley DM, Jones DE, Coffman DL, Greenberg MT. Can we build an efficient response to the prescription drug abuse epidemic? assessing the cost effectiveness of universal prevention in the PROSPER trial. *Prev Med*. 2014;62:71-77.
- Murthy VH. Ending the opioid epidemic — a call to action. *N Engl J Med*. 2016;375(25):2413-2415.
- Skolnick P. The opioid epidemic: crisis and solutions. *Ann Rev Pharmacol Toxicol*. 2018;58:143-159.
- Leslie DL, Ba DM, Agbese E, Xing X, Liu G. The economic burden of the opioid epidemic on states: the case of Medicaid. *Am J Manag Care*. 2019;25:S243-S249.
- Zajac G, Aveh Nur S, Kreager DA, Sterner G. Estimated costs to the Pennsylvania criminal justice system resulting from the opiate crisis. *Am J Manag Care*. 2019;25:S250-S255.
- Segeal JE, Shi Y, Moran JR, Scanton DP. Opioid misuse, labor market outcomes, and means-tested public expenditures: a conceptual framework. *Am J Manag Care*. 2019;25:S270-S276.
- Morgan PL, Wang Y. The opioid epidemic, neonatal abstinence syndrome, and estimated costs for special education. *Am J Manag Care*. 2019;25:S264-269.
- Connell CM, Bergeron N, Katz KH, Saunders L, Tebes JK. Re-referral to child protective services: the influence of child, family, and case characteristics on risk status. *Child Abuse Negl*. 2007;31(5):573-588.
- English DJ, Marshall DB, Brummel S, Orme M. Characteristics of repeated referrals to child protective services in Washington state. *Child Maltreat*. 1999;4(4):297-307.
- Magura S, Laudet AB. Parental substance abuse and child maltreatment: review and implications for intervention. *Child Youth Serv Rev*. 1996;18(3):193-220.
- Swinglen L, Dykstra RE, Simpson JL, et al. Associations between family history of substance use, childhood trauma, and age of first drug use in persons with methamphetamine dependence. *J Addict Med*. 2016;10(4):269-273.
- Walsh C, MacMillan HL, Jamieson E. The relationship between parental substance abuse and child maltreatment: findings from the Ontario Health Supplement. *Child Abuse Negl*. 2003;27(12):1409-1425.
- Fuller TL, Wells SJ. Predicting maltreatment recurrence among CPS cases with alcohol and other drug involvement. *Child Youth Serv Rev*. 2003;25(7):553-569.
- National Academies of Sciences, Engineering, and Medicine. Advancing the power of economic evidence to inform investments in children, youth, and families. Washington, DC: The National Academies Press; 2016. doi: 10.17726/23481.
- HHS; Administration for Children and Families; Administration on Children, Youth and Families; Children's Bureau. Child maltreatment 2017. acf.hhs.gov/sites/default/files/cb/cm2017.pdf. Accessed June 19, 2019.
- Brook J, McDonald T. The impact of substance abuse on the stability of family reunifications from foster care. *Child Youth Serv Rev*. 2009;31(2):193-198.
- Vanderploeg JJ, Connell CM, Caron C, Saunders L, Katz KH, Tebes KJ. The impact of parental alcohol or drug removals on foster care placement experiences: a matched comparison group study. *Child Maltreat*. 2007;12(2):125-136.
- HHS; Administration for Children and Families; Administration on Children, Youth and Families; Children's Bureau. Child maltreatment 2014. acf.hhs.gov/sites/default/files/cb/cm2014.pdf. Accessed June 19, 2019.
- HHS. Administration for Children and Families; Administration on Children, Youth and Families; Children's Bureau. Child maltreatment 2015. acf.hhs.gov/sites/default/files/cb/cm2015.pdf. Accessed June 19, 2019.
- HHS. Administration for Children and Families; Administration on Children, Youth and Families; Children's Bureau. Child maltreatment 2016. acf.hhs.gov/sites/default/files/cb/cm2016.pdf. Accessed June 19, 2019.
- Berger LM, Slack KS, Waldfogel J, Bruch SK. Caseworker-perceived caregiver substance abuse and child protective services outcomes. *Child Maltreat*. 2010;15(3):199-210.
- Haight SC, Ko JY, Tong VT, Bohm MK, Callaghan WM. Opioid use disorder documented at delivery hospitalization — United States, 1999–2014. *MMWR Morb Mortal Wkly Rep*. 2018;67(31):845-849.
- Krans EE, Patrick SW. Opioid use disorder in pregnancy: health policy and practice in the midst of an epidemic. *Obstet Gynecol*. 2016;128(1):4-10.
- Desai RJ, Hernandez-Diaz S, Bateman BT, Huybrechts KF. Increase in prescription opioid use during pregnancy among Medicaid-enrolled women. *Obstet Gynecol*. 2014;123(5):997-1002.
- Martin CE, Longinaker N, Terplan M. Recent trends in treatment admissions for prescription opioid abuse during pregnancy. *J Subst Abuse Treat*. 2015;48(1):37-42.
- Guttmacher Institute. Substance use during pregnancy. Guttmacher Institute website. guttmacher.org/state-policy/explore/substance-use-during-pregnancy. Accessed June 14, 2019.
- Wang X, Zhu Y, Dave CV, Alrwisan AA, Voils SA, Winterstein AG. Trends of neonatal abstinence syndrome epidemic and maternal risk factors in Florida. *Pharmacotherapy*. 2017;37(7):806-813.
- Lynch S, Sherman L, Snyder SM, Mattson M. Trends in infants reported to child welfare with neonatal abstinence syndrome (NAS). *Child Youth Serv Rev*. 2018;86:135-141.
- O'Donnell M, Nassar N, Leonard H, et al. Increasing prevalence of neonatal withdrawal syndrome: population study of maternal factors and child protection involvement. *Pediatrics*. 2009;123(4):e614-e621.
- Franca UL, Mustafa S, McManus ML. The growing burden of neonatal opiate exposure on children and family services in Massachusetts. *Child Maltreat*. 2016;21(1):80-84.
- Wolf JP, Ponicki WR, Kepple NJ, Gaidus A. Are community level prescription opioid overdoses associated with child harm? a spatial analysis of California zip codes, 2001–2011. *Drug Alcohol Depend*. 2016;166:202-208.
- Quast T, Storch EA, Yampolskaya S. Opioid prescription rates and child removals: evidence from Florida. *Health Aff (Millwood)*. 2018;37(11):134-139.
- Ghertner R, Waters A, Radel L, Crouse G. The role of substance use in child welfare caseloads. *Child Youth Serv Rev*. 2018;90:83-93.
- Crowley M, Jones D. A framework for valuing investments in a nurturing society: opportunities for prevention research. *Clin Child Fam Psychol Rev*. 2017;20(1):87-103.
- Ringel JS, Schultz D, Mendelsohn J, et al. Improving child welfare outcomes: balancing investments in prevention and treatment. *Rand Health Q*. 2018;7(4):4.
- Lee S, Aas S, Miller MG. Evidence-based programs to prevent children from entering and remaining in the child welfare system: benefits and costs for Washington. Olympia, WA: Washington State Institute for Public Policy, document 08-07-3901. wsipp.wa.gov/ReportFile/1020/Wsipp_Evidence-Based-Programs-to-Prevent-Children-from-Entering-and-Remaining-in-the-Child-Welfare-System-Benefits-and-Costs-for-Washington_Report.pdf. Published July 2008. Accessed June 17 2019.
- Adoption and Foster Care Analysis and Reporting System (AFCARS). Children's Bureau website. acf.hhs.gov/cb/research-data-technology/reporting-systems/afcars. Updated April 22, 2019. Accessed June 19, 2019.
- Healthcare Cost and Utilization Project (HCUP). Trends in opioid-related inpatient stays and emergency department visits, national and state. HCUP website. hcup-us.ahrq.gov/faststats/OpioidUseMap. Updated April 2019. Accessed June 19, 2019.
- Fals-Stewart W, O'Farrell TJ. Behavioral family counseling and naltrexone for male opioid-dependent patients. *J Consult Clin Psychol*. 2003;71(3):432-442.
- Moore BC, Easton CJ, McMahon TJ. Drug abuse and intimate partner violence: a comparative study of opioid-dependent fathers. *Am J Orthopsychiatry*. 2011;81(2):218-227.
- Harman JS, Childs GE, Kelleher KJ. Mental health care utilization and expenditures by children in foster care. *Arch Pediatr Adolesc Med*. 2000;154(11):1114-1117.
- Nygren J. Heroin, Opioid Prevention and Education (HOPE) agenda. Wisconsin State Legislature website. legis.wisconsin.gov/assembly/hope. Accessed June 19, 2019.
- Crowley DM, Scott JT. Bringing rigor to the use of evidence in policy making: translating early evidence. *Public Admin Rev*. 2017;77(5):650-655.
- Crowley DM, Dodge KA, Barnett WS, et al. Standards of evidence for conducting and reporting economic evaluations in prevention science. *Prev Sci*. 2018;19(3):366-390.

The Opioid Epidemic, Neonatal Abstinence Syndrome, and Estimated Costs for Special Education Services

Paul L. Morgan, PhD, and Yangyang Wang, MA

Conceptual Framework

Maternal opioid use is hypothesized to result in neonatal abstinence syndrome (NAS), as well as in cognitive, physical, and behavioral impairments that create both academic and behavioral difficulties in school. **Figure 1** displays a conceptual model that summarizes hypothesized or reported linkages between early exposure to opioids, including maternal prescribed use, and children's subsequent risk for disability identification that results in them receiving special education services. We summarize findings from empirical studies reporting on these linkages below.

