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Health policy and economic growth in India

Lessons from International Growth Centre projects

Nidhiya Menon

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Health Policy and Economic Growth in India: Lessons from International Growth Center Projects

Nidhiya Menon
Brandeis University

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Abstract. This paper synthesizes evidence from International Growth Center (IGC) projects to underline the fact that health is an integral component of economic growth. Health affects growth by augmenting worker productivity, by increasing average life expectancy and subsequent human capital accumulation, and by reducing the burden of disease. In the Indian context, the main source of increases in worker productivity has come from improving nutrition. While the link between longevity and economic growth is muted because of the mediating impact of population growth, reducing the incidence of diseases such as tuberculosis in India would undoubtedly liberate significant resources currently spent on treatment. Evidence from IGC studies on policies to promote health in the public health sphere includes research that improves nutrition, increases sanitation infrastructure and access to clean drinking water, identifies effective means to detect diseases and health hazards, and devises ways to combat the debilitating effects of air and water pollution. Policies to promote health in the non-public health sphere focus on improving health care management and service quality, and methods to improve the delivery and affordability of care. This study concludes by highlighting areas where our knowledge is limited and further research seems warranted.

JEL Classification Codes: I15, I18, I12

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Thanks to Dilip Mookherjee for guidance on the paper. The usual disclaimer applies. Address for correspondence: Nidhiya Menon, Associate Professor of Economics, Department of Economics, MS 021, Brandeis University, Waltham, MA 02454, USA. Tel. 781.736.2230. Email: nmenon@brandeis.edu.

I. *Introduction*

The relationship between health and economic growth is dynamic, complex, and under-appreciated. As one of the components of human capital (along with education), health may be viewed as an integral input to productivity, similar to other conventional inputs such as labor and physical capital (Weil 2007). Yet health is different in that it is multi-dimensional and thus may be represented by varied indicators including life expectancy and the infant mortality rate. Its multi-dimensionality also suggests that there are several pathways by which health may be augmented, making it a versatile tool in the basket of commodities to improve per capita income and well-being. For these reasons research on the relationship between health and economic growth has been growing in recent times. This body of work reveals that health and socio-economic status are closely related; however, not every pathway is causally identified. Further, while there is compelling evidence that health impacts economic growth, sustained increases in income need not necessarily be required for improvements in health which often appear to advance independently (Deaton 2003). This paper focuses on the former channel, health as an integral component of increases in per capita well-being, and highlights health policies that demonstrate beneficial impacts on economic growth. Further, the paper provides a synthesis of evidence for these policies gleaned from IGC health-related projects implemented in India.

Existing studies across different countries demonstrate that health affects growth through several channels. First, improvements in health drive increases in worker productivity. Hence for example, reductions in general levels of anemia across countries improve overall worker output levels, and where the adult survival rate is used as a proxy for general health, increases in this measure contribute to rising economic growth (Weil 2003, Weil 2007). Moving beyond measures of disease and survival, the main source of improvements in worker productivity has

come from increasing nutrition. For instance, overall caloric intake was found to have a highly significant beneficial impact on worker productivity in Brazil (Strauss 1986). Additional evidence from Brazil shows that height, a long term measure of health, significantly impacts wages, and body mass index increases wages particularly for men (Thomas and Strauss 1997). Other studies on Indonesia and Vietnam have also documented the causal impact of health on wages and productivity especially in low income settings (Strauss and Thomas 1998, Strauss and Thomas 2007). On the basis of evidence from China, Sri Lanka and Indonesia, Frankenberg and Thomas (2002) notes that incrementing nutrition involves more than just increasing calorie and protein intake. In particular, their research also emphasizes the importance of micronutrients including iron, iodine, zinc, calcium and other key vitamins.

The second channel by which health affects economic growth is by increasing longevity and subsequent human capital accumulation. The insight underlying this pathway is that reductions in mortality can potentially increase returns to human capital investments which, in turn, boosts schooling (Weil 2013). Moreover people have the incentive to save more for retirement as mortality declines, thus spurring investment and augmenting physical capital per worker. Using cross-country data that spans developed countries like the United Kingdom, United States and European countries, and developing countries in Sub-Saharan Africa and Latