



GDAHA
Greater Dayton Area Hospital Association

one morning

The Economic Impact of Behavioral Health in the Greater Dayton Region

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I. Abstract

This study calculated comprehensive estimates of all economic impacts of mental illness within the Dayton, Ohio, Region for 2023. Every cost area within each pathway through which mental illness generates economic impacts was estimated for the Region. This was accomplished by using pre-existing per capita estimates from similar regions and using economic cost analysis methods to adjust the estimates to the Dayton Region.

The dollar values of the economic impacts were categorized into three distinct impact types: Impact on the Region's GDP (\$12.65 billion); spending directed to mental health care and physical health care (3.25 billion); to the community impacts of mental illness (177.65 million); and the economic value of the quality-of-life impact of premature deaths resulting from mental illness (\$13.92 billion).

II. Introduction

Behavioral health has a significant impact on the economic strength and well-being of communities, affecting workforce productivity, healthcare expenditures, and overall quality of life. This economic impact study examines data from the region supported by the Greater Dayton Hospital Association (GDAHA), an eleven-county region surrounding Dayton, Ohio, with a population of 1,818,795. Specifically, the counties included in this study are *Auglaize, Shelby, Miami, Darke, Preble, Butler, Montgomery, Greene, Clark, Champaign, and Warren Counties*.

The total economic burden of mental illness has many facets, including direct and indirect expenditures on mental health treatment, expenditures on treatment of physical health needs resulting from mental illness, lost economic production and associated income, and the value of personal and family impacts of premature deaths due to mental illness. By including all facets, this study provides a comprehensive estimate of the impact of mental illness on the Greater Dayton region.

This study uses publicly available data and prior estimates for demographic, mental illness, and cost factors that allow for the estimation of economic costs by type of mental health impact. The economic impact of mental illness for the Dayton region is estimated for three categories: the loss to the region's Gross Domestic Product (GDP); the expenses incurred by the region's population due to mental illness; and emotional and quality of life impacts in the region.

The main findings of this study are:

- The Dayton region's GDP is estimated to be \$12.65 billion lower than it would be in the absence of mental illness. These are known as the indirect costs of mental illness. A helpful way to interpret this estimate is that a 10% across-the-board reduction in all levels/types of mental illness would increase worker productivity in the region enough to increase its GDP, and the income earned by the population, by an estimated \$1.227 billion. However, it is essential to note that the most significant income increases would go to households with working-age adults who are among those who experience reduced mental illness.
- The direct costs of mental illness are the expenses for mental and physical health care, and include such costs for individuals experiencing homelessness or who are housed in the criminal justice system. The region allocates \$3.25 billion annually to these direct costs. While these health expenditures do not reduce the region's GDP, they represent expenditures that would be applied to other, preferred uses if mental illness were less prevalent.
- Non-healthcare community costs include the victim impacts from crimes committed by those suffering from mental illness, the costs of housing and feeding inmates, and sheltering and feeding the mentally ill homeless population. An estimated \$177.65 million was allocated to these expenses accrued by the Dayton Region's population
- The last, and largest, impact is the economic value of the negative emotional and quality of life effects to the families and friends of those who died prematurely due to mental illness, which has an estimated economic value of \$13.92 billion.

The estimates underscore the urgent need for targeted interventions to support behavioral health, driving sustainable improvements to economic growth and the economic value of quality of life in the region. The productivity impacts estimated herein provide evidence that supports increased employer investment in mental health screening, early intervention, access to care, and recovery, which in turn can improve business productivity, reduce healthcare costs, and support public sector efforts to make similar investments.

III. Summary of Relevant Research

The economic impact of mental illness started gaining interest among public health experts and economists in the 1970s. In the United States, work to estimate this impact began with measures of the direct costs of mental health treatment. In the decades since, experts as well as the public have increasingly recognized that mental illness also affects physical health, economic productivity, and the quality of life for those suffering from mental illness, as well as their families and communities. As interest in this issue grew, the support for research increased, and the quality and comprehensiveness of estimates improved. This section highlights key research and methods used to generate the estimates in this study.

Rice et al. (1980) conducted one of the first studies to estimate a comprehensive measure of the impact of mental illness beyond treatment costs. The authors introduced a research structure in which total costs are estimated by separately measuring direct, indirect, and intangible costs, which are then aggregated. Direct costs consist of mental illness treatment expenses plus the medical expenses of physical illness and injury caused by mental illness. Indirect costs are the reduced total income resulting from lost productivity due to morbidity and mortality caused by mental illness. Intangible costs are the economic value of the reduced quality of life resulting from mental illness. While estimation techniques have improved and additional factors have been identified for inclusion in mental impact studies, this basic structure continues to form the foundation of modern studies.

Greenberg et al. (2003) developed a significant improvement in the measurement of indirect costs. To improve the accuracy of estimates of the impact of major depression on workplace productivity, the authors developed methods for enhanced measurement of absenteeism and reduced on-the-job productivity (presenteeism), resulting in a significant improvement in indirect cost measurement.

Insel (2008) pioneered the inclusion of non-health care costs by pointing out that mental illness increases the number of people who struggle in school, who drop out of school, who are homeless, and who commit crimes. This, along with further studies by Insel, brought the measurement of these factors into the mainstream of research on the impact of mental health. Additionally, follow-up studies have so far indicated that spending on the early detection and treatment of mental illness more than pays for itself through reduced expenditures on social services and the criminal justice system, as well as increased productivity through improved educational outcomes.