Opioid Misuse and Children's Risk for Disability Identification

Children who are prenatally exposed to opiates are about twice as likely as nonexposed children to display intellectual disabilities and mild developmental impairments at 1 year of age.¹ Exposed children are at a greater risk for attention-deficit/hyperactivity disorder (ADHD) and other types of behavioral disorders² that can occur up to 8 years after birth.³ Children born to parents addicted to opiates display risk alleles for ADHD.⁴ These children also experience cognitive delays not fully elucidated by other factors (eg, low birth weight),⁵ which become increasingly more severe over time. For example, at 8 years of age, both boys and girls who were prenatally exposed to opiates demonstrated levels of general cognitive functioning that averaged less than 1 standard deviation lower than those of children who were not exposed.⁶ A linear relationship between increased prescription opioid dosage and greater risk for adverse clinical outcomes among infants is evident, including an increased risk for prematurity and longer postdelivery hospitalization despite statistical control for a range of covariates.⁷

Opioid misuse is likely intergenerational. Children born to mothers using opioids are more likely to misuse opioids as adults.⁸ Clinical practice recommendations suggest that children with ADHD, speech or language impairments, specific learning disabilities, or other types of disorders or disabilities that impair their major life activities (eg, schooling) should be provided with specialized services and interventions. Doing so may improve educational

ABSTRACT

Children whose mothers used or misused opioids during their pregnancies are at an increased risk of exhibiting cognitive or behavioral impairments in the future, which may result in identifiable disabilities that require special education services in school. The costs associated with these additional educational services, however, have remained unknown. Using data from available empirical work, we calculated a preliminary set of cost estimates of special education and related services for children diagnosed with neonatal abstinence syndrome (NAS). We estimated these costs for a single cohort of children from the Commonwealth of Pennsylvania with a diagnosis of NAS. The resulting cost estimates were \$16,512,996 (2017 US\$) in total educational services provisions, with \$8,256,498 (2017 US\$) of these costs attributable to the additional provision of special education services. This estimate includes both opioid use during pregnancy that was linked to NAS in general and NAS that resulted specifically from prescription opioid use. We estimate the total annual education costs for children born in Pennsylvania with NAS associated with maternal use of prescription opioids to be \$1,012,506 (2017 US\$). Of these costs, we estimate that \$506,253 (2017 US\$) are attributable to the additional provision of special education services. We detail the calculation of these cost estimates and provide an expanded set of estimates for additional years of special education services (3-year, 5-year, and 13-year, or the K-12 educational time frame). We conclude with a discussion of limitations and suggestions for future work.

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opportunities over time and reduce the risk for opiate use during adolescence or adulthood.⁴

NAS and Increased Risk for Academic and Behavioral Difficulties

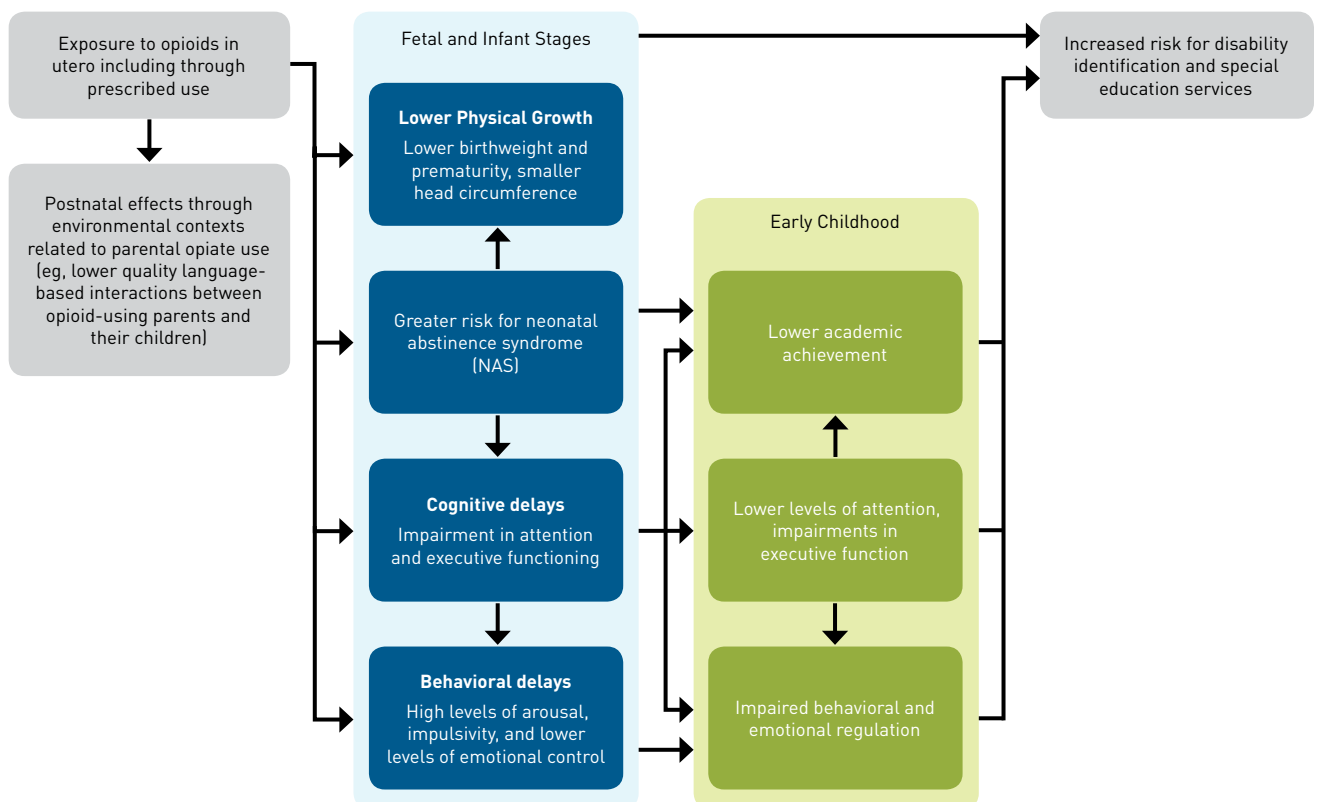
NAS is a general multisystem disorder that predominantly involves the central and automatic nervous systems. NAS results from a sudden discontinuation of fetal exposure to substances used or misused by mothers during their pregnancies, including prescription opioids.⁹ Infants with NAS experience sudden withdrawal symptoms and later exhibit high levels of stress, dysregulated behavior, hyperactivity, poor sleep, rapid respiration, and other indicators of nervous system distress. About 75% to 90% of prenatal opioid-exposed infants are diagnosed with NAS.^{10,11} NAS is considered an expected and treatable condition in these infants.¹² Opioid agonist pharmacotherapy can help manage neurobiological effects of opioid exposure or social impacts of maternal addiction that may result in NAS. Opioid agonist pharmacotherapy can also help to improve adherence to addiction treatment as well as prenatal care.¹²

Use of opioids by women during their pregnancies, including as prescribed by a physician, is associated with a greater risk for NAS. Current estimates of NAS are 5.9 per every 1000 deliveries (95% CI,

5.6 to 6.2).¹³ A dose-response relationship has been observed between the use of prescription opioids and a child’s risk for NAS.¹³ The risk for NAS increases with a cumulative dose of opioids, as well as with later (eg, third trimester) versus earlier (eg, first trimester) use. Absolute risk for NAS among mothers who are long-term users of prescription opioids with no other measured risk factors (eg, history of alcohol, smoking, substance misuse, or use of other psychotropic medications) is estimated to be 4.2 per 1000 live births (95% CI, 3.3 to 5.4).¹³ The adjusted relative risk for long-term versus short-term users in propensity score-matched analyses is estimated to be 5.67 per 1000 live births (95% CI, 3.07 to 10.47).¹³ The risk for NAS, however, increases in mothers who use prescription opioids and present with other risk factors.

The incidence of NAS has been increasing rapidly throughout the United States. The Centers for Disease Control and Prevention (CDC) estimated that the overall incidence rate of NAS in 2013 increased by 300%—from 1.5 per 1000 live births to 6.0 per 1000 live births.¹⁴ In 2011, it was estimated that the Middle Atlantic region (ie, New York, Pennsylvania, and New Jersey) had a mean NAS incidence rate of 6.8 per 1000 live births.¹⁴ Between 2000 and 2013, the incidence rates of NAS in West Virginia increased sharply—from 0.5 per 1000 live births to 33.4 per 1000 live births. The rise in NAS incidence

FIGURE 1. Special Education Conceptual Framework



rate occurred simultaneously with a similar increase in the rate of delivering mothers diagnosed as opioid-dependent or using opiates at the time of delivery—from 1.19 per 1000 hospital births to 5.63 per 1000 hospital births nationally between 2000 and 2009.¹⁵ The incidence of both maternal opioid use and NAS has been on the rise, particularly in rural counties in the United States,^{16,17} suggesting that rural communities are disproportionately affected.

Children with NAS have a lower birth weight, length, and mean head circumference at birth, and they are more likely to be born with birth defects.¹⁸ Children with NAS are also more likely to be hospitalized,¹⁹ and to exhibit significantly lower levels of language ability and general cognitive functioning over time. This includes low levels of functioning and a greater likelihood of displaying extremely low levels of functioning, which increases the risk for disability identification among these children and results in them receiving special education services. For example, in 2015, Beckwith and Burke reported that 14.3% and 7.1% of children with NAS exhibited extremely low levels of language and general cognitive functioning, respectively.²⁰ The contrasting percentages from a general sample of children were 3.7% and 2.4%, respectively,²⁰ suggesting that infants and toddlers with NAS are approximately 3 to 4 times more likely to exhibit extremely low levels of language and general cognitive functioning. Neurodevelopmental impairment is evident as early as 6 months of age²¹ and remains evident at 3 years of age,²² as indicated across multiple measures of cognitive functioning, intelligence, social maturity, and psychomotor abilities.

