

My research is at the nexus of development, health, and behavioral economics. Methodologically, I employ field and laboratory experiments as well as secondary data analyses. Many of my field studies utilize a “lab-in-the-field” approach based on randomized trials in natural environments. This approach aims for strong external validity and policy relevance while simultaneously allowing creative and rigorous measurement which promotes internal validity and the understanding of mechanisms. In the process of undertaking these studies, I co-founded the [Behavioral Development Lab](#) in Chennai, India to facilitate this approach by developing and maintaining a strong infrastructure and investing heavily in training and mentoring staff.

*My first line of research explores how aspects of life in poverty can impede productivity, cognitive function, and decision-making, as well as what can be done to address these challenges.* My first study in this space examined the economic consequences of low caloric intake in India. This line of research provided evidence that increased caloric intake creates broadly generalizable changes in productivity with large returns. This work began with a five-week randomized controlled trial (RCT) among cycle-rickshaw drivers in Chennai, in which half of the participants received an additional 700 calories per day. Treated individuals showed significant improvements in both physical and cognitive tasks, and increased labor supply and income by approximately 10% by the final week. The estimated return to investment in additional calories was positive and large – 65 percent over six months. Building on these initial findings and suggestive evidence that incorrect beliefs may play a role in low caloric intake, I conducted a second RCT with a larger sample size, more detailed cognition measures, a longer time horizon, and a secondary randomization which will allow me to assess the role of incorrect beliefs in low caloric intake. In this cross-randomization, half of the participants received information about both the returns to higher caloric intake and which foods provide more calories per unit cost. Following this cross-randomization, I tracked beliefs about the returns to caloric intake, the caloric content of food, and food consumption. Data from this study are under analysis.

I have supplemented these RCTs with a natural experiment exploring the generalizability of the results. This research examines the impact of a 700 calorie per day decline in caloric intake, caused by fasting during Ramadan, on agricultural production in India. This analysis leverages heterogeneity in cropping cycles between and within districts as well as the fact that Ramadan cycles throughout the calendar year to generate three sources of variation in the overlap between fasting and the labor-intensive portions of the cropping cycle. Using a triple-difference approach, I find that overlap between Ramadan and labor-intensive portions of cropping cycles results in production declines which correspond to over 1% of India’s annual agricultural GDP and a 20% to 30% decrease in productivity per fasting individual. Multiple sources of evidence suggest that these production declines are driven primarily by reduced caloric intake rather than by other behavioral changes. The working paper is available on [my website](#).

Building on this work, I applied for and received an NIH K01 award for research examining the impact of poor sleep in India on similar outcomes. One-third of our time is dedicated to sleep, yet little is known about the levels and consequences of sleep deprivation, especially in low-income settings. To begin to address this gap, this research measures the prevalence and consequences of sleep deprivation among the urban poor in India via an RCT. We found that low-income adults in Chennai sleep little and poorly – 5.6 hours of objectively-measured sleep per night – despite spending over 8 hours in bed. Their sleep can be increased substantially: treatments increased night sleep by 30 minutes on average. Offering short afternoon naps at the workplace also increased overall sleep. A striking finding was that these naps improved cognition, subjective well-being, productivity, and savings, and reduced inattention to incentives and present bias, although increased night-sleep had no detectable effects on any of the outcomes measured. This work was conducted in collaboration with the Tamil Nadu state government with the aim of informing local policies that can promote sleep. It is joint with Pedro Bessone, Gautam Rao, Frank Schilbach, and Mattie Toma and was published in the *Quarterly Journal of Economics*. In addition, we collaborated with Dr. Susan Redline to write an article highlighting the value of integrating social science and sleep science approaches to conduct field research on sleep around the globe. Accepted at *Science*, this article highlights the benefits of conducting this research in everyday settings and advocates for collaborations between researchers and policy makers to test creative scalable solutions to improve sleep.