An analysis of untreated mental illness in Indiana, Taylor, et. al. (2023) included the economic costs of unpaid at-home caregiving by one person, usually a family member, with mental illness, and the costs for households undertaking such care as a non-health care cost.

The estimation of the economic impact of mental illness has developed over 50 years, from initially simple measures of mental health care spending to comprehensive, multi-component studies. As more impacted components have been identified, the total measured economic impact of mental illness has grown. Future research promises to improve the quality of data gathered, identify new methods that improve the accuracy of estimates, and discover additional impacts to be included in truly comprehensive estimates. Additionally, prescriptive studies that guide health providers, employers, public health professionals, and public policy are likely to become more common and better at providing practical recommendations that will meaningfully reduce the economic impact of mental illness in the future.

IV. Research Strategy and Cost Estimation Methods Used

Based on current standards and practices for estimating the total economic impact of mental illness, this study first estimates the impact of each component within the Greater Dayton region for 2023, then aggregates these component estimates to calculate the total impact. The component impacts are:

- Indirect Costs – Lost Productivity (resulting in lost income and lost regional GDP) from:
 - Premature deaths attributed to mental illness (suicides, accidental deaths, cardiovascular disease, etc.).
 - Unemployment attributed to incapacitating mental illness (including the mentally ill homeless population), incarceration, or family caregiving.
 - Employee absenteeism attributed to mental illness.
 - Employee presenteeism, reduced at-work productivity, attributed to mental illness.
 - Reduced educational attainment attributed to mental illness.
- Direct Costs – Expenditures on mental and physical health care include:
 - Mental health treatment and care expenditures
 - Physical health care expenditures

- Other Non-Health Care Costs:
 - Incarceration expenditures for adult prisoners with mental illness
 - Costs associated with the incarceration of youth with mental health needs.
 - Expenditures for the support of the mentally ill homeless population
 - Expenditures on K-12 education that are underutilized or diverted due to mental illness.
 - Economic value of the emotional pain and suffering experienced by family and friends of those who die prematurely due to mental illness.

To estimate all the component impacts, the study identified every population group impacted by mental illness and then estimated the cost of every type of mental illness impact accrued to each population group. For example, the economic impacts of mental illness for the student population in Greater Dayton consist of both school resources that are underutilized or reallocated away from instruction due to student mental illness, as well as the lost productivity of students whose educational attainment is reduced by mental illness. The total costs of these two impacts were estimated separately. The cost of reallocation of school resources was then included in the sum of Other Non-Health Care Costs, while the lost productivity resulting from reduced educational attainment was included as an Indirect Cost. The details of these cost calculations will be presented in a later section of this study.

All impacts of mental illness are, in economic terms, costs. In some cases, the costs used in this study were measured directly as events or outcomes occurred. However, in most cases, such directly measured data were unavailable, and costs were estimated based on indirect data sources or estimates calculated by other researchers. The cost estimation methods used in this study are all common to the methods accepted by economists for cost-benefit analysis (Boardman et al., 2018). These include:

- Extrapolation from Ohio-level or national-level costs, in which costs for those regions are adjusted for characteristics of the Dayton region to calculate a regional-specific estimate.
- Market price valuation is the average of market prices for several goods or services that are very similar to the cost factor used as the estimated cost.
- Analogous cost averaging, in which cost estimates calculated by experts for identical costs in similar but not identical circumstances (other geographic areas, other years) are adjusted for geographical and time differences, then averaged.
- The value of statistical life (VSL), in which the variations in market wages attributable to variations in fatality risk for different occupations are used to estimate the average value people place on their lives and those very close to them.

Because many different cost components are measured, the main body of this study will provide the specific approach used to estimate each cost, detailed explanations of each method, and demonstrations of calculations using each method.

Once each estimated cost impact is calculated, they will be gathered into three major categories:

- Impacts on the Dayton Region's GDP. Workers affected by mental illness are less productive on the job or are unable to work at all. This reduces the region's economic output (GDP), which ultimately results in lower levels of income for the population than would be the case with lower levels of mental illness.
- Impacts on spending patterns and resource allocation. This consists of the spending to treat mental illness and to provide medical care to those who suffer injuries and physical illnesses resulting from the impact of mental illness.
- Impacts on other quality of life factors. This is the value of the emotional anguish experienced by people who lose a close friend or family member to suicide or other types of premature death because of mental illness.

The sum of the economic costs of these three major categories is the total economic impact of mental illness. However, for discussions about resource allocations by businesses, nonprofits, or government agencies, the ability to focus on one or two of the categories separately can be highly valuable. They will, therefore, be reported separately.

Categories of Mental Illness

Mental illness exists on a spectrum, ranging from mild conditions with minimal impact on daily life to severe forms that can be profoundly disabling or even life-threatening and can result in fatality. For simplicity and the sake of using the most commonly available data on the prevalence of mental illness, this study follows the standard of categorizing mental health conditions into two key groups:

- **Serious Mental Illness (SMI):** These are diagnosable mental, behavioral, or emotional health conditions that significantly interfere with daily life and productivity. Examples include schizophrenia, bipolar disorder, and major depressive disorder. Individuals with SMI often require intensive treatment and support, and their conditions contribute heavily to lost income, healthcare costs, and other economic burdens.

- **Other Mental Illness (OMI):** These diagnosable conditions, while less severe, can still interfere with daily functioning. Examples include adjustment disorders, generalized anxiety disorders, and mild depressive disorders. Addressing OMI through early intervention and accessible care can help reduce long-term economic impacts.