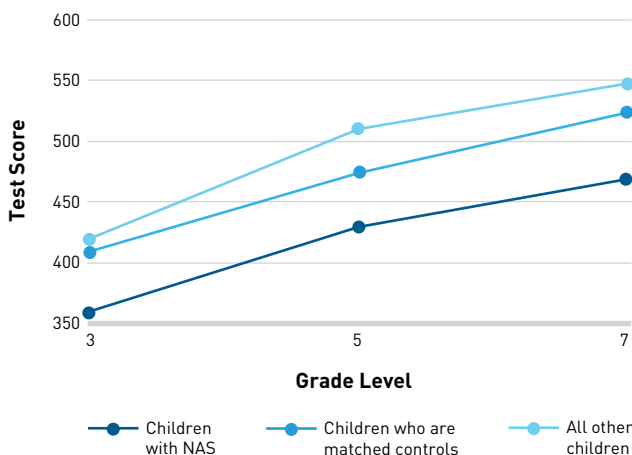
Children with NAS manifest declining academic achievement relative to their peers during elementary and middle school.²³ This group of children average lower levels of reading, mathematics, and writing achievement compared with students without NAS

who are similar in gestational age, year of birth, gender, and socioeconomic status. Children with NAS are approximately 2 to 3 times more likely to fail to attain grade-level achievement, and are also more likely to require additional specialized support and intervention throughout school compared with children without NAS. Specifically, children with NAS had odds that were 3.5 (95% CI, 2.8 to 4.4), 2.8 (95% CI, 2.4 to 3.2), and 2.4 (95% CI, 1.9 to 2.9) times higher of failing to attain grade-level achievement in third, fifth, and eighth grade, respectively, compared with controls.²³ In fact, children with NAS had odds that were 2.5 (95% CI, 2.2 to 2.7) times higher of failing to attain grade-level achievement at any one of the study's measured time periods (Figure 2).²³

A 2016 longitudinal study reported that children with NAS are also more likely to exhibit a general set of behavioral deficits (eg, more frequent externalizing and internalizing problem behaviors; greater levels of impulsivity, inattention, and other behavioral indicators of ADHD) as they attend school, as reported by both teachers and caregivers.³ Children who struggle academically are at greater risk for having disabilities and requiring special education services.²⁴

Recent longitudinal analysis also demonstrates that children with NAS are at a greater risk of being identified as having disabilities and receiving special education services in school. In 2018, Fill and colleagues reported that children with a history of NAS were approximately 1.3 to 1.4 times more likely to meet the criteria for exhibiting a disability and receiving special education services for specific conditions of developmental delays and speech or language impairments during early childhood compared with children without a history of NAS, who were matched for gender, age, birth region, race/ethnicity, and medical enrollment status.²⁵ Children with a history of NAS had a significantly higher risk of being identified with educational disabilities compared with matched controls without NAS. This increased risk associated with NAS was evident after accounting for potential confounders, including maternal education status, maternal tobacco use, gestational age, and birth weight.²⁵

FIGURE 2. Academic Achievement by Grade Level for Children With NAS, Matched Controls, and All Other Children²³



NAS indicates neonatal abstinence syndrome.

Opioid Use in Pennsylvania

Although the aforementioned empirical work indicates that children of mothers using opioids are at a greater risk for later being identified as having disabilities, the expected costs of special education services have been largely unknown. Therefore, we calculated a preliminary set of cost estimates of special education and related services for children diagnosed with NAS—specifically, costs for a single cohort of children from Pennsylvania with an NAS diagnosis. The Commonwealth of Pennsylvania currently ranks high in the United States for the prescription of opioid pain relievers, long-acting/extended-release opioids, high-dose opioids, and benzodiazepines. For example, the CDC estimates that Pennsylvania ranked 21st and 14th in the United States for the prescription of opioids and high-dose opioids, respectively, in 2014.²⁶

Gross Cost Estimates

Costs for Special Education Services in the Commonwealth of Pennsylvania

In 2015, public school expenditures per student in Pennsylvania were \$14,717 (2015 US\$).²⁷ The cost to educate a student in special education is typically estimated to be, on average, about twice that of educating a student in general education.²⁸ Thus, a reasonable cost estimate per student who receives both general and special education in Pennsylvania in 2015 would \$29,434 (2015 US\$) or \$30,682 (2017 US\$), using a Bureau of Labor Statistics Consumer Price Index (BLS CPI) correction factor for inflation.

Increased Special Education Costs for Children in Pennsylvania With NAS

In 2015, a total of 2691 children were diagnosed with NAS in Pennsylvania, which translates to about 2% of recorded births.²⁹ Approximately 80% of hospital costs for NAS, which averaged \$66,693 per child in 2012 (BLS CPI: \$73,262.11 in 2017 US\$), are currently being charged to state Medicaid programs.¹⁴ About 20% of children with NAS subsequently receive special education services²⁵ because of identified disabilities. A reasonable estimate of the educational costs to the Commonwealth of Pennsylvania for children with NAS who experienced prenatal opioid exposure and have identified disabilities would be more than \$16.5 million (2017 US\$; n = 538). The additional cost to provide special education services to children with NAS who are identified as having disabilities (ie, above the cost to provide a student with a general education) would be \$8,253,458 (2017 US\$) for this cohort. **Table 1**^{14,25,27,29} illustrates these cost estimates.

A conservative estimate based on a limited provision of 3 to 5 years of special education services for children in Pennsylvania born with NAS would result in a lower bound estimate of additional expenses due to NAS-related disability services of \$24.8 million and an upper bound estimate of \$41.3 million (2017 US\$). Currently, the federal government would be expected to provide approximately 15% of these special education costs²⁸; the remaining 85% of the costs would be paid for by the Commonwealth of Pennsylvania’s local and state governments. Total costs to the Commonwealth of Pennsylvania’s government for 3-year and 5-year time periods would amount to \$21,046,318 (2017 US\$) and \$35,077,197 (2017 US\$), respectively. These figures do not account for inflation during the 3-year and 5-year time periods.

A liberal estimate of 13-year costs of special education services (ie, kindergarten through 12th grade, assuming both early and stable disability identification and receipt of services) would amount to \$91,200,711 (2017 US\$), accounting for inflation each year from 2003 to 2015 (using 2017 as the reference year), as well as an 85% responsibility by the state and local governments of the Commonwealth of Pennsylvania. These cost estimates are specific to one cohort

of children from Pennsylvania. Additional costs would then be entailed to provide services to both historical and future cohorts of Pennsylvania children, as well as to those in other states diagnosed with NAS and subsequently identified as requiring additional special education services.

Estimated Special Education Costs for a Single Cohort of Pennsylvania Children With NAS Born to Mothers Using Prescription Opioids During Their Pregnancies

We also estimated a more conservative set of costs based on NAS associated with maternal prescription opioid use during pregnancy.^{13,30} These would be based on the following prevalence estimates: Of recorded births in the Commonwealth in 2015, an estimated 20%³¹ of these births were from mothers using prescription opioids (n = 27,600).³⁰ Of the 27,600 mothers, 166 would conservatively be expected to give birth to children with NAS, using a current absolute risk rate of 6 per 1000 births. Of these 166 children with NAS

TABLE 1: Estimates of Increased Special Education Costs for Pennsylvania Children With NAS^{14,25,27,29}

Public school expenditures per student, 2015	\$14,717 (2015 US\$)
Estimated costs per student in special education, 2015	\$29,434 (2015 US\$)
Estimated costs per student in special education, corrected for inflation	\$30,682 (2017 US\$)
Number of children diagnosed with NAS, 2015	2691
Percent of children with NAS who subsequently received special education services	20%
Number of children diagnosed with NAS in 2015 who subsequently received special education services	538
Estimated educational costs for children with NAS receiving special education services	\$16,506,916 (2017 US\$)
1-year additional costs for children with NAS in special education compared with the 2015 cohort of children in general education	8,253,458 (2017 US\$)
3-year to-5-year additional costs for children with NAS in special education compared with the 2015 cohort of children in general education	\$24,760,374 (2017 US\$) to \$41,267,290 (2017 US\$)
3-year to-5-year additional costs for children with NAS in special education estimated to be paid for by the Commonwealth of Pennsylvania’s local and state governments (85% of total)	\$21,046,318 (2017 US\$) to \$35,077,197 (2017 US\$)
13-year additional costs for children with NAS in special education estimated to be paid for by the Commonwealth of Pennsylvania’s local and state governments (85% of total)	\$91,200,711 (2017 US\$)

NAS indicates neonatal abstinence syndrome.

born to mothers in Pennsylvania who were prescribed opioids during their pregnancies, 20% (n = 33) of these children would be expected to receive special education services because of identified disabilities. The resulting costs attributable to the additional provision of special education services for this single cohort of children are calculated as \$506,253 (2017 US\$) (Table 2).^{13,30,31}

Assuming that the Commonwealth of Pennsylvania would be responsible for 85% of costs, the estimates of 3-year and 5-year time frames are \$1.3 million and \$2.2 million, respectively—that is, \$1,290,945 (2017 US\$) and \$2,151,575 (2017 US\$), respectively—to provide special education services to children born with NAS to

TABLE 2: Estimated Special Education Costs for a Single Cohort of Pennsylvania Children With NAS Born to Mothers Using Prescription Opioids During Their Pregnancies^{13,30,31}

Number of births to mothers using prescription opioids in 2015	27,600
Number of mothers expected to give birth to children with NAS	166
Number of children with NAS expected to receive special education services	33
1-year additional costs of special education services for the 2015 cohort of children with NAS compared with children in general education	\$506,253 (2017 US\$)
3-year to-5-year additional costs for children with NAS in special education estimated to be paid for by the Commonwealth of Pennsylvania's local and state governments (85% of total)	\$1,290,945 (2017 US\$) to \$2,151,575 (2017 US\$)
13-year additional costs for children with NAS in special education estimated to be paid for by the Commonwealth of Pennsylvania's local and state governments (85% of total)	\$5,594,096 (2017 US\$)

NAS indicates neonatal abstinence syndrome.

