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U.S. Counties with Higher Drug Overdose Rates Have Lower School Test Scores

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KEY FINDINGS

- Counties that experienced higher drug overdose rates from 1995 to 2014 have lower average 3rd and 8th grade test scores than counties with lower overdose rates.
- The relationship between higher overdose rates and lower test scores is particularly strong in rural counties.
- The places with the highest overdose rates and lowest test scores tend to be economically-disadvantaged, suggesting that additional resources may be needed to address the issue.

The impacts of the contemporary U.S. drug overdose crisis on child and family wellbeing have been profound. Children are affected in many ways, including directly through the overdose or incarceration of family members and indirectly through seeing the effects in their neighborhoods (e.g., witnessing drug sales, finding discarded syringes). Without adequate family, school, and community supports children who are exposed to family and community drug use and overdose may be at risk for poor educational outcomes.

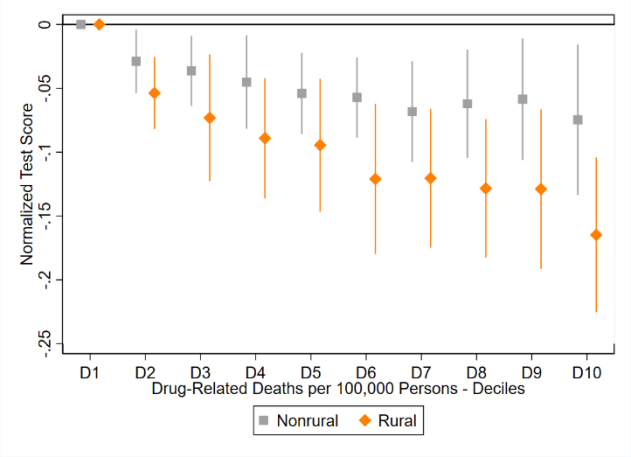
This brief summarizes findings from our recent peer-reviewed study that examined the link between community-level exposure to the opioid crisis (as measured by county-level drug-related mortality rates over a child's lifetime) and children's educational outcomes (as measured by standardized Math and Reading test scores) in grades 3 and 8 for years 2009 to 2014. We found that counties with relatively higher drug-related mortality rates have lower 3rd and 8th grade standardized test scores. Community exposures to the overdose crisis and poor testing performance are not evenly distributed across the country. Areas with high rates of overdose, and low-test scores are concentrated throughout Appalachia, the Industrial Midwest, and parts of the South and West. We find that the link between high overdose rates and low-test score rates is strongest in rural counties though the problem is by no means restricted to rural areas. The relationship and spatial pattern we find suggests that places with particularly high drug-related overdose rates tend to also be experiencing economic hardship which can tax local community, school, and health resources and supports.

What is the Relationship between Opioid Overdose Rates and Student Test Scores?

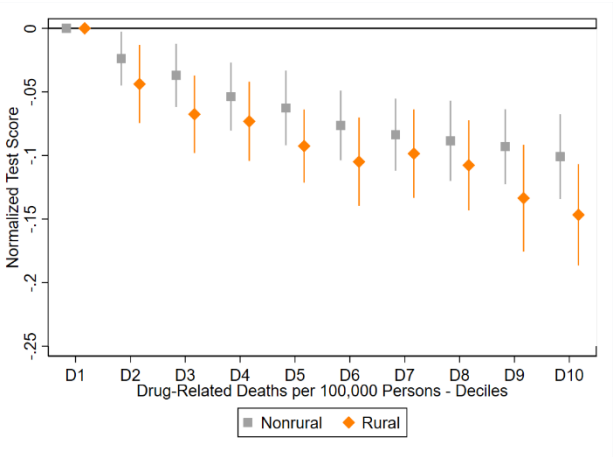
We separated counties into deciles (i.e., 10th percentile, 20th percentile, etc.) based on their drug-related mortality rates, which allowed us to examine the relationship between the level of drug mortality and students' combined test scores on the standardized Math and Reading exams in 3rd and 8th grades. We found that students in counties with higher drug-related death rates performed worse on both the 3rd and 8th grade exams than students in counties with lower drug-related death rates (Figure 1). The relationship generally follows a downward trajectory where test scores are comparatively lower in counties with higher drug-related mortality rates. For example, counties with the highest drug-related mortality rates (the top 10%) had non-rural and rural test scores which were 0.101 and 0.120 standard deviations lower than counties with the lowest drug-related mortality rates (the bottom 10%), respectively.