Both SMI and OMI contribute to the economic burden on the Dayton region. While each individual suffering from SMI has a significantly more profound effect on the costs of mental illness, the large numbers of individuals suffering from OMI also create significant costs to the region. An estimated 6.1% of the region's residents suffer from SMI, and about 16.8% suffer from some form of OMI. Further, in cases where mental illness has been left untreated, the severity of the illness and its impacts on society can escalate, resulting in higher costs. As will be discussed further in the study's conclusion, investments in mental health services and strategic investments in early detection and intervention mitigate these economic consequences and improve overall community well-being.

V. The Estimates

Premature Deaths Due to Suicides or Due to Accidents or Illnesses Brought on By Mental Illness

The loss of life by suicide or by other causes of premature death attributable to mental illness, such as increased accidents due to inattention or physical illnesses such as cardiovascular illnesses, can have profound and far-reaching consequences for communities. The effects of early deaths include the quality-of-life hardships suffered by the immediate family and friends of the individual and the production of workers whose contribution to economic output and to family income is lost by their premature death.

The Manner in Which the Economic Impact of Premature Deaths is Estimated

To calculate the economic cost of premature deaths in the Dayton region, this study uses Value of Statistical Life (VSL) estimates. While there are multiple approaches to calculating the VSL, the underlying economic concept behind these estimates remains the same. That concept is that the economic value of a life is revealed by human decisions made regarding either spending to reduce the risk of death, spending to ensure sufficient compensation to dependents for a possible premature loss of life (Ex,

life insurance), or the additional compensation required to induce workers to accept jobs with higher probabilities of suffering a work-related death. Observed for large groups of people and controlling for the other factors that impact behavior, an estimate of the economic value of a life (known as the VSL) can be calculated. Due to the ready availability of data, the most common method is the wage-risk method, in which the ratio of the difference in pay to the difference in risk of death between two jobs, controlling for other factors that impact pay, yields the estimated VSL.

Several federal agencies expend significant resources to calculate an estimated VSL to assess the efficacy of regulations or spending decisions that impact fatality risks that are impacted by the government. These are the Federal Emergency Management Agency (FEMA), the Environmental Protection Agency (EPA), the U.S. Department of Transportation (DOT), and the U.S. Department of Health and Human Services (HHS). Each uses the wage-risk method. HHS also uses surveys of individuals' willingness to pay for reductions in fatality risk to assess the accuracy of the wage-risk estimates and improve those estimates when necessary. In most cases, the VSL estimates produced by these four agencies are very similar. This study uses the average of the seven most recent estimates produced by these departments or their agencies as the VSL used to estimate the economic impact of suicides in the Dayton region.

The VSL is an all-inclusive measure of the economic impact of premature deaths, encompassing both the lost production (lost GDP) and reduced quality-of-life impacts. To obtain separate estimates, the lost production impact is calculated using the expected lost compensation over the average remaining years of workplace earnings for those who suffer early deaths. This estimated loss of GDP is subtracted from the VSL to determine the impact on quality of life.

Suicides

As described above, suicide is a form of premature death that results in quality-of-life and production impacts. The estimated economic impact of suicides on the Dayton Region in 2023 is calculated as the number of suicides multiplied by the estimated VSL of a single premature death for the average age of deaths by suicide.¹

The annual number of suicides is recorded for every county and reported to the Ohio Department of Health. As with all but the most populous regions in the United States, year-to-year suicide totals in the Dayton Region are subject to fluctuations that are attributable to statistical randomness. To control for this effect, the average annual number of suicides in the Dayton Region for the three years ending in 2023 is used,

¹ Ohio Department of Public Health (2024). 2023 Ohio Suicide Report, p. 5.

which has a value of 270.7. Note that this translates to a suicide rate of 14.95 per 100,000 residents in the Dayton region, which is above the suicide rates of 14.74 for Ohio and 14.13 for the nation.

The VSL per suicide is \$13.32 million per life lost to suicide.² The total economic impact of adult suicides in the Dayton region is the product of the number of suicide deaths and the VSL: $\$13,320,000 \times 270.7 = \3.61 billion

This VSL estimate represents all costs of a death by suicide. As described above, a separation of the impact of suicides on the Dayton region's GDP of the emotional effects on families and friends will help provide further insight into the impacts. The estimated impact on the region's GDP is a straightforward calculation of the discounted present value of the expected remaining lifetime earnings of suicide victims. The calculations are based on the median earnings per worker aged 45 in the Dayton region of \$61,417 in 2023, a growth rate in earnings of 4.22% per year to account for inflation and increased productivity, and a discount rate of 3%.³ Using the median age at suicide of 45 years and the average age of retirement of 65 years (inclusive), 21 years were used as the average remaining years of work for suicides. Based on the BLS estimates of employment, it is assumed that 65% of victims would have been employed had they lived an average lifespan. Finally, the multiplier effect caused by the lost output and the resulting lost income on other sectors of the regional economy through lost spending is 1.5.⁴ The present discounted value of the production lost per worker lost to suicide, on average, is \$1,113,762 for 2023. Accounting for the 65% employment rate and the multiplier effect results in a per suicide loss to GDP of \$1,085,918. Multiplied by the 270.7 average annual suicides for 2021-2023, these values yield a total loss to GDP of \$293.96 million. Therefore, the quality-of-life impact of the region's suicides on family and friends in 2023 is calculated as the VSL minus the GDP loss, which is \$3.32 billion.