TABLE 3: Estimates of Increased Special Education Costs for Children With NAS in a New York State, 2015 Cohort³⁴

Public school expenditures per student	\$22,593 (2015 US\$)
Estimated costs per student in special education	\$45,186 (2015 US\$)
Number of children born with NAS	1068
Number of children born with NAS in 2015 who subsequently received special education	4
1-year additional costs for children with NAS in special education compared with the 2015 cohort of children in general education paid by New York State's local and state governments (85% of total)	\$8,219,333 (2015 US\$)
Number of children born to mothers using prescription opioids during their pregnancies	43

NAS indicates neonatal abstinence syndrome.

mothers who used prescription opioids during their pregnancies. Further costs would be incurred for additional service years or additional Pennsylvania cohorts, as well as for cohorts from other states. These figures do not account for inflation during the 3-year and 5-year time periods.

If the single cohort of Pennsylvania children born with NAS from mothers who used prescription opioids received 13 years of special education services (ie, from kindergarten through 12th grade), the resulting upper bound of estimated costs would be \$5,594,096 (2017 US\$; Table 2).^{13,30,31} This estimate accounts for inflation from 2003 to 2015, using 2017 as the reference, and assumes that the state and local government would have 85% financial responsibility. Additional costs would be incurred for historical and future cohorts of Pennsylvania children, as well as for children with NAS in other states who were born to mothers using prescription opioids during their pregnancies.

Example Extension of Cost Estimates to an Additional State

These cost estimates can be applied to additional states using similar calculations. For example, an estimated 237,274 children were born in New York State in 2017.³² Using a conservatively estimated absolute risk ratio³³ of 4.5 children born with NAS per every 1000 births, this would suggest that 1068 children would be diagnosed with NAS in 2015. Of this population, approximately 20% would be expected to subsequently receive special education services because of identified disabilities (n = 213). New York State currently spends an average of \$22,593 per student to provide general education services, with additional special education costs resulting in \$45,186 in total expenditures (Table 3).³⁴ To provide 214 children with NAS with special education services, New York State would be expected to pay 85% of these special education costs for this single cohort, or \$8,219,333 for one school year. Additional costs would be incurred for additional school years. For children with NAS born to mothers using prescription opioids during their pregnancies (20% of the number of children with NAS with special education services, or n = 43), this calculation would amount to \$1,651,548 for a single school year.

Limitations and Future Directions

Few longitudinal studies have followed children born to opioid-using mothers throughout school. We extrapolated preliminary cost estimates based on this limited empirical work. These estimates may change as additional longitudinal studies become available. We did not formally search the available empirical research using a Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) review protocol.

Our assessments estimate the costs for children who were independently evaluated by healthcare professionals as being born with NAS. The advantage of using a diagnosis of NAS is that

it more clearly establishes that the children were born to mothers who used opioids, as well as other types of substances (eg, heroin), including possible prescription opioids. The negative impact of opioid use on a child's cognitive and behavioral development can be rendered more accurately because the estimates do not rely on maternal self-reports. Maternal self-reporting might result in a less accurate history of opioid use and present an unclear picture of the impact of opioid use on a child's neurobehavioral development. Restricting the estimates to children with NAS at birth, however, also indicates that our estimates are limited to children diagnosed with this specific condition. For example, we do not estimate the costs attributable to postnatal exposure to parental opioid use, as such estimates would likely be confounded by other factors, (eg, chaotic home environments, parental mental health, unemployment, divorce) and thus result in less reliable cost estimates. We are unable to disaggregate the costs attributable to being born with NAS that result from the neurobiological effects of opioid exposure, including through opioid agonist pharmacotherapy, from the social impacts of maternal addiction and substance misuse more generally, which pharmacotherapy is designed to manage.

Additional longitudinal studies are warranted, to evaluate prenatal exposure to opioid prescription use; NAS; children's risk for cognitive, physical, and behavioral impairments; later disability identification; and opioid-related special education services. We were able to identify only 1 peer-reviewed longitudinal study that reported on a sample of children in the United States diagnosed with NAS, their risks for disability identification, and their receipt of special education services.²⁵ This study was limited to estimates of disability identification risk during early childhood and analyses of a state-specific cohort. Investigations of additional longitudinal datasets would allow for more precise estimates of the extent to which children diagnosed with NAS are more likely to later receive special education services because of disabilities identified throughout their early life course. Additional studies that examine the risk for disability identification among children with NAS over time (eg, middle school and high school into adulthood), as well as investigations that report on the NAS-related risk across a wide range of specific disability conditions would also enhance the currently limited knowledge in this field. ■

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REFERENCES

- Bunikowski R, Grimmer I, Heiser A, Metzke B, Schäfer A, Obladen M. Neurodevelopmental outcome after prenatal exposure to opiates. *Eur J Pediatr*. 1998;157(9):724-730.
- Ornoy A. The impact of intrauterine exposure versus postnatal environment in neurodevelopmental toxicity: long-term neurobehavioral studies in children at risk for developmental disorders. *Toxicol Lett*. 2003;140-141:171-181.
- Nygaard E, Stinning K, Moe V, Walhovd KB. Behavior and attention problems in eight-year-old children with prenatal opiate and poly-substance exposure: a longitudinal study. *PLoS One*. 2016;11(6):e0158054.
- Ornoy A, Finkel-Pekarsky V, Peles E, Adelson M, Schreiber S, Ebstein PR. ADHD risk alleles associated with opiate addiction: study of addicted parents and their children. *Pediatr Res*. 2016;80(2):228-236.
- Nygaard E, Stinning K, Moe V, Walhovd KB. Cognitive function of youths born to mothers with opioid and poly-substance abuse problems during pregnancy. *Child Neuropsychol*. 2017;23(2):159-187.
- Nygaard E, Moe V, Stinning K, Walhovd KB. Longitudinal cognitive development of children born to mothers with opioid and polysubstance use. *Pediatr Res*. 2015;78(3):330-335.
- Woudes TA, Woodward LJ. Maternal methadone dose during pregnancy and infant clinical outcome. *Neurotoxicol Teratol*. 2010;32(3):406-413.
- Log T, Skurtveit S, Selmer R, Tverdal A, Furu K, Hartz I. The association between prescribed opioid use for mothers and children: a record-linkage study. *Eur J Clin Pharmacol*. 2013;69(1):111-118.
- Kocherlakota P. Neonatal abstinence syndrome. *Pediatrics*. 2014;134(2):e547-e561.
- Hudak ML, Tan RC; Committee on Drugs; Committee on Fetus and Newborn; American Academy of Pediatrics. Neonatal drug withdrawal. *Pediatrics*. 2012;129(2):e540-e560.
- Jansson LM, Velez M, Harrow C. The opioid-exposed newborn: assessment and pharmacologic management. *J Opioid Manag*. 2009;5(1):47-55.
- American College of Obstetricians and Gynecologists (ACOG), Committee on Obstetric Practice; American Society of Addiction Medicine. Opioid use and opioid use disorder in pregnancy. American College of Obstetricians and Gynecologists website. <https://www.acog.org/Clinical-Guidance-and-Publications/Committee-Opinions/Committee-on-Obstetric-Practice/Opioid-Use-and-Opioid-Use-Disorder-in-Pregnancy>. Number 711; Published August 2017. Accessed June 20, 2019.
- Desai RJ, Huybrechts KF, Hernandez-Diaz S, et al. Exposure to prescription opioid analgesics in utero and risk of neonatal abstinence syndrome: population based cohort study. *BMJ*. 2015;350:h2102. doi: 10.1136/bmj.h2102.
- Patrick SW, Davis MM, Lehmann CU, Cooper WO. Increasing incidence and geographic distribution of neonatal abstinence syndrome: United States 2009 to 2012. *J Perinatol*. 2015;35(8):650-655.
- Patrick SW, Schumacher RE, Benneworth BD, Krans EE, McAllister JM, Davis MM. Neonatal abstinence syndrome and associated health care expenditures: United States, 2000-2009. *JAMA*. 2012;307(18):1934-1940.
- Kozhimannil KB, Chantarat T, Ecklund AM, Henning-Smith C, Jones C. Maternal opioid use disorder and neonatal abstinence syndrome among rural US residents, 2007-2014. *J Rural Health*. 2019;35(1):122-132.
- Villapiano NL, Winkelman TN, Kozhimannil KB, Davis MM, Patrick SW. Rural and urban differences in neonatal abstinence syndrome and maternal opioid use, 2004 to 2013. *JAMA Pediatr*. 2017;171(2):194-196.
- Auger N, Luu TM, Healy-Profittós J, Gauthier A, Lo E, Fraser WD. Correlation of neonatal abstinence syndrome with risk of birth defects and infant morbidity. *J Stud Alcohol Drugs*. 2018;79(4):553-560.
- Liu DG, Gong L, Leslie DL, Corr TE. A longitudinal healthcare use profile of children with a history of neonatal abstinence syndrome. *J Pediatr*. 2019;204:111-117.
- Beckwith AM, Burke SA. Identification of early developmental deficits in infants with prenatal heroin, methadone, and other opioid exposure. *Clin Pediatr (Phila)*. 2015;54(4):328-335.
- McGlone L, Mactier H. Infants of opioid-dependent mothers: neurodevelopment at six months. *Early Hum Dev*. 2015;91(1):19-21.
- Hunt RW, Tzioumi D, Collins E, Jeffery HE. Adverse neurodevelopmental outcome of infants exposed to opiate in-utero. *Early Hum Dev*. 2008;84(1):29-35.
- Oei JL, Melhuish E, Uebel H, et al. Neonatal abstinence syndrome and high school performance. *Pediatrics*. 2017;139(2). pii: e20162651. doi: 10.1542/peds.2016-2651.
- Morgan PL, Farkas G, Hillemeier MM, Maczuga S. Replicated evidence of racial and ethnic disparities in disability identification in U.S. schools. *Educ Res*. 2017;46(6):305-322.
- Fill MA, Miller AM, Wilkinson RH, et al. Educational disabilities among children born with neonatal abstinence syndrome. *Pediatrics*. 2018;142(3). pii: e20180562. doi: 10.1542/peds.2018-0562.
- Paulozzi LJ, Mack KA, Hockenberry JM; Division of Unintentional Injury Prevention, National Center for Injury Prevention and Control, CDC. Vital signs: variation among States in prescribing of opioid pain relievers and benzodiazepines — United States, 2012. *MMWR Morb Mortal Wkly Rep*. 2014;63(26):563-568.
- Education spending per student by state. Governing the States and Localities website. <http://www.governing.com/gov-data/education-data/state-education-spending-per-pupil-data.html>. Updated June 1, 2018. Accessed June 20, 2019.
- Griffith M. A look at funding for students with disabilities. Education Commission of the States website. <https://www.ecs.org/clearinghouse/01/17/72/11772.pdf>. Published 2015. Accessed June 20, 2019.
- Martin J. PHC4 data shows large increases in neonatal and maternal hospitalizations related to substance use. Pennsylvania Health Care Cost Containment Council (PHC4) website. www.phc4.org/reports/ResearchBriefs/neonatal/092716/nr092716.htm. Published September 27, 2016. Accessed June 20, 2019.
- Yazdy MM, Desai RJ, Brogly SB. Prescription opioids in pregnancy and birth outcomes: a review of the literature. *J Pediatr Genet*. 2015;4(2):56-70.
- Volkow ND. Opioids in pregnancy. *BMJ*. 2016;352:i19. doi: 10.1136/bmj.i19.
- Henry J Kaiser Family Foundation. State health facts. Total number of births (2017). <https://www.kff.org/other/state-indicator/number-of-births/?currentTimeframe=0&sortModel=%7B%22colId%22%22Loc ation%22%22sort%22%22asc%22%7D>. Accessed June 20, 2019.
- Ko JY, Patrick SW, Tong VT, Patel R, Lind JN, Barfield WD. Incidence of neonatal abstinence syndrome — 28 states, 1999-2013. *MMWR Morb Mortal Wkly Rep*. 2016;65(31):799-802.
- Spector J. NY spends \$22,593 per pupil, but there's wide disparity. Lohud website. <https://www.lohud.com/story/news/politics/politics-on-the-hudson/2016/12/07/ny-spends-22593-per-pupil-but-theres-wide-disparity/95088028/>. Published December 7, 2016. Accessed June 20, 2019.