Drawing on the data generated by this study, Isadora Frankenthal, Pedro Bessone, and I also conducted an analysis of the effect of temperature on productivity and learning, an increasingly important concern given the rapid increase in temperature in many parts of the world. Similar to the previous literature, we document a substantial immediate negative effect of heat on productivity. We also document a novel dynamic effect – heat reduces not only the level

of worker output but also the rate of output growth (learning). We find no evidence of cognitive mechanisms and show that the effect of temperature on productivity cannot be offset by a higher piece rate. This paper is currently being drafted and will be available on my website this winter.

More broadly, this line of research speaks to a long-standing question about the nature of poverty that I plan to continue to explore: does poverty have hidden costs that impede one's ability to escape? Understanding which features of life in poverty have this impact and developing practical, scalable solutions to address them will not only enhance knowledge, but will also provide actionable solutions to alleviate poverty.

*A second related line of research considers long run human capital accumulation, studying how elements of one's upbringing and schooling may fundamentally alter long run cognition and one's life trajectory.* For example, Supreet Kaur, Christina Brown, Geeta Kingdon and I collaborated to explore the possibility that schooling builds human capital not only by teaching academic content, but also by expanding the mind's capacity for cognition itself. Using a field experiment with over 1,600 primary school students in India we show that cognitive endurance – the ability to sustain performance throughout an intellectually challenging activity – is a malleable skill that can be influenced by one's environment. Our experiment, which provides students with focused, sustained practice in a cognitively demanding task (math or attention-heavy games), reduces the rate of decline in performance when engaged in intellectual activities (e.g. listening comprehension, IQ tests), increases attentiveness in the classroom, improves performance on psychological measures of sustained attention, and improves students' school performance by 0.09 SD in unrelated domains (e.g. Hindi). This indicates that simply spending time in effortful thinking – without learning any directly relevant subject content – substantially improves performance on traditional measures of human capital. This study is conditionally accepted at the *Quarterly Journal of Economics*.

I have continued this line of work by undertaking a study – with Supreet Kaur, Yogita Shamdasani, and Luisa Cefala – which is motivated by low levels of employment and high rates of absenteeism in labor markets in low-income countries. The economic history literature notes that many economies have undergone a period of transition from agricultural to industrial societies which is accompanied by a shift toward formal and regular employment. Yet, many low-income countries today still experience high rates of informal employment and absenteeism. This study examines whether it is possible to incentivize workers develop the “habit” of regular labor supply, which may never have been learned during schooling given high levels of both teacher and student absenteeism or in previous work in the informal sector. The study also examines the reaction of employers to more regular labor supply of potential employees in spot labor markets to understand the mechanisms through which changes in labor supply behaviors may be reinforced. This study is directly relevant to government policy; if the intervention is successful, we hope to scale it through government-led labor market occupational training centers which prepare workers for work in certain industries (e.g. garment production). We anticipate the study will conclude this winter.

I have also begun a collaboration with Marianne Bertrand and Rebecca Dizon-Ross to conduct two studies examining how cultural forces and access to schooling may shape female labor force participation (FLFP) in India. FLFP in India is roughly half of the global average. Further, FLFP has been declining in recent years despite increasing educational attainment among women, generating a puzzle. Through a survey experiment and secondary data analysis, we are exploring two potential causes for this low and declining rate of FLFP. First, increasing access to education may, counterintuitively, decrease FLFP by altering marriage market outcomes. Given social norms regarding work, young women who marry into wealthier families may be prevented from entering the labor market in order to preserve status. We will explore this hypothesis using an IV approach drawing on the rapid expansion of educational opportunities at both the secondary and college level with a large (50,000-60,000 household) panel survey in India combined with additional data collection in the panel. Second, using a survey experiment in the same panel – we will explore whether Sanskritisation – the emulation of the practices of higher castes in order to increase one's status or respect – could be a force driving low FLFP. We have completed wave 1 of the survey experiment, will implement wave two in February 2023, and will complete the study in June 2023.