Summary of data sources:

- VSL: FEMA, EPA, DOT, HHS
- Number of Suicides: Ohio Department of Health
- Impact on regional GDP: Bureau of Labor Statistics (BLS) for earnings, Bureau of Economic Analysis (BEA) for earnings growth rate, Congressional Budget Office (CBO) for discount rate

² Adjustments for inflation were made to ensure the VSL was accurate for 2023.

³ Median Earnings for the Dayton Region were reported by the Bureau of Labor Statistics, the earnings growth rate of 4.22% is equal to the 20-year historical average of earnings growth, and the 3% discount rate is equal to that recommended by the Office of Management and Budget.

⁴ The multiplier of 1.5 was calculated the input-output multipliers published by the Bureau of Economic Analysis for the industries present in the Dayton Region and weighted by the percentage of the region's employment in each industry.

Summary of estimates:

Loss to regional GDP = \$293.96 million

Lost quality-of-life = \$3.32 billion

Total economic impact = \$3.61 billion

Premature Deaths Due to Accidents or Ailments Brought on by Mental Illness

People with mental health conditions, particularly severe mental illness or chronic mental illnesses of less severe forms, can experience higher rates of physical illnesses, which contribute to the reduced life expectancy observed in this group (Walker et al., 2015). These physical health conditions are sometimes exacerbated by factors like medication side effects, unhealthy coping mechanisms, and barriers to accessing care. The most common life-shortening physical illnesses and conditions that have been established to be caused by or worsened by mental illness include cardiovascular disease, pulmonary disease, infections, and autoimmune disorders. In addition, mental illness has also been found to increase accidental fatalities due to an increase in inattentive and/or aggressive behavior (Crump et al., 2013).

The estimated number of non-suicide deaths in 2023 attributable to mental illness was calculated using extrapolation from state-level data. The number of deaths in Ohio, 127,769, and the percent of those deaths that were premature (under the age of 75), 34%, were reported by the Ohio Department of Health. The percentage of non-suicide deaths in Ohio that resulted from mental illness was estimated to be 17.8% in 2007 (Sherman et al., 2013). This estimate was adjusted to 22.1% to account for the increase in mental illness from 2007 to 2023, from 19.5% to 24.4% in Ohio.⁵ The number of non-suicide deaths in the Dayton region attributable to mental illness was calculated as the product of total Ohio deaths, the percentage of Ohio deaths that were premature, the percentage of non-suicide premature Ohio deaths attributable to mental illness, and the percentage of Ohio residents who reside in the Dayton region (15.4%). 8.21

The economic impact of these deaths is calculated similarly to the economic impact of suicides. The VSL per premature non-suicide deaths attributable to mental illness is lower than the value calculated for suicides, purely because the average age of death is higher for this population than for the suicide population. The average age of non-suicide premature death resulting from mental illness is 55 years old. Therefore, the average VSL among those calculated by federal agencies for this age is \$8.21 million.

⁵ Reeves, *et. al.* (2011), p.26.

For the 1,482 premature non-suicide deaths in the Dayton area, the total economic impact based on this VSL was \$12.17 billion in 2023.

To calculate the impact on the Dayton region's GDP, the present discounted value of the typical person's remaining productive life, which in this case was 11 years from age 55 until expected retirement at age 65, inclusive. This was calculated beginning with the median income per worker in the Dayton region at age 55 of \$71,877. As with suicides, I assumed an annual salary growth rate of 4.22% and a discount rate of 3%, a 65% employment rate, and a 1.5 multiplier effect. The estimated loss to GDP per individual was \$1,062,486, which aggregates to \$1.57 billion for the region. The emotional cost of premature deaths, as with suicides, is the difference between the VSL and the loss to GDP, which is \$10.60 billion.

Summary of data sources:

- VSL: FEMA, EPA, DOT, HHS
- Number of non-suicide premature deaths due to mental illness: Ohio Department of Health, Sherman, et. al., 2013, USAFacts.org,
- Impact on regional GDP: BLS, BEA, CBO

Summary of estimates:

Loss to regional GDP = \$1.57 billion

Quality-of-life impact = \$10.60 billion

Total economic impact = \$12.17 billion

Adult Crime and Criminal Justice

The four component costs of adult criminal activity attributable to mental illness that are measured in this study are the costs suffered by victims, criminal justice costs, costs of prisoner mental health treatment, and the loss to local GDP of prisoners being outside of the workforce. To calculate these costs for 2023, the estimated number of prisoners from the Dayton region who have mental illness is multiplied by the sum of estimated average per prisoner costs to victims, for incarceration, prisoner mental health care, and lost production.

The number of adult prisoners (measured as the average daily prison population) in the state prison system from the Dayton region is estimated based on the assumption that it is proportionate to the number of Ohio adults who live in the Dayton region (15.2%). Thirty percent of Ohio's state prison population has a mental illness, as estimated by the Ohio Department of Mental Health and Addiction Services (2024). Therefore, the

number of state prisoners from the Dayton Region is estimated to have been 6,745, of which 2,024 are estimated to have had mental illness in 2023.

The average daily population of adults held in county and municipal jails is based on the 2023 census of local jail populations in the state of Ohio. For the 11-county Dayton Region that is the focus of this study, the local prisoner population was 2,628, of whom 788 were suffering from mental illness (30%).