Opioid Misuse, Labor Market Outcomes, and Means-Tested Public Expenditures: A Conceptual Framework

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Introduction

As the opioid epidemic continues to grow, with 45,000 opioid-related overdose deaths in 2017 alone in the United States,¹ several studies have estimated the economic cost of the epidemic.²⁻⁹ One particular area of emphasis is the financial burden resulting from opioid-related reductions in employment and labor market productivity. To date, estimates have largely focused on the costs borne at the societal level. This article provides a conceptual framework for understanding how opioid-related effects on the labor market translate into increased costs to state and federal governments, both in terms of reduced tax revenue and increased spending on means-tested programs.

Background

An increasing number of studies have assessed how opioid misuse may impact labor market outcomes.¹⁰⁻¹³ In addition, several studies have estimated how the resulting lost productivity due to opioid misuse translates to costs, typically focusing on 5 main categories: unemployment/underemployment, absenteeism, presenteeism, incarceration, and premature mortality. One study³ also includes disability-related costs. The estimated opioid-related productivity losses range from \$4.5 billion to \$431.7 billion annually. Much of the large variability of estimates can be attributed to methodological differences across studies, including which categories of the aforementioned costs are included and how they are estimated.

In this section, we briefly summarize previous estimates, highlight key estimation issues, and provide an outline of important considerations for assessing the costs of increased public expenditures due to opioid misuse. **Table 1**²⁻⁹ summarizes the cost estimates in the literature associated with lost productivity due to opioid misuse. Three studies²⁻⁴ estimate costs of unemployment/underemployment due to opioid misuse by extrapolating from a report by the Office of National Drug Control Policy.¹⁴ Each study²⁻⁴ analyzes the effect of all types of drug use on employment and wages, making adjustments specific to opioids. As the approach of the studies is essentially descriptive, each make assumptions about the fraction of overall addiction attributable to opioids and

ABSTRACT

As the opioid epidemic has drawn increased attention, many researchers are attempting to estimate the financial burden of opioid misuse. These estimates have become particularly relevant as state and local governments have begun to take legal action against pharmaceutical manufacturers, distributors, and others who are identified as being potentially responsible for the worsening epidemic. An important category of costs includes those related to the effect of opioid misuse on labor market outcomes and productivity. Most published estimates of opioid-attributable productivity losses estimate the financial burden borne by society, failing to distinguish between costs internalized by individuals and those that spill over to third parties, such as state and federal governments. This article provides an overview and a conceptual framework for 2 types of labor market-related costs borne by state and federal governments that typically have not been incorporated into existing estimates, which may represent important categories of expenditures. Because detailed estimates of lost tax revenue are available elsewhere, this article focuses largely on whether, and how, to incorporate opioid-related expenses incurred by means-tested government programs into more general estimates of the economic harm created by the opioid epidemic.

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opioid-specific unemployment values to construct estimates of lost wages because of opioid misuse.

The next 2 types of cost—absenteeism and presenteeism—are conceptually similar. Absenteeism captures lost wages due to lost work time (eg, attending a doctor’s visit or a hospital admission), while presenteeism captures lower productivity at work (eg, not being able to work at the normal level of productivity due to the impact of addiction).¹⁵ Both are difficult to measure empirically, as reflected by the wide range of absenteeism estimates in the literature (\$0.3 billion-\$16.2 billion).^{3,5,7} There are 2 significant challenges to estimating these costs, both of which could lead to overestimation of the forgone tax revenue resulting from absenteeism or presenteeism. First, employees may be able to make up lost work hours in a way that is difficult to observe in standard data sets. Second, lost work time or reduced productivity may not reduce taxable income when workers are salaried. In both cases, either because time is made up or because of limited effects on income, the forgone tax revenue attributed to absenteeism and presenteeism may actually be lower than if one assumes that

measured reductions in hours or productivity translate into lower tax payments in a 1-to-1 fashion.

The estimates in the next category, incarceration-related costs, also exhibit a wide range (\$0.7 billion-\$14.8 billion).^{2-4,7,8} These costs include lost productivity for those who are incarcerated and unable to work. Although several studies explicitly calculate incarceration costs, a number of studies that estimate the effect of opioid misuse on employment combine effects of incarceration into overall estimates of reduced employment or lost productivity by estimating the overall effect of opioid misuse on labor force exits regardless of cause.¹⁰⁻¹³

The category that typically contains the largest overall cost estimates is premature mortality. Losses from premature mortality are calculated either by using a human capital approach to estimate what an individual would have earned had they worked the typical number of additional years²⁻⁷ or by using a set value of a statistical life.⁹ The latter generally leads to larger estimates.

Each of the aforementioned studies estimate costs using the full dollar value of lost productivity. However, when analyzing the

TABLE 1. Summary of Opioid-Related Cost Estimates of Reduced Productivity in the Literature (in billions USD)²⁻⁹

Study	Year Costs Are Measured	Premature Mortality Costs	Unemployment/ Underemployment	Absenteeism	Presenteeism	Disability	Incarceration-related Employment Costs	Total Productivity Costs ^a
Birnbaum et al. (2006)	2001	\$0.865	\$3.024	-	-	-	\$ 0.658	\$4.55
Birnbaum et al. (2011)	2009	\$11.22	\$7.931	\$1.814	\$2.044	\$0.81	\$1.768	\$25.58
Hansen et al. (2011)	2006	\$12.4	\$14.7	-	-	-	\$14.8	\$42.00
Inocencio et al. (2013)	2011	\$17.91	-	\$0.335	-	-	-	\$18.24
Rice et al. (2014)	2012	-	-	\$3773 per misuser ^b	-	-	-	-
Florence et al. (2016)	2013	\$21.43	-	\$16.26 ^c	-	-	\$4.18	\$41.87
Rhyan (2017)	2016							
Private		\$31.1			\$8.1		\$0.9	\$40.00
Federal tax		\$8.2			\$2.1		\$0.2	\$10.6
State tax		\$2.2			\$0.6		\$0.1	\$2.8
Local tax		\$1.7			\$0.4		\$0.1	\$2.2
CEA (2017)	2015	\$431.7	-	-	-	-	-	\$431.7

CEA indicates Council of Economic Advisers.