Although the adverse relationship between drug mortality rates and test scores was observed across both rural and urban counties, the relationship appears to be stronger in rural counties, suggesting that higher overdose rates are especially harmful for student test scores in rural areas. For example, whereas the difference in 3rd grade math and ELA test scores was only 0.075 standard deviations in urban counties with the highest and lowest overdose rates, the average 3rd grade (math/ELA) test score in rural counties with the highest overdose rates was almost two tenth of a standard deviation below the test score among rural students in counties with the lowest overdose rates.

These findings suggest a troubling spillover of the U.S. drug overdose crisis on the educational outcomes of elementary and middle-school children. One potential mechanism is that the ill-effects of exposure to the overdose crisis accumulate over the lifetime of children. Today's 3rd and 8th graders were born into the contemporary overdose crisis (which began in the 1990s) and have lived their entire lives exposed to increasing rates of overdose, child removal from homes, parental incarceration, and other negative exposures. Such trauma can affect educational performance through additional stressors in a child's life such as a deterioration of household stability or dealing with the loss of family or community members. Research on childhood stressors suggests that "prolonged activation of the body's stress response systems"[1] can lead to a toxic stress response which can leave a child with learning and behavioral challenges.[1,2]



(A) 3rd Grade Math & Reading



(B) 8th Grade Math & Reading

Figure 1: Test Scores and Drug-Related Mortality Rates, by Rurality.
Data Source: Data on drug-related deaths are from the Institute for Health Metrics and Evaluation (IHME). Data on test scores are from the Stanford Educational Data Archive (SEDA).
Notes: The drug-related death rate is the number of drug-related deaths per 100,000 persons averaged across the prior 9 years for 3rd graders and the prior 14 years for 8th graders. Test scores are the average of math and reading (ELA) standardized test scores in the 3rd and 8th grades for 2009 to 2014. A rural county is defined as having greater than 75% of the population living in a rural area as identified in the 2010 Census.

Where are "Hot Spots" with High Overdose Rates and Low Test Scores?

Mapping counties based on their mortality rates and test scores reveals regional variation – or high overdose-poor educational performance "hot spots". These are counties with both relatively high rates of drug-related mortality and relatively low average test scores (Figure 2). Particularly notable areas include Appalachia, the Industrial Midwest, and parts of the South and the West. On the opposite end of the spectrum the Great Plains, the Northeast, and parts of the Mountain West have relatively better drug mortality and test performance outcomes than the rest of the country.

This regional variation reinforces the notion that the negative intersection between the overdose crisis and educational outcomes is more acute in some areas of the country than others. One potential explanation for these findings is that high overdose and low educational performance counties may also have fewer school or community supports that reduce children's vulnerability from the overdose crisis.