Using estimates by criminal justice researchers, the economic costs to victims of crime averaged an estimated \$19,000 per criminal conviction, including estimated values of violent acts as well as property damage.⁶ Criminal justice expenditures in Ohio for each adult in the state prison system averaged \$37,595 annually in 2023, and annual spending on mental health care per inmate receiving that care was \$3,132. Median annual earnings for those employed in the Dayton Region were estimated to be \$46,717 in 2023, which, with the 65% employment rate and a multiplier effect of 1.5, results in a \$45,549 loss to GDP per prisoner's non-participation in the workforce. Thus, the sum of the four component costs of criminal activity per mentally ill inmate in state penitentiaries was \$105,276, and the aggregate impact for the 2,024 prisoners from the Dayton was \$213.08 million.

For local county and municipal prisoners in the Dayton region, the average daily cost of detention is \$74, or \$27,010 annually. Due to an absence of a comprehensive measure of local prisoner mental health spending for the Dayton region or for comparable regions, this study uses the same \$3,132 as in the state penitentiary system. Since most local prisoners have either not been convicted of a crime (are awaiting trial or undergoing trial) or have been convicted of lesser offenses, the victim impact is excluded. Lastly, the lost productivity is measured identically to that used for state prisoners, \$45,549. The sum of these component costs is \$74,691 per mentally ill local prisoner and \$59.64 million for the 11-county Dayton region.

The product of this sum and the number of prisoners for each group yields the estimated economic cost of crime committed by adult state prisoners and local prisoners who are mentally ill, respectively, the sum of which is \$272.72 million.

Summary of data sources:

- Number of prisoners from the Dayton region with mental illness: Ohio Department of Rehabilitation and Correction for the number of state prisoners, Ohio Department of Mental Health and Addiction Services for a percentage of prisoners with mental illness, and individual counties for county and city jail populations.

⁶ McCollister et. al., 2010, and Roman et. al., 2023.

- Economic cost of crime to victims: McCollister et. al. (2010) and Roman et. al. (2023).
- Prison inmate housing costs: Ohio Department of Rehabilitation and Correction for state prisons, Buckeye State Sheriffs' Association (2023) for local jails.
- Mental Health Care Spending for Prisoners: Ohio Department of Rehabilitation and Correction
- Impact on regional GDP: BLS, BEA, CBO

Summary of estimates:

Loss to regional GDP = \$128.07 million

Economic cost to crime victims = \$38.45 million

Inmate housing expenditures = \$97.40 million

Mental health care expenditures for inmates = \$8.80 million

Total economic impact = \$272.72 million

Juvenile Crime and Criminal Justice

The three component costs of juvenile criminal activity attributable to mental illness measured in this analysis are the costs suffered by victims, criminal justice costs, and the costs of prisoner mental health treatment. To calculate these costs for 2023, the estimated number of juvenile detainees from the Dayton region with mental illness is multiplied by the sum of the average of each of these three costs per detainee.

Based on the demographic similarity between the 11-county area used for this study and the state of Ohio, the number of juvenile detainees (measured as the average daily population in the state's juvenile detention system) from the Dayton region is estimated based on the assumption that it is proportionally the same as the number of Ohio juveniles that live in the Dayton region (16.2%). The number of detainees under the supervision of the Ohio Department of Youth Services was 1,494 in 2023. The 16.2% of these detainees who are from the Dayton region, is estimated to be 242. Of this total, 169 (70%) is the estimated number of state juvenile detainees from Dayton who are suffering from mental illness.

Using estimates from prior academic research, criminal justice researchers estimated that the economic costs to victims of juvenile crime averaged an estimated \$10,000 per case, including the estimated values of violent acts and damage to property.⁷ Using the average length of incarceration per offender of 1.3 years, the annualized value of the victim impact is \$7,692 per offender, on average, and the cost to the region is \$1.3

⁷ McCollister et. al., 2010

million. Housing expenditures in Ohio for each juvenile detainee averaged \$99,372 annually in 2023, and annual spending on mental health care per detainee receiving that care was \$27,375. The sum of these three costs is \$134,439 per juvenile detainee. The product of these sums' value and the number of prisoners for each group yields the estimated economic cost of crime committed by adult state prisoners and local prisoners who are mentally ill, respectively, the sum of which is \$22.72 million.

Summary of data sources:

- Number of juvenile detainees from the Dayton region with mental illness: Ohio Department of Youth Services for the number of state juvenile detainees, National Alliance of Mental Illness (NAMI) for a percentage of prisoners with mental illness, and individual counties for county and city jail populations.
- Economic cost of crime to victims, juvenile crime: McCollister et. al. (2010)
- Juvenile detainee housing costs: Ohio Department of Youth Services
- Mental Health Care Spending for Juvenile Detainees: Ohio Department of Youth Services

Summary of estimates:

Economic cost to victims of juvenile crime = \$1.30 million

Detainee housing expenditures = \$16.79 million

Mental health care expenditures for detainees = \$4.63 million

Total economic impact = \$22.72 million

Homelessness

A higher percentage of the homeless population has mental illness (45%) than is the case for the general population in the Dayton region (24%), indicating that mental illness increases the costs of sheltering and other care for the homeless population. Increased homelessness due to mental illness also results in decreases in the local workforce and regional GDP. The three types of economic costs of homelessness attributable to mental illness measured in this analysis are the expenditures on sheltering mentally ill homeless people, expenditures on mental health care for the homeless population, and the impact on the Dayton region's GDP of nonparticipation in the labor force by homeless people with mental illness. To calculate the total costs associated with the portion of the homeless population that has mental illness for 2023, the estimated population of this group is multiplied by the sum of the averages of each of these three costs.