^aTotal productivity costs represent a sum across each of the individual categories of costs. Note that the total reported may be different from the sum of each component due to rounding.

^bRice et al⁶ only report absenteeism and disability costs together; however, they report number of work days missed separately for each. They report 47.4% of days missed were due to disability and 52.6% were due to medically-related absenteeism. They also only report per misuser relative to the comparison group without summing them.

^cFlorence et al⁷ estimate the loss in total productivity due to opioids by including work as well as household production. They do not divide into absenteeism, presenteeism, and disability.

financial burden borne by state and federal governments, we must consider which specific components of lost productivity actually translate into costs to federal and state governments. This narrower focus may lead to lower estimates compared with studies that consider costs related to lost productivity more expansively. For example, an earlier report,⁸ with limited detail on the analytical approach, finds \$2.8 billion in lost state tax revenue, \$2.2 billion in lost local tax revenue, and \$10.6 billion in lost federal tax revenue, which are in line with estimates of lost income and sales tax revenue in a recent study.¹⁶

Conceptual Framework

The effect of opioid misuse on labor market outcomes can negatively impact state and federal budgets through 2 main channels (Figure). First, adverse labor market outcomes can lead to lower income, therefore lowering state and federal income tax, as well as state sales tax revenues. Second, reductions in household income due to opioid misuse could lead users or their families to become eligible for a wide range of means-tested state and federal programs. Below, we provide a more detailed, conceptual description of these 2 avenues by which opioid misuse may impose costs on state and federal governments.

Lost Tax Revenue

In our previous work,¹⁶ we separately estimate tax revenue losses due to opioid-related labor force exits and opioid-related premature mortality. Building upon earlier work by Krueger,¹⁰ we combine plausibly causal estimates of the effect of opioid misuse on prime-age (aged 25-54 years) labor force exits with data on median wage and family structure taken from the National Survey of Drug Use

and Health. We then use the National Bureau of Economic Research TAXSIM calculator to estimate state and federal income tax losses. For premature mortality, we use a similar approach to estimate forgone taxes for those who died during prime working years using CDC's WONDER mortality data.

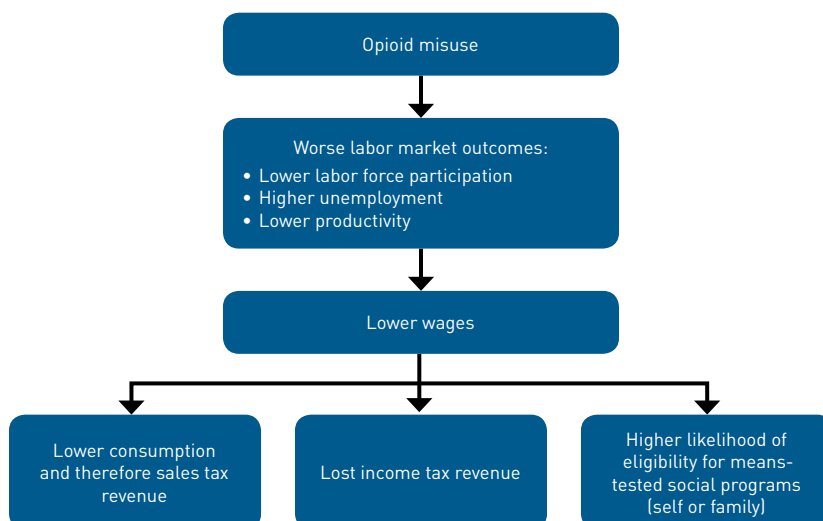
Means-Tested Social Programs

To the extent that opioid misuse leads to a greater likelihood of leaving the labor force or suffering reduced income, this may lead a number of means-tested social programs to increase their expenditures on those who were previously employed or those who remain employed but whose incomes have dropped below eligibility thresholds. These types of programs include cash assistance, unemployment insurance, disability coverage, workers' compensation, publicly funded health insurance, nutrition programs, and employment training programs, all of which have funding mechanisms that differ in the extent to which they are predominantly federally funded, state funded, or some combination of each. To date, most studies have not examined these costs. Table 2¹⁷⁻³⁷ highlights specific programs and the degree of federal-state cost sharing.

Cash Assistance

Individuals and families facing adverse labor market outcomes and lower incomes due to opioid misuse may become eligible for federal and/or state income assistance programs. The federal government provides the greatest share of funding for cash assistance programs,¹⁷ with the Earned Income Tax Credit^{17,38,39} for lower-income families being the largest program. Depending on household size, families below a specific income threshold are eligible to receive a credit between \$519 to \$6431 for tax year 2018.⁴⁰ In addition, low-income families may qualify for the Temporary Assistance for Needy Families (TANF) Program.⁴¹⁻⁴³ Under TANF, the federal government provides states with block grants to assist needy families for up to 60 months, while recipients are required to engage in work activities. However, states have flexibility in terms of both how they spend the federal block grant and, within the general requirements, whom they deem eligible for benefits.⁴² Spending can include basic assistance, supporting work activities and job training, and child care. Furthermore, states are required to provide supplemental funding in the form of Maintenance of Effort (MOE). For example, Pennsylvania spent \$455 million on MOE in 2016.⁴³ A large range of cash assistance programs exist, but to date there is little empirical evidence on how opioid misuse increases the use of such programs. Although

FIGURE. Conceptual Framework for Effect of Opioid Misuse on Adverse Labor Market Outcomes and Resulting Government Costs



a report from Express Scripts suggests that TANF recipients may have higher rates of opioid use, it does not provide evidence for higher rates of opioid misuse among them.⁴⁴

Unemployment Benefits

Adverse labor market outcomes may also lead to eligibility for unemployment benefits. However, for 2 reasons, the total opioid-attributable cost of unemployment benefits borne by state and federal governments is likely to be low. First, unemployment is funded by experience-rated taxes imposed on employers, meaning that if opioid misuse increases the rate of unemployment claims, the increase would largely be recouped through higher taxes on employers.^{18,19} The exception would be if the state or federal government is the employer. Second, unemployment benefits are typically available only to workers who lose their jobs without cause.^{19,20} However, opioid-related job separations may be more likely to result from employees being fired for cause or due to voluntary separations initiated by workers, in which case expenditures would likely be lower. Overall, if firing for cause is difficult and opioid misuse leads to increased claims, then governments might bear substantial, increased costs in their capacity as employers.

Disability Benefits

The disabled population is eligible for additional assistance programs. Because opioids are often prescribed for the types of injuries or illnesses that lead individuals to become disabled,^{21,45} and given that opioid use is significantly higher in the disabled population,^{21,46,47} this category of costs may be important. To date, the only estimates that include disability-related costs is a 2011 study by Birnbaum et al,³ which focuses on lost productivity following disability rather than on the cost of the disability benefits themselves.

In terms of the potential governmental expenditures, most disability claims are paid by federal sources such as the Social Security Administration’s Supplemental Security Income Program and Social Security Disability Insurance,²² but many states also provide supplemental income to disabled individuals who are eligible for federal assistance.²³ Further, state and federal governments may have additional expenses when they provide their employees with supplemental disability insurance.^{24,37}

Importantly, individuals are not eligible for federal disability coverage if “drug addiction or alcoholism is a contributing factor material to the determination that the claimant is disabled.”²⁶ Therefore, the primary mechanism by which opioid misuse could lead to increased disability payments is that an injured employee becomes eligible due to an injury but experiences a longer disability period due to opioid misuse. Evidence is uncertain as to whether opioids lead to longer disability spells,^{45,48-51} with several important studies still in progress. Given the mixed evidence regarding the effect of opioid misuse on extended disability periods, it is unclear how large opioid-attributable costs for disability benefits may be. This cost is likely to be larger for the federal government than for state governments due to the relatively smaller fraction of disability benefits supported by state funding.

TABLE 2. Means-Tested Programs by Type of Government Funding¹⁷⁻³⁷

Program Type	Federally Funded ¹⁷	Funded by States
Cash assistance	<ul style="list-style-type: none"> EITC TANF 	<ul style="list-style-type: none"> Maintenance-of-effort funding for TANF recipients Various state programs
Unemployment benefits ^{18-20,35}	<ul style="list-style-type: none"> Typically offered in less common circumstances such as during disasters or times of high unemployment when many may have exhausted state benefits³⁵ 	<ul style="list-style-type: none"> Risk-rated coverage paid by employers but managed by states
Disability benefits ^{21-24,26,37}	<ul style="list-style-type: none"> Social Security Supplemental Income Program Social Security Disability Insurance 	<ul style="list-style-type: none"> Various state programs
Workers’ compensation ^{27,36}	<ul style="list-style-type: none"> Several programs under Office of Workers’ Compensation Programs for federal employees³⁶ Several smaller section-specific programs such as Federal Black Lung Program 	<ul style="list-style-type: none"> Risk-rated coverage paid by employers but states bear administrative costs
Publicly funded health insurance ^{28,29}	<ul style="list-style-type: none"> Medicaid SCHIP Premium and cost-sharing subsidies for Marketplace plans 	<ul style="list-style-type: none"> Varying state matches for Medicaid and SCHIP
Nutrition programs ^{30,31}	<ul style="list-style-type: none"> Supplemental Nutrition Assistance Program Special Supplemental Nutrition Program for Women, Infants, and Children National School Lunch Program and National School Breakfast Program Variety of other programs 	<ul style="list-style-type: none"> Largely federally funded, administered by states Some additional programs by state
Job training programs ^{25,32-34}	<ul style="list-style-type: none"> Largely covered through TANF 	<ul style="list-style-type: none"> TANF administration Additional programs may vary by state

EITC indicates Earned Income Tax Credit; SCHIP, State Children’s Health Insurance Program; TANF, Temporary Assistance for Needy Families.