*My third line of research has begun to consider questions about the relationship between poverty and elements of mental health and utility/enjoyment of life.* One new study in this line of research considers the relationship between migration and mental health. In many low-income countries rates of internal migration are much lower and migration stays much shorter than predicted given the substantial urban wage premium. While many potential reasons for this puzzle have been examined, much of the gap remains unexplained. Achyuta Adhvaryu, Pedro de

Souza, Anant Nyshadham, Andelyn Russell, and I explore a potentially important but understudied driver of short migration stays, loneliness, via an RCT with 2,000 garment female factory workers in India. The RCT introduces two low-cost and scalable interventions to address loneliness: 1) social support from a senior mentor, and 2) social support combined with Problem-Management+ counseling (PM+). The study will evaluate impacts of the interventions on loneliness and other aspects of mental health, productivity, retention, savings, physical health, and female empowerment. In addition, the large scale of the study will allow us to examine how the creation of exogenous links in networks reshape the network as well as the flow of mental health through social networks. Finally, are layering an additional randomization onto the study to examine how improving mental health shapes workers' beliefs and learning about their productivity. If proven successful, the more cost-effective of the interventions will be scaled to all 120,000 workers at this firm as well as disseminated through buyer networks.

This study is complemented by an RCT which examines how poverty may influence welfare both directly via lower consumption and indirectly through taxes on cognition (i.e. "bandwidth taxes"). Specifically, many of the conditions associated with poverty (e.g. poor sleep, stress, etc.) may not only impact productivity and decisions as described above, but may also influence perceptions of experiences via reductions in cognitive resources. If such taxes reduce enjoyment from consumption (e.g. when sleep deprived, a person enjoys watching a movie less), being poor would result in a "double-tax" in which the poor not only consume less, but also have reduced utility from a given unit of consumption. We evaluated this hypothesis by experimentally altering bandwidth, via both commonly used lab-based methods and methods akin to natural bandwidth taxes, and studied downstream effects on the value of consumption. Following treatment, participants undertook simple lab-based tasks to measure bandwidth, followed by consumption activities and ratings of their enjoyment. We found that the bandwidth taxes reduce enjoyment of consumption activities, with the strongest effects on the value of food – a common and important type of consumption. These results deepen our understanding of the consequences of poverty for human welfare as well as the relative costs and benefits of poverty-alleviation programs. For example, they suggest that the benefits of cash transfer programs may be larger than just the gains associated with additional consumption; the value of existing consumption may also increase. This study, coauthored with Atheendar Venkataramani, was published in *PNAS*.

I am currently the PI of an NIH funded study (\$2.6m) working to expand this line of research with Leandro Carvalho and Vincent Somville. While unstable and unpredictable incomes are ubiquitous among the poor, many households may not be able to smooth consumption as effectively as traditional models predict. The study of the welfare consequences of these patterns is long, but challenging given the difficulty in knowing the income generating process underlying observed realizations. Further, studies to date have largely set aside the potential mental health consequences of income instability. Our experiment aims to fill these gaps. The experimental design will not only allow us to estimate how households react to income instability, but also to parse the impacts of risk (ups and downs) from unpredictability (lack of knowledge of future income). We will collect detailed survey data on consumption (including food insecurity), expenditures, income, savings and assets, loans and debt, transfers, and mental health. In addition to reduced-form analyses, we will estimate a structural model to conduct a welfare analysis and to simulate policy counterfactuals.

Finally, I have broadened this line of research to also include a study with Simone Schaner of the causal effects of covid-19 incidence on mental health. We leverage the quasi-random timing of India's elections – typically accompanied by travel for large rallies – that coincided with the rise of the Delta variant. Using a difference-in-differences strategy, we find additional time outside the home, and a more than doubling of the incidence of Covid in the months following the elections in election states. These changes are accompanied by a roughly 30% decline in mental health, measured by PHQ-4 scores. These effects are remarkably durable, persisting for nearly a year after the shock. A placebo test with an earlier election suggests this decline is not simply an election effect. Finally, we explore a number of potential channels for these negative mental health effects including economic impacts, stress/worry, loneliness, and direct effects of disease. This working paper will be submitted for publication soon.

In short, although my research is interdisciplinary and involves a variety of topical areas (e.g., physical health, mental health, education, and labor markets) and partners (governments, firms, schools), it is unified by a desire to understand the bidirectional links between poverty and wellbeing and to find scalable ways to alleviate poverty and reduce its harms.