**Zoë M. McLaren, Ph.D.**
**University of Michigan**

**Research**

My research strengthens the *data-evidence-policy pathway* by using applied econometric methods to build the evidence base to guide health and labor policy in developing countries. My work contributes to three strands of the literature: (1) identifying the causes of high unemployment in South Africa, (2) estimating the impact of access to health resources on economic outcomes, and (3) generating rigorous evidence to address the tuberculosis (TB) epidemic. I describe each strand in more detail below.

1. Identifying the causes of high unemployment in South Africa

In a foundational work that has been cited over 300 times (*Economics of Transition* 2008), we examined the potential causes of high unemployment in South Africa to set the stage for policy intervention. We documented structural changes in post-apartheid South Africa that increased both the supply of low-skilled labor and the rate of skill-biased technical change. The key to identifying constraints on employment was understanding the dynamics of transition between employment statuses. We found that there were high rates of formal sector job separation and very low rates of transition out of unemployment. Notably, young people, even with a high school education, had low rates of employment before age 35. The analysis pointed to high reservation wages, high job search costs, the HIV epidemic, and poor education quality as potential culprits. This work led to the subsequent implementation by the South African government of a youth wage subsidy and greater resources for educational reform.

In a forthcoming article (*Economic Development and Cultural Change*), I find that *involuntary* unemployment rather than high reservation wages is a primary driver of South Africa's persistent unemployment problem. After a prime-age household member loses a job, households are unable to fully replace lost household income through employment or sending migrants. They are worse off for at least two years, in that they are less likely to hold financial assets and more likely to report frequent food insecurity. This evidence highlights need for policy that directly addresses structural frictions in the labor market.

My most important study in this research area was the first to estimate the magnitude of the negative impact of being HIV-positive on individual labor market outcomes in South Africa (*Review of Economics and Statistics* 2013). Because of concerns about bias due to sample selection (HIV status is not randomly assigned) and reverse causality (poor labor market outcomes could lead to the acquisition of HIV), we developed an innovative propensity score econometric approach to produce unbiased estimates from rich survey data. In the period before widespread access to AIDS treatment, HIV-positive individuals experienced a surprisingly large negative labor market impact equal to the loss of about 10 years of schooling. This study contributed to the methods literature on addressing sample selection as well as to the policy debate on the optimal allocation of AIDS treatment.

Two working papers extend this contribution by demonstrating that access to anti-retroviral therapy (ART) for AIDS improved labor market outcomes in South Africa, including for HIV-negative individuals. In "The Effect of Access to AIDS Treatment on Employment Outcomes in South Africa," I provide the first evidence that the government provision of free AIDS treatment in South Africa increased labor force participation and employment for Black African men. I use geographic and temporal variation in the program rollout between 2004 and 2008, when over

500,000 patients began treatment, to identify the causal impact of AIDS treatment on labor market outcomes. Initially, some dismissed my estimates as "implausibly high" given the size of the treated population. However, subsequent work in this area has demonstrated spillover pathways that further validate the magnitude of my original estimates, notably raised expectations about the future and improvements in mental health (see Baranov, Bennett and Kohler 2015).

In a follow-on paper "HIV Treatment as Economic Stimulus: Community Spillover Effects of Mass ART Provision in Rural South Africa," our results present new evidence of positive spillover effects of ART scale-up on employment of HIV-uninfected community members, through channels that operate outside the household. We use a similar identification strategy to compare employment gains by HIV-status using Africa Centre surveillance-site population data that includes HIV test results. We find that employment gains were largest for HIV-infected people, but substantial gains in employment were observed for HIV-negative community members as well, even those in households that didn't contain an HIV+ member. Economic returns to large-scale investments in ART programs are therefore much larger than current estimates suggest. My future work in this area seeks to estimate the relative impact of channels such as expectations about the future, savings behavior and the capital-to-labor ratio.

2. Estimating the impact of access to health resources on economic outcomes

The second thread of my research aims to quantify the impact of access to health resources on economic outcomes. In "Does Family Planning Increase Children's Economic Resources? Evidence from the War on Poverty and the Early Years of Title X (minor R&R at *Journal of Human Resources*), we use plausibly exogenous variation in the county-level rollout of U.S. family planning programs (1964-73) to identify the impact of access to family planning on children's later life outcomes. We find that children born after family planning programs began were 7% less likely to live in poverty. These estimates imply that family planning programs reduced child poverty in the U.S. at less than half of the cost of the EITC program and one quarter of the cost of TANF. One of the main contributions of the paper is to quantify the relative contributions of the *selection effect* (children not being born), which accounts for about one-third of the overall impact and the *income effect* (the ability to avert births leads potential parents to invest in their human capital, partnerships, and careers which raises future income), which accounts for two-thirds.