The Department of Housing and Urban Development conducts an annual census of homelessness in the U.S., measured by county. While imperfect, this census provides the most accurate measure of the homeless population and includes county-level populations. The homeless population in the Greater Dayton region was 1,562 in 2023. The existing research that has estimated the percentage of the homeless population that is mentally ill has produced widely varying estimates from roughly 20% to 67%. This study uses the mean value of these studies (44%) generated by this research, which results in an estimated population of 687 people in the Dayton Region who are homeless and mentally ill.⁸ The basic costs for the emergency sheltering of homeless individuals vary widely depending on the facility, averaging about \$30 per day, or \$10,950 annually, resulting in total sheltering costs of \$7.52 million for the Dayton homeless population that is suffering from mental illness.⁹ The additional annual costs of care for the mentally ill homeless population are significantly higher, \$32,485, for individuals with SMI and \$15,400 annually for those with OMI. This study uses the estimated percentages of the homeless population suffering from SMI (21%) and OMI (23%) in Ohio.¹⁰ This results in additional costs of care for the Dayton region's mentally ill homeless population that is equal to \$16.19 million. Finally, the loss to the region's GDP resulting from the homeless population that has mental illness, using the same average occupational income as for the earlier estimates, is \$31.30 million.

Summary of data sources:

- Number of homeless people in the Dayton region: HUD Annual Homeless Assessment Report
- Percent of the homeless population suffering from mental illness: Barry (2024), Gutwinski (2021), and Padgett (2020)
- Average cost of sheltering homeless individuals: Ohio Housing Finance Agency
- Average additional cost, per person, of mental health care for homeless individuals: Culhane, et. al. (2002)

Summary of estimates:

Basic sheltering cost, Dayton region's homeless population with mental illness = \$7.52 million

Health care expenditures for the region's mentally ill homeless population = \$ 16.19 million

⁸ Barry et. al. (2024) estimate of 67%, Gutwinski et. al., (2021) estimate of 45%, and Padgett (2020) estimate of 20%.

⁹ Fiscal Year 2023 Financial Statements, Ohio Housing Finance Agency estimate of \$22 per day, Culhane and an (2021) estimate of \$38 per day.

Loss to the region's GDP due to workforce non-participation by the homeless population that is mentally ill = \$31.30 million

Total economic impact of mental illness through homelessness = \$55.01 million.

Unemployment

The economic impact of unemployment resulting from mental illness is simply the loss to the region's GDP resulting from the higher level of nonparticipation in the labor market among adults. The estimate for this impact is the product of the excess number of people who are unemployed due to mental illness and the median annual earnings that would have been expected to be earned had they not suffered from mental illness.

Thirty-five percent of the adult population in the Dayton region is not employed. This compares to 84% of the adult SMI population and 56% of the adult OMI population that are not employed. For the combined SMI and OMI population, 63% of the total mentally ill population is not employed. Thus, mental illness is a very significant factor in explaining unemployment and broader nonparticipation in the labor market. The 28% difference between the proportions of the general adult population and the mentally ill population that are not employed represents the excess level of unemployment attributable to mental illness.

To avoid double-counting, the number of adults in the Dayton region suffering from mental illness who are not employed is adjusted in this section of the study to account for those already counted due to their homeless status (prisoners are already excluded due to their status as part of the institutionalized population). So, the estimated additional number of people in the region who are not employed due to mental illness is 28% of the region's non-institutionalized adult population with mental illness that is not employed because of their mental illness. This estimate is 93,743 people, or 6.7% of the region's adult population.

As with this study's previous estimates of the impacts of mental illness via unemployment, the median annual earnings for workers in the Dayton region, \$46,717, which is adjusted to account for the 1.5 multiplier effect of changes in employment. Therefore, the total economic impact of mental illness on the Dayton region from increased unemployment is \$6.57 billion.

Summary of data sources:

- Percent of the Dayton region's adult population that is not employed: BLS.
- Percent of the SMI and OMI populations that are not employed: Diel et. al., (2014) for SMI and Luciano, et. al., (2014) for SMI and Luciano et. al. (2014) for SMI and OMI.

Summary of estimates:

Loss to the region's GDP from unemployment caused by mental illness = \$6.57 billion

Absenteeism and Presenteeism Due to Mental Illness Within the Workforce

Workers suffering from mental illness are absent more often than the general workforce population and are less productive when at work. Absenteeism consists of unexpected absences from work, usually due to illnesses (including mental illness), family emergencies, lack of childcare, or other personal reasons. Presenteeism comprises cases where workers are present at work but not fully productive due to illness, stress, or other factors. Both absenteeism and presenteeism result in reduced workforce productivity due to lost hours of work or reduced productivity during effective work hours.

Similar to unemployment, the economic costs of absenteeism and presenteeism are calculated as the product of the annual hours of work lost due to these mental illness impacts and the median hourly wage for the Dayton region. On average, a worker who has a mental illness is absent from work an additional 38.4 hours annually compared with the general workforce and provides 76.8 fewer hours of productive work per year than if they were not suffering from mental illness (Stewart et. al., 2003).

Using the Ohio median hourly wage of \$23.95, the estimated number of employed adults suffering from OMI in the Dayton Region (18.75%, or 155,827 workers), and including the multiplier effect, the total loss to the Dayton region's GDP attributable to this loss of productivity is \$456.45 million. This can be broken down into \$152.15 million from absenteeism and \$304.3 million from presenteeism.