Workers' Compensation

While workers' compensation claims may be associated with opioid use, no clear conceptual link exists between opioid misuse and elevated governmental expenditures on workers' compensation; this is primarily because, as was the case with unemployment insurance, costs are generally borne by employers. Again, direct costs may exist where the state or federal government is the employer. Moreover, although some evidence ties opioid use to higher workers' compensation claims,^{27,52} it is difficult to disentangle the role of opioid misuse in causing workplace injuries from their role in appropriately medicating workers with existing injuries unrelated to prior opioid use, both of which would yield a positive correlation between use and claims. A final possibility is that existing injuries could lead to opioid use and subsequent misuse, which in turn could impede one's ability to work and thus increase the size of the workers' compensation claim.

Publicly Funded Health Insurance

Opioid-attributable declines in income may also result in individuals or families becoming eligible for means-tested, publicly funded health insurance. The 2 largest programs are Medicaid and the Children's Health Insurance Program (CHIP).¹⁷ Previous studies have emphasized the funding Medicaid (or potentially other public payers) provides for opioid misuse treatment,^{53,54} including a study by Leslie et al⁵⁵ in this volume. Here, we focus on how opioid misuse may lower household income and potentially increase enrollment in Medicaid or CHIP, including family members who are not using opioids. Although both Medicaid and CHIP are state programs, they include significant federal matching funds, and, in both cases, eligibility, funding, and the types of plans available vary significantly by state.^{28,29} Additionally, we note that although Medicare is also a large health insurance program that includes significant federal funding, eligibility is largely based on age and is not initiated by opioid-related declines in labor force participation. One relevant exception is disabled individuals who become eligible for Medicare.⁵⁶ To the extent that opioid misuse leads to greater Medicare eligibility due to disability, Medicare could bear increased cost. Lastly, the Affordable Care Act includes both premium and cost-sharing subsidies that may be available to low-income individuals who purchase health insurance through the individual marketplace. Although no study has directly estimated the impact of opioid misuse on greater eligibility and use of publicly funded health insurance, it potentially represents a significant expense to both state and federal governments.

Nutrition and Employee Training Programs

Lower family incomes due to opioid misuse may also lead to eligibility for, and therefore greater use of, food assistance and job training programs. The largest food assistance program is the

Supplemental Nutrition Assistance Program, which is funded by the federal government, with states covering administrative costs.^{17,30} The federal government also funds the Special Supplemental Nutrition Program for Women, Infants, and Children, the National School Lunch Program, and the National School Breakfast Program, as well as a variety of other programs.³¹ On the job training side, the federal government covers significant employment training programs through TANF,³² but states vary in whether and which additional training programs they offer. Many state job training programs target dislocated workers or firms that hire low-income workers and may be less relevant for those exiting the labor force due to opioid misuse.^{25,33,34} Similar to the other cost categories, little evidence exists regarding the effect of opioid misuse on expenditures by either of these types of programs.

Gross Cost Estimates

We estimate that between 2000 and 2016, opioid misuse reduced state tax revenue by \$11.8 billion, including \$10.1 billion in lost income tax revenue and \$1.7 billion in lost sales tax revenue.¹⁶ In this survey article, we do not attempt to empirically estimate the impact of opioid misuse on state and federal spending on means-tested programs, but instead provide an overview of the programs that, based on their eligibility criteria, funding mechanisms, and other rules, are most vulnerable to adverse impacts from the opioid epidemic. However, if detailed state- or county-level data on means-tested program participation were available, we could envision how future studies might estimate these costs. Using an approach similar to the one employed by Krueger to estimate the effect of opioid misuse on increased labor force exits,¹⁰ or others that adopt an instrumental variables strategy to isolate exogenous geographic variation in opioid use,^{11,12} one could use state- or county-level variation in opioid prescribing to estimate their effect on means-tested program participation. Combining the resulting estimates with state and federal budget data, it should be possible to estimate the change in public expenditures due to increased participation. A major challenge in many cases is identifying county-level sources for means-tested program participation data.

Future Directions

To date, studies that analyze the effect of opioid misuse on governmental expenditures, including forgone tax revenue, have focused on how increased prescribing may have led to worse labor market outcomes. However, with the concurrent decline in prescribing and increase in treatment, an important question for future research is how treatment affects labor market outcomes, state and federal tax revenues, and participation in the means-tested public programs discussed in this article. For example, does the effect vary by treatment type? Does medication-assisted therapy improve labor market outcomes more than other forms of treatment? A related question

is the extent to which opioid-related arrests and convictions may mediate this effect if having a criminal record limits an individual's ability to return to the labor force or limits their earning ability. States continue to implement a number of opioid mitigation strategies, such as prescription drug monitoring programs,⁵⁷ increased funding for treatment and access to naloxone, and criminal justice diversion programs, among others. It remains to be seen whether these programs will lead to improved labor market outcomes, thereby partially offsetting the cost of such programs and in the process reducing the impact of the opioid epidemic on state and federal budgets more generally.

Although we highlight a number of factors to consider when estimating the effect of opioid misuse on disability, workers' compensation, and various means-tested assistance programs, future research is needed to expand on these ideas, as limited research has been published to date. Other state and federal assistance programs may also be important, but we note that obtaining reliable estimates will be difficult if relevant data sources are not available. Therefore, partnerships with state and federal governments may be necessary to produce an accurate accounting of the full impact of the opioid epidemic on state and federal budgets. ■

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REFERENCES

1. Ahmad FB, Escobedo LA, Rossen LM, Spencer MR, Warner M, Sutton P. Provisional drug overdose death counts. CDC website. cdc.gov/nchs/nvss/vsrr/drug-overdose-data.htm. Updated April 17, 2019. Accessed April 22, 2019.

2. Birnbaum HG, White AG, Reynolds JL, et al. Estimated costs of prescription opioid analgesic abuse in the United States in 2001: a societal perspective. *Clin J Pain*. 2006;22(8):667-676.

3. Birnbaum HG, White AG, Schiller M, Waldman T, Cleveland JM, Roland CL. Societal costs of prescription opioid abuse, dependence, and misuse in the United States. *Pain Med*. 2011;12(4):657-667. doi: 10.1111/j.1526-4637.2011.01075.x.

4. Hansen RN, Oster G, Edelsberg J, Woody GE, Sullivan SD. Economic costs of nonmedical use of prescription opioids. *Clin J Pain*. 2011;27(3):194-202. doi: 10.1097/AJP.0b013e3181ff04ca.

5. Inocencio TJ, Carroll NV, Read EJ, Holdford DA. The economic burden of opioid-related poisoning in the United States. *Pain Med*. 2013;14(10):1534-1547. doi: 10.1111/pme.12183.

6. Rice JB, Kirson NV, Shei A, et al. Estimating the costs of opioid abuse and dependence from an employer perspective: a retrospective analysis using administrative claims data. *Appl Health Econ Health Policy*. 2014;12(4):435-446. doi: 10.1007/s40258-014-0102-0.

7. Florence CS, Zhou C, Luo F, Xu L. The economic burden of prescription opioid overdose, abuse, and dependence in the United States, 2013. *Med Care*. 2016;54(10):901-906. doi: 10.1097/MLR.0000000000000625.

8. Rhyan C. The potential societal benefit of eliminating opioid overdoses, deaths, and substance abuse disorders exceeds \$95 billion per year. Altarum website. altarum.org/sites/default/files/uploaded-publication-files/Research-Brief_Opioid-Epidemic-Economic-Burden.pdf. Published November 16, 2017. Accessed April 22, 2019.

9. Council of Economic Advisers report: the underestimated cost of the opioid crisis. The White House website. whitehouse.gov/briefings-statements/cea-report-underestimated-cost-opioid-crisis/. Published November 20, 2017. Accessed April 22, 2019.

10. Krueger AB. Where have all the workers gone? an inquiry into the decline of the U.S. labor force participation rate. *Brookings Pap Econ Act*. 2017;2017(2):1-87. doi: 10.1353/eca.2017.0012.

11. Harris MC, Kessler LM, Murray MN, Glenn B. Prescription opioids and labor market pains: the effect of schedule II opioids on labor force participation and unemployment [published online January 10, 2019]. *J Human Resources*. doi: 10.3368/jhr.55.4.0517-8782R1.

12. Currie J, Jin JY, Schnell M. U.S. employment and opioids: is there a connection? National Bureau of Economic Research website. nber.org/papers/w24440. Published March 2018. Updated April 2019. Accessed April 22, 2019.

13. Aliprantis D, Fee K, Schweitzer ME. Opioids and the labor market. Federal Reserve Bank of Cleveland website. clevelandfed.org/en/newsroom-and-events/publications/working-papers/2019-working-papers/wp-1807r-opioids-and-labor-market.aspx. Published May 2018. Updated March 2019. Accessed April 22, 2019.

14. Executive Office of the President/Office of National Drug Control Policy. The economic costs of drug abuse in the United States: 1992-2002. National Criminal Justice Reference Service website. ncjrs.gov/ondcpubs/publications/pdf/economic_costs.pdf. Published December 2004. Accessed April 22, 2019.

15. Segel J. Cost-of-illness studies—a primer. RTI International website. rti.org/sites/default/files/resources/COI_Primer.pdf. Published January 2006. Accessed April 22, 2019.

16. Segel JE, Shi Y, Moran JR, Scanton DP. Revenue losses to state and federal government from opioid-related employment reductions [published online March 5, 2019]. *Med Care*. doi: 10.1097/MLR.0000000000001107.