Three studies investigate factors that influence access to care, which mediates the relationship between poverty and poor health outcomes, and is therefore an essential component for policy design (McLaren et al. 2014, *BMC Health Services Research;* McLaren 2015, *Health Policy and Planning*; and Moyer et al. 2013 *IJGO*). Both South African studies used novel geospatial data and methodologies to examine policy questions that had not been previously addressed in the literature. I performed the first study to examine whether the implementation of South Africa's $1.2 billion AIDS treatment program was equitably distributed or whether disadvantaged groups experienced systematically worse access (*Health Policy and Planning* 2015). Using regression and duration analysis, the study found, contrary to previous small-scale quantitative analyses, that the combination of a clear policy objective, limited bureaucratic discretion, and monitoring by civil society ensured equitable access to AIDS treatment. Future work in this thread will focus on producing some of the first estimates of impact of common public health interventions in maternal and child health (such as promoting facility-based delivery) on human capital and other economic outcomes.

3. Generating rigorous evidence to address the tuberculosis (TB) epidemic

The third thread focuses on generating rigorous evidence to guide global health policy to address the TB epidemic. Last year TB overtook HIV to become the leading infectious disease cause of death in the world. TB kills 1.5 million people annually and incurs a global economic burden of more than $12 billion, despite the fact that approximately 97% of TB cases can be cured with a course of antibiotics that costs around $30. Evidence-based TB policy is rare because of the dearth of evidence and the poor translation of evidence into policy (see McLaren et al. *BMC Infectious Diseases* 2016). Economists have great potential to contribute evidence to the policy debate around TB, just as they have made important contributions to HIV and malaria.

"An Econometric Method for Estimating Population Parameters from Non-Random Samples: An Application to Clinical Case Finding" (*Health Economics* 2017) makes both a methodological contribution to the literature on addressing sample selection issues, and a policy contribution to global health. We develop a new method for estimating population characteristics from selected samples of the type that frequently arise when agents (such as doctors, police officers, customs officials or tax authorities) search for "high-value" targets. For example, doctors test patients for diseases based on observed symptoms, tax authorities select individuals for audits based on tax returns, and customs officials investigate suspicious shipments. Data on these types of sampling is generally routinely collected. We implement an instrumental variables method that leverages exogenous, discontinuous changes in the availability of resources for sampling to estimate both the population prevalence of the characteristic of interest and the agents' accuracy in identifying high-value targets.

Ours is the first study to estimate that approximately one fifth of drug-resistant TB cases were undiagnosed and to quantify the poor predictive power of clinical testing protocols for TB. The policy implications are three-fold: the transmission of drug-resistant TB is higher than previously estimated, the health resources budgeted for treatment are inadequate, and the level of investment in treatment innovation is sub-optimal because the potential market size is underestimated. Future work will develop applications of this method to improve the measurement of poverty and to evaluate the effectiveness of police search and seizure. Our approach is widely applicable in economics because of the availability of routinely collected data and the abundance of potential instruments.

I am the lead author on 8 of my 9 TB publications and working papers, with collaborators who are economists, clinicians, epidemiologists or industrial engineers. This is evidence of my creativity, initiative and innovation as well as my ability to work inter-disciplinarily. My studies on TB question conventional thinking and provide evidence to guide a diverse set of key policy areas: clinical practice for TB testing, supply-chain policy to reduce stockouts, the appropriate allocation of resources to TB programs, and data-driven targeting of TB interventions. Future work in this thread will evaluate behavioral economics interventions to improve adherence to TB treatment and quantify the causal impact of TB on economic outcomes.

**Funding**

I was a co-Investigator on a grant of $76,087 for a project entitled "Fertility Timing and Women's Economic Outcomes in South Africa" from the Population Reference Bureau (PRB)/Hewlett Foundation (2012). I also was awarded $129,000 between 2011 and 2012 from sources at the University of Michigan to support my research on TB in South Africa. I have submitted a number of external funding applications as PI for my TB research including "The Impact of AIDS Treatment on the Spread of Tuberculosis in South Africa" (NIH-NIAID, R03,

2012), "Factors affecting the spread of tuberculosis in South Africa" (NIH-NIAID, K01, 2012, resubmitted 2013); "Factors affecting the spread of tuberculosis in South Africa" (Institute of International Education, 2012); "Estimating Local Rates of Underdiagnosis of Multi-Drug Resistant Tuberculosis: An Econometric Approach Using Routinely Collected Data from Four High-Burden Countries" (Gates Foundation Grand Challenges 2015, resubmitted 2016). I have also been meeting with the Gates Foundation and Global Fund about funding a new project entitled "Developing Healthcare Facility-Level Operational Guidelines To Improve Tuberculosis Care in Emerging Markets". I was also a co-I on two proposals "The Effect of U.S. Family Planning Programs on Children and Persistence of Poverty" (NIH-NICHD R01, 2011 and resubmitted 2012) and "How Does Family Planning Impact Children's Economic Resources?" (NIH-NICHD, R21, 2013). Though none of these proposals have been funded yet, I have honed my grant writing skills and continue to submit proposals to obtain external funding. I am preparing an NIH-R01 entitled "Developing Data-Driven Clinical Guidelines to Increase the Detection of Tuberculosis in Resource-Limited Settings." I have also prepared grant applications for a number of foundations that are interested in funding my TB research because of its measurable real-world impact on a problem of great importance.