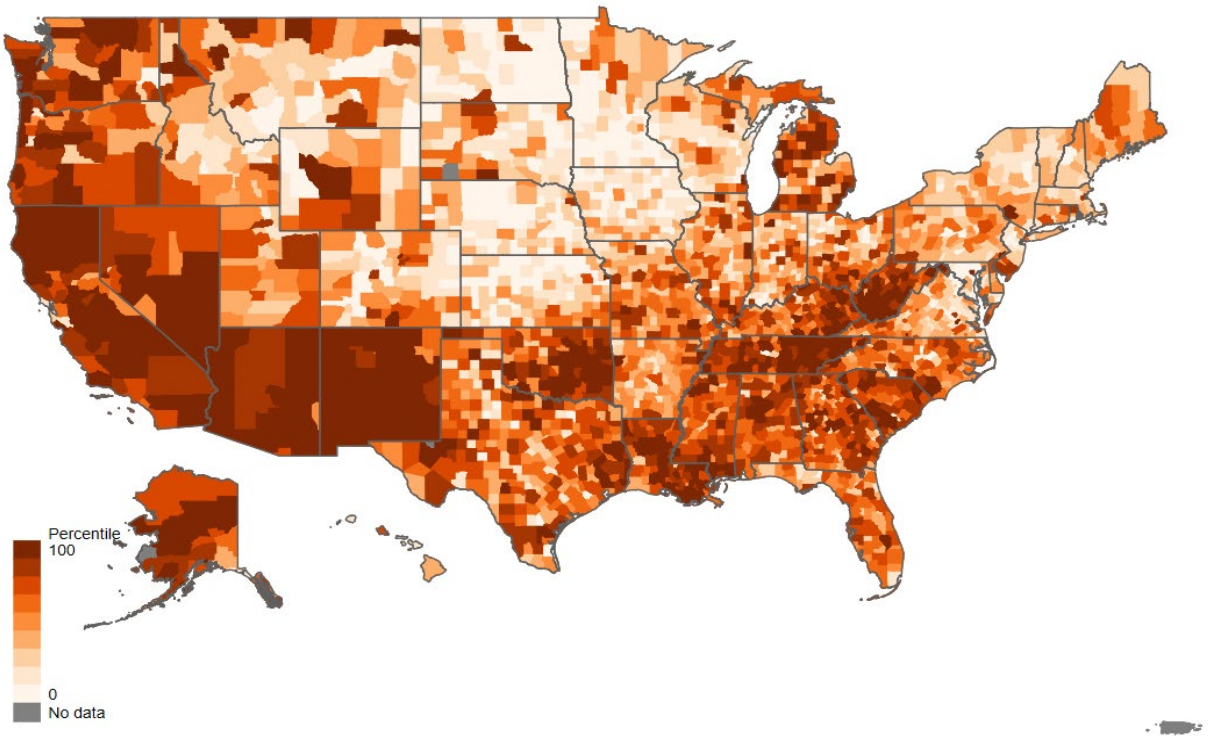


Figure 2: Overlap Between 3rd Grade Math and Reading Test Scores and Drug-Related Mortality Rates, 2009-2014
Data Source: Data on drug-related deaths are from the Institute for Health Metrics and Evaluation (IHME). Data on Math and Reading test scores are from the Stanford Educational Data Archive (SEDA). Notes: Shading is based on taking the average of the percentile ranks for

3rd grade standardized test scores (Math and Reading) and drug-related overdose mortality rates. Darker colors indicate relatively worse outcomes (i.e., higher average mortality rates and lower average test scores), while lighter colors indicate relatively better outcomes (i.e., lower average mortality rates and higher average test scores). The drug-related mortality rate is the average for the prior 9 years for 3rd graders, so the rate captures the child's lifetime exposure to the county drug-overdose mortality rate. Test scores are the average percentile rank for 3rd grade standardized test scores, averaged across math and ELA standardized tests, averaged over 2009-2014.

Policymakers Can Work to Reduce Vulnerability

Our research indicates that students with higher exposure to the opioid crisis have worse academic performance. We view this work as important to help diagnose the problem that students in these communities face; however, more work is needed to identify and evaluate appropriate policy solutions. We posit that exposure to the epidemic is more damaging in areas where students have higher vulnerability, such as areas lacking resources which can be directed towards vulnerable children – particularly in parts of rural America. For example, as of 2017 only 15% of rural counties had a registered non-profit dedicated to substance abuse.[3] Therefore, it is important to consider the ways that schools can potentially play an important role in reducing vulnerability through providing greater access to counselors and support personnel, and also by creating strong communication and coordination channels among supports available within and outside the school system. Compounding this challenge is evidence we provide that indicates that school finances are in worse shape in areas also hard hit by the opioid epidemic, and because communities with relatively worse overdose rates tend to also experience other economic hardships which limit the ability of local policymakers and advocates to address the issue without assistance from higher levels of government or non-profits. As such, resources that can help fill in the gaps and reduce the vulnerability of children in these communities are needed.

Data and Methods

We merged data on drug-related mortality rates by county between 1995 and 2014 from the Institute of Health Metrics and Evaluation (IHME) with standardized test scores by county between 2009 and 2014 from the Stanford Educational Data Archive (SEDA). To develop county-level drug-related mortality measures, IHME estimated drug-related mortality based on ICD-9 codes 292-292.9, 304.0-304.83, 305, 305.1-305.93, 760.7-760.79, E850-E850.29, E850.3-E854.3, E854.8, E855-E855.6, E855.8-E855.9, E858-E858.9, E866-E866.9 and ICD-10 codes F11-F16.99, F18-F19.99, P04.4-P04.49, P96.1, R78.1-R78.5, X40-X44.9, X49-X49.9. Additionally, IHME estimated the proportion of deaths using "garbage codes", such as a death attributed to a symptom such as back pain, that are drug-related. We tested conditional correlations between drug-related mortality rates in a county averaged over a student's lifetime and combined math and ELA test scores for 3rd and 8th grade students. Models controlled for three categories of covariates: education, demographic, and economic factors. Education controls are district-level percent black students and percent Hispanic/Latino students in 3rd or 8th grade, school-level percentages of English language learners and special education students, and county-level total schools, total charter schools, pupil-teacher ratio, and expenditures per pupil. Demographic controls are percentages of foreign-born residents, single parents, non-white residents, rural residents, holders of a bachelor's degree or higher, and residents in poverty. We also control for median household income, population density, total population, and land area. County-level economic controls are unemployment rate, annualized job growth between 2004 and 2013, and job density in 2013. Details on the data and methods can be found in the peer-reviewed paper.

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