Summary of data sources:

- Number of hours of absenteeism and presenteeism attributable to mental illness: Stewart et. al. 2003.
- Median hourly earnings for the Dayton region: BLS

Summary of estimates:

Value of lost work hours from absenteeism due to mental illness = \$214.97 million

Value of lost work hours from presenteeism due to mental illness = \$429.94 million

Combined value of lost work hours from absenteeism and presenteeism due to mental illness = \$644.91 million.

Home Care of Mentally Ill Individuals

Many individuals who suffer from mental illness receive unpaid care from family or other members of their household. Those with serious mental illness are significantly more likely to receive at-home care from family or friends and receive more hours of such care per year than those with other mental illnesses. The economic cost of this care is its opportunity cost in terms of employment foregone by caregivers to care for a household member.

The opportunity cost to the Dayton region of unpaid home care is equal to the product of the estimated population suffering from mental illness in the region, the percentage of that population that receives unpaid at-home care, the estimated average annual hours of care provided by each of these caregivers, the percent of the non-working population that would be employed, and the median hourly wage that would be earned from paid work.

An estimated 55% of the Dayton region's population with serious mental illness receives unpaid at-home care, for an average of 1,144 hours per year (22 per week).⁶ The value of the work foregone by caregivers to provide this support is the product of these annual hours, the average percent of available hours that the general adult population applies to work (65%), and the median hourly earnings for Dayton regional workers (\$23.95), and the multiplier effect (1.5).¹¹ This results in an estimate of \$1.17 billion in reduced GDP due to the reallocation of caregivers' time away from work due to serious mental illness.

For the population with other mental illness, 27% receive and average of 384 hours per year (7.4 per week) of at-home care.¹² Again, with 65% of those hours applied to the workforce if not for the care obligation, the median wage of \$23.95, and the multiplier effect of 1.5, \$632.54 million is lost to the region's GDP due to other mental illness. Thus, the total loss to the region's GDP from at-home caregiving of family or friends who have a mental illness is \$1.8 billion in the Dayton region.

⁶ Arnone (2024)

¹¹ BLS

¹² Cham, et. al. (2022)

Summary of data sources:

- Number of hours of work foregone to provide unpaid at-home mental health care for those with serious mental illness: Arnone (2024) and BLS
- Number of hours of work foregone to provide unpaid at-home mental health care for those with other mental illness: Cham et. al. (2022) and BLS
- Median hourly earnings for the Dayton region: BLS

Summary of estimates:

Value of lost work hours from unpaid at-home care for SMI = \$1.17 billion

Value of lost work hours from unpaid at-home care for OMI = \$632.54 million

Total value of lost work hours from unpaid at-home care due to mental illness = \$1.80 billion.

Direct Mental Health Care and Physical Health Care Expenses Attributable to Mental Illness and not Already Measured as a Part of Criminal Justice and Homelessness

To estimate the total direct costs of mental illness outside of the prison system and homeless support system, expenditures on mental health care for adults and juveniles, and physical health care expenditures attributable to mental illness for adults and juveniles are estimated separately. The sum of all four expenditure types is the total direct health care costs of mental illness.

Total regional expenditures on adult mental health care are estimated as the product of average annual per-patient mental health care spending in Ohio in 2023, \$5,250, and the estimated number of adults in the Dayton Region with mental illness, 340,334 (Greenberg et. al., 2021). This product yields a value of \$1.79 billion.

Total expenditures on juvenile mental health care in the region are the product of average annual per-patient mental health care spending for juveniles in Ohio in 2023, \$2,550, and the estimated number of juveniles in the Dayton region with mental illness, 76,168.¹³ This product yields a value of \$194.23 million.

Total expenditures on adult physical health care attributable to mental illness are significantly higher for those with severe mental illness due to increased rates of injury due to inattention, as well as increased rates of cardiovascular and other illnesses. The average annual excess physical health care spending in 2023 per patient due to severe

¹³ Ibid.

mental illness is \$5,428, and the number of Dayton region adults with severe mental illness is 79,613. The product of these two values results in an estimated total cost of \$432.14 million in health care spending for adults with serious mental illness in the Dayton region. For those with other mental illnesses, average annual physical health expenditures are \$2,630 per patient, which for the 260,721 adults in the region estimated to have OMI, results in total OMI-related physical health expenditures of \$685.7 million. The sum of SMI and OMI health care spending was \$1.12 billion in 2023.

For juveniles, physical health care expenses attributable to mental illness are far more closely aligned with injuries due to risk-taking and inattention than for adults. The average annual excess physical health care spending in 2023 per juvenile patient due to serious mental illness is \$3150, and the number of juveniles over the age of 4 in the Dayton region with serious mental illness is 31,34.¹⁴ The product of these two values results in an estimated total cost of \$98.74 million in health care spending for adults with serious mental illness in the Dayton region. For those with other mental illnesses, average annual physical health expenditures are \$470 per patient. For the 44,820 juveniles in the region estimated to have OMI, total OMI-related physical health expenditures are \$21.1 million. The sum of SMI and OMI juvenile physical health care spending was \$119.84 million in 2023.

Summary of data sources:

- Percent of the adult population suffering from SMI and OMI: Greater Dayton Area Hospital Association
- Percent of the juvenile population suffering from SMI and OMI: Greater Dayton Area Hospital Association
- Spending per adult and juvenile patient receiving mental health care: Greenberg, et. al., (2021) and Ivanova et. al., (2011)
- Spending per adult and juvenile patient receiving physical health care for injuries or illness attributable to mental illness: Greenberg et. al., (2021) and Ivanova et. al., (2011)

Summary of the above estimates (Note that they exclude the direct expenses of mental illness for incarcerated and homeless individuals):

Mental health care spending for adults in the Dayton region = \$1.79 billion

Mental health care spending for juveniles in the Dayton region = \$1.12 billion

Physical health care spending for adults in the Dayton region = \$194.23 million

Physical health care spending for juveniles in the Dayton region = \$119.84 million

Total of the above direct costs of mental illness in the Dayton region = \$3.22 billion

¹⁴ Ibid.

