Harnessing Big Data to Improve Children’s Mental Health Treatment

Mental health issues in adults are the leading cause of disability and lost workdays, and yet many mental health problems are already diagnosed in childhood, suggesting that we are not properly addressing the situation. Globally, 10% to 20% of children suffer from a mental health issue. Rising suicide rates among adolescents are also a grave global concern. In the US, for instance, suicide is the second leading cause of death among children 15 to 19 years old.

Despite these statistics, there is little systematic research exploring the economic consequences of mental health problems, the role economic factors play in mental illness, or the costs and benefits of treatments. In fact, mental health is rarely discussed in an economic context at all, which likely reflects the stigma attached to mental illness.

I want to change that. Through my project, Harnessing Big Data to Improve Children’s Mental Health Treatment, my team and I are using big data generated by the health care system to better understand how children are diagnosed with mental illness, how they are treated and their ultimate outcomes. In this five-year study, we will identify the specific therapies most promising for children with mental disorders, as well as therapies that pose the highest risk of harm.

At present, the crucial role of childhood circumstances in the development of productive workers is widely accepted, and the role that childhood disparities play in creating inequality is much studied. But to better understand the economic consequences of mental health problems, it is particularly important to first understand how children with mental illness are being treated.
Top: Mental health problems often begin in early childhood and impact educational attainment. This figure summarizes middle school outcomes for children diagnosed with ADHD in elementary school in both the United States and Canada.

Bottom: Increases in diagnoses of chronic conditions, including mental health problems, in South Carolina after the state switched children in their public health insurance program to a managed care system that increased the incentives of providers to screen for conditions.
A Rising and Complex Problem

Nearly 30 years ago, I began working in what has become a new field: the study of how children develop their productive capabilities over time, their "human capital." One of my first research projects was a collaboration with biostatisticians looking at records from Canada. We were startled to find that childhood attention deficit hyperactivity disorder (ADHD) had a large impact on college attendance and welfare use. On average, childhood mental disorders were more debilitating and had more harmful effects on children’s future education and employment prospects than common physical health problems, such as asthma, even in a country where most health care is publicly funded and free to all.

Toward Evidence-Based, Personalized Care

Clinicians face overwhelming choices as well. For depression alone, there are 32 different antidepressant molecules in common use in the US, not to mention atypical antipsychotics and anti-anxiety drugs that are also often prescribed off-label for this condition. Moreover, most experts agree that drug treatment should be combined with therapy; however, there is little agreement on exactly which combinations of drugs and therapy are most effective.

Even when specific drugs and therapies have been tested in children, they may be prescribed in sequence or in combination with other drugs — and those sequences and combinations have not been tested. Given the sheer number of possible psychiatric diagnoses and available psychiatric medications, it is unlikely that all possible combinations and sequences could be tested through clinical trials.

In the absence of good evidence, many children are still being treated with powerful psychotropic medications by desperate parents and providers. The problem seems tailor-made for new and intelligent machine-learning methods that can help identify the treatments that provide the best results for a given diagnosis. The time now appears ripe to investigate whether administrative big data can be used to identify the most promising therapies for children with diagnoses of mental disorders, as well as those therapies in current use that pose the highest risk of harm.

Creating a Proof of Concept

Our first aim will be to apply state-of-the-art machine learning to administrative big data to develop a proof of concept that our methods can complement traditional clinical trials to assess mental health treatments for children.

One of the outcomes we will explore is emergency room (ER) visits, as people suffering from mental health crises are usually first brought to an ER, even if the hospital does not have a psychiatric unit.

A second group of outcomes will be captured through outpatient visits. Children with negative (or null) reactions to treatment might be more likely than successfully treated children to have additional outpatient visits for mental health, substance abuse, injuries, or the consequences of other risky behaviors.
Harnessing Big Data

Every time a person sees a doctor, and every time a doctor writes a prescription, a medical record is generated.

Using prescription records, we can characterize each doctor’s practice style.

We then link millions of patient records with measures of practice style to investigate the effects of practice style on outcomes, such as hospital visits.

The common element that allows a linkage is the doctor.
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Looking Across Borders to Enable Better Treatments

Cross-country comparisons are one way to determine the extent to which the experience of mental illness is similar across industrialized countries, rather than being determined by culture or medical systems. One key idea in the machine learning literature is that one can “train” a model using a set of data, and then further test the model using additional data. If we are successful in identifying conditions and treatments that work well using an initial source of administrative big data, then we will be able to see whether these same treatments also work well in other settings. It will also be informative to describe the extent to which diagnosis, treatment patterns and subsequent outcomes vary across these data sources and countries.

Having identified the most promising therapies, we will disseminate this information with the ultimate goal of improving clinical practice. Turning our attention to providers, we will identify those provider characteristics that are associated with better and worse treatments in order to facilitate the targeting of efforts to enhance and improve practice. For example, we will be able to see how general practitioners or pediatricians do treating mental health problems compared with specialists.

From Insight to Impact

If successful, this new and ambitious research holds the promise of revolutionizing our approach to assessing treatment modalities by making full use of the rich data generated by children’s everyday encounters with the medical system. It will also have a concomitant effect on the whole of society — simply talking about mental health the same way we talk about other health problems reduces stigma.

But that may not be the only incidental positive outcome of this research: My previous work on early childhood education and the importance of health insurance for pregnant women and young children has had an influence on policy internationally. This incredible experience puts me in a position to continue inspiring others to work on child mental health — an equally important and even less explored domain — and in doing so expanding the field of the economics of children.
We are working to analyze data for the 40 to 50 percent of US children who are covered by public health insurance (Medicaid) and how the features of state programs affect how children with mental health problems are diagnosed and treated. Our lab is also training scholars like Anna Chorny (above right) who completed a postdoctoral fellowship and is now continuing this work at Northwestern University.

References