17. Federal spending for means-tested programs, 2007 to 2027. Congressional Budget Office website. cbio.gov/sites/default/files/115th-congress-2017-2018/reports/52405-means-tested-programs.pdf. Published February 15, 2017. Accessed April 22, 2019.

18. Ratner DD. Unemployment insurance experience rating and labor market dynamics. The Federal Reserve Board website. federalreserve.gov/pubs/feds/2013/201386/201386pap.pdf. Updated June 20, 2014. Accessed April 22, 2019.

19. State unemployment insurance benefits. United States Department of Labor website. workforcesecurity.dol.gov/unemploy/uifactsheet.asp. Published March 29, 2004. Updated June 6, 2018. Accessed March 1, 2019.

20. Boushey H, Wenger JB. Unemployment insurance is not a safety net for unemployed former welfare recipients. Center for Economic and Policy Research website. cepr.net/documents/publications/TANF_UI.htm. Published December 4, 2003. Accessed April 22, 2019.

21. Meara E, Horwitz JR, Powell W, et al. State legal restrictions and prescription-opioid use among disabled adults. *N Engl J Med*. 2016;375(1):44-53. doi: 10.1056/NEJMsa1514387.

22. Overview of our disability programs. Social Security Administration website. ssa.gov/redbook/eng/overview-disability.htm. Published 2018. Accessed April 22, 2019.

23. State assistance programs for SSI recipients, January 2011: guide to reading the state summaries. Social Security Administration Office of Retirement and Disability Policy website. ssa.gov/policy/docs/prodesc/ssi_st_asst/2011/guide.html. Published January 2011. Accessed April 22, 2019.

24. FERS [Federal Employees Retirement System] information: types of retirement: disability. US Office of Personnel Management website. opm.gov/retirement-services/fers-information/types-of-retirement/#url=Disability. Accessed April 22, 2019.

25. Employment Training Panel program overview. California state government/Employment Training Panel website. etp.ca.gov/program-overview/. Accessed April 22, 2019.

26. Program Operations Manual System (POMS): DI 90070.050 adjudicating a claim involving drug addiction or alcoholism (DAA). Social Security website. <https://secure.ssa.gov/poms/nfx/0490070050>. Updated March 2, 2016. Accessed April 22, 2019.

27. National Institute for Occupational Safety and Health. Opioids in the workplace. CDC website. cdc.gov/niosh/topics/opioids/data.html. Updated January 30, 2019. Accessed April 22, 2019.

28. Medicaid: summary of the 2018 CHIP funding extension. Henry J Kaiser Family Foundation website. kff.org/medicaid/fact-sheet/summary-of-the-2018-chip-funding-extension/. Published January 24, 2018. Accessed April 22, 2019.

29. Rudowitz R, Orgera K, Hinton E. Medicaid financing: the basics. Henry J Kaiser Family Foundation website. kff.org/report-section/medicaid-financing-the-basics-issue-brief/. Published March 21, 2019. Accessed April 22, 2019.

30. Policy basics: the Supplemental Nutrition Assistance Program (SNAP). Center on Budget and Policy Priorities website. cbpp.org/research/policy-basics-the-supplemental-nutrition-assistance-program-snap. Updated February 13, 2018. Accessed April 22, 2019.

31. Chart of federal nutrition programs. National Conference of State Legislatures website. ncsl.org/research/human-services/federal-nutrition-programs-chart.aspx. Published March 15, 2018. Accessed April 22, 2019.

32. Adult Services. US Department of Labor Employment and Training Administration website. doleta.gov/pubs/. Updated January 22, 2019. Accessed April 22, 2019.

33. Workforce development: financial and technical assistance for employers. Pennsylvania Department of Community and Economic Development website. Accessed April 22, 2019.

34. Low Income Worker Training Program. The Minnesota Department of Employment and Economic Development website. mn.gov/deed/business/financing-business/training-grant/liw/. Accessed April 22, 2019.

35. Unemployment Insurance. US Department of Labor website. dol.gov/general/topic/unemployment-insurance. Accessed April 22, 2019.

36. Workers' compensation. US Department of Labor website. dol.gov/general/topic/workcomp. Accessed April 22, 2019.

37. About the State Disability Insurance program. State of California Employment Development Department website. [edd.ca.gov/disability/About_the_State_Disability_Insurance_\(SDI\)_Program.htm](http://edd.ca.gov/disability/About_the_State_Disability_Insurance_(SDI)_Program.htm). Accessed April 22, 2019.

38. Burman LE, Kobes DI. EITC reaches more eligible families than TANF, food stamps. Tax Policy Center website. taxpolicycenter.org/publications/eitc-reaches-more-eligible-families-tanf-food-stamps. Published March 17, 2003. Accessed April 22, 2019.

39. Earned Income Tax Credit (EITC). Internal Revenue Service website. irs.gov/credits-deductions/individuals/earned-income-tax-credit. Updated April 8, 2019. Accessed April 22, 2019.

40. 2018 EITC income limits, maximum credit amounts and tax law updates. Internal Revenue Service website. irs.gov/credits-deductions/individuals/earned-income-tax-credit/eitc-income-limits-maximum-credit-amounts. Updated January 24, 2019. Accessed April 22, 2019.

41. Temporary Assistance for Needy Families (TANF). HHS/Office of Family Assistance website. actf.hhs.gov/ofa/programs/tanf. Updated June 28, 2017. Accessed April 22, 2019.

42. Policy basics: an introduction to TANF. Center on Budget and Policy Priorities website. cbpp.org/research/policy-basics-an-introduction-to-tanf. Updated August 15, 2018. Accessed April 22, 2019.

43. FY [fiscal year] 2016 federal TANF [Temporary Assistance for Needy Families] & state MOE [Maintenance of Effort] financial data. HHS/Administration for Children and Families website. https://www.acf.hhs.gov/sites/default/files/ofa/tanf_financial_data_fy_2016_121817.pdf. Accessed April 22, 2019.
44. A nation in pain: the Medicaid opioid crisis. Express Scripts website. [lab.express-scripts.com/lab/insights/government-programs/a-nation-in-pain-the-medicaid-opioid-crisis](https://www.lab.express-scripts.com/lab/insights/government-programs/a-nation-in-pain-the-medicaid-opioid-crisis). Published June 21, 2017. Accessed April 22, 2019.
45. Kilby A. Opioids for the masses: welfare tradeoffs in the regulation of narcotic pain medications. Massachusetts Institute of Technology Department of Economics website. economics.mit.edu/files/11150. Published November 3, 2015. Accessed April 22, 2019.
46. Fitzcharles MA, Ste-Marie PA, Gamsa A, Ware MA, Shir Y. Opioid use, misuse, and abuse in patients labeled as fibromyalgia. *Am J Med*. 2011;124(10):955-960. doi: 10.1016/j.amjmed.2011.05.031.
47. Morden NE, Munson JC, Colla CH, et al. Prescription opioid use among disabled Medicare beneficiaries: intensity, trends, and regional variation. *Med Care*. 2014;52(9):852-859. doi: 10.1097/MLR.000000000000183.
48. Franklin GM, Stover BD, Turner JA, Fulton-Kehoe D, Wickizer TM; Disability Risk Identification Study Cohort. Early opioid prescription and subsequent disability among workers with back injuries: the disability risk identification study cohort. *Spine*. 2008;33(2):199-204. doi: 10.1097/BRS.0b013e31816d0455c.
49. Steenstra IA, Franche RL, Furlan AD, Amick B 3rd, Hogg-Johnson S. The added value of collecting information on pain experience when predicting time on benefits for injured workers with back pain. *J Occup Rehabil*. 2016;26(2):117-124. doi: 10.1007/s10926-015-9592-3.
50. Savych B, Neumark D, Lea R. The impact of opioid prescriptions on duration of disability. American Society of Health Economists website. ashecon.confex.com/ashecon/2018/webprogram/Paper6148.html. Published June 2018. Accessed April 22, 2019.
51. Savych B, Neumark D, Lea R. Do opioids help injured workers recover and get back to work? the impact of opioid prescriptions on duration of temporary disability. National Bureau of Economic Research website. [nber.org/papers/w24528](https://www.nber.org/papers/w24528). Published April 2018. Revised December 2018. Accessed April 22, 2019.
52. White JA, Tao X, Talreja M, Tower J, Bernacki E. The effect of opioid use on workers' compensation claim cost in the State of Michigan. *J Occup Environ Med*. 2012;54(8):948-953. doi: 10.1097/JOM.0b013e318252249b.
53. Cher BAY, Morden NE, Meara E. Medicaid expansion and prescription trends: opioids, addiction therapies, and other drugs. *Med Care*. 2019;57(3):208-212. doi: 10.1097/MLR.0000000000001054.
54. Wen H, Hockenberry JM, Borders TF, Druss BG. Impact of Medicaid expansion on Medicaid-covered utilization of buprenorphine for opioid use disorder treatment. *Med Care*. 2017;55(4):336-341. doi: 10.1097/MLR.0000000000000703.
55. Leslie DL, Ba D, Agbese E, Xing X, Liu G. The economic burden of the opioid epidemic on states: the case of Medicaid. *Am J Manag Care*. 2019; 25:S243-S249.
56. Medicare information. Social Security Administration website. [ssa.gov/disabilityresearch/wi/medicare.htm](https://www.ssa.gov/disabilityresearch/wi/medicare.htm). Accessed April 22, 2019.
57. Nam YH, Shea DG, Shi Y, Moran JR. State prescription drug monitoring programs and fatal drug overdoses. *Am J Manag Care*. 2017;23(5):297-303.

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