Total direct costs, including those incurred in the penal system and homeless care system:

Above direct costs of mental illness in the Dayton region = \$3.22 billion

Health care expenditures for the region's mentally ill homeless population = \$ 16.19 million

Mental health care expenditures for juvenile detainees = \$4.63 million

Mental health care expenditures for inmates = \$8.80 million

Total direct costs of mental illness = \$3.25 billion

Workforce Development

Mental illness also impacts workforce productivity via its impact on students. Students with mental illness miss more days of school annually and, on average, reach lower levels of educational attainment than the general population. The first of these impacts is the loss of education that results from the higher numbers of absences experienced by students with mental illness. The second is the loss of education that results from students who end their education (drop out) with a lower level of educational attainment than would have been achieved if they did not have a mental illness.

The first of these impacts cannot be measured directly, so it is estimated by the fiscal resources devoted to K-12 students who are underused due to absences that result from mental illness. In this case, the daily cost of educating a student is a conservative estimate of the value of that day's education. The second of these effects is measured as the present value of the lifetime loss in earnings that results from students ending their education earlier due to mental illness than they otherwise would have. This loss in earnings is a conservative estimate of the loss to the region's GDP from the reduced production resulting from juvenile mental illness. There are an estimated 76,168 school-aged residents in the Dayton region with mental illness (23.6% of the school-aged population). The average number of days missed due to mental illness beyond the expected absences for other reasons is 7.35 days per year, and the average daily expenditures per student in Ohio in 2023 were \$83.33.¹⁵ Thus, the total value of education lost due to student absences caused by mental illness in the Dayton region is \$46.65 million.

To estimate the loss to GDP attributable to students truncating their education due to mental illness, this study uses the number of high school students, community college students, and four-year college students, respectively, who drop out due to mental illness, then calculates the present values of the differential earnings between one level

¹⁵ Lawence, et. al., (2019).

of educational attainment and the next. The high school dropout rate for the state of Ohio was 5.3% in 2023, and an estimated 22% of students who drop out of high school did so primarily because of their mental illness. Based on these values, 414 students were estimated to have dropped out of high school in the Dayton Region in 2023, primarily due to mental illness.

As before, the difference in earnings is assumed to expand at a 4.22% annual rate and is discounted at a 3% rate for the calculation. The 1.5 multiplier effect is also applied. The estimated present value of the earnings differential is \$568,242 in foregone GDP (and income) per student dropout, which aggregates to \$235.26 million for the 414 students who dropped out of high school due to mental illness in the Dayton region.

Equivalent estimates are also calculated for community college students who end their education before earning an associate's degree and for students at four-year colleges who end their pursuit of a bachelor's degree before completion. An estimated 1,075 community college students from the Dayton region are estimated to have dropped out due to mental illness at a cost to GDP of \$472,013 per student and \$507.41 million for the region. Lastly, an estimated 891 students from the Dayton region are estimated to have dropped out of four-year colleges due to mental illness at a cost to GDP of \$903,257 per student and \$804.80 million for the Dayton region. Summing these three populations of students, the total loss to GDP resulting from students ending their education earlier due to mental illness is \$1.57 billion.

Summary of data sources:

- Average additional days of school absences due to mental illness: Lawrence, et. al. (2019)
- Daily cost of education per student: Ohio Department of Education
- Annual drop-out rates: National Center for Education Statistics
- Foregone income: BLS

Summary of estimates:

Value of education lost due to K-12 student absences caused by mental illness = \$46.65 million

Loss to the region's GDP from high school noncompletions caused by mental illness = \$235.26 million

Loss to the region's GDP from community college noncompletions caused by mental illness = \$507.41 million

Loss to the region's GDP from high school dropouts (noncompletions) caused by mental illness = \$804.80 million

Total economic impact of mental illness on workforce development = \$1.62 billion

Summary

This study estimates the economic impact of mental illness on an eleven-county region of Ohio centered on Dayton. The estimates were calculated for each of the many specific implications in the region: Direct mental health spending, related physical health spending, unpaid caregiving, suicide, other premature mortality caused by mental illness, unemployment, workplace absenteeism and presenteeism, lost workforce development through truncated education, homelessness, and criminal justice impacts.

The impacts can then be partitioned into three major categories: Lost economic output (loss to GDP), inefficient resource allocation in that many of the negative impacts of mental illness could be reduced at a relatively low cost, and the emotional, quality of life, and toll of mental illness. These costs, respectively, are:

Impact on the region's GDP (lost output and income): \$12.65 billion

Impact on allocative efficiency (all direct costs): \$3.25 billion

Impact on non-healthcare community costs: 177.65 million

Impact on quality-of-life (from lives lost): \$13.92 billion

Of course, these costs cannot be eliminated. However, they can be reduced, particularly with early recognition, diagnosis, and treatment of mental illness. For example, Rosenberg et al. (2020) found that early intervention after an individual's first episode of psychosis reduces long-term disability and had a return-on-investment of \$2 - \$3 for every \$1 of care. Such early interventions have lower treatment costs and either prevent or reduce the magnitude of many of the impacts of mental illness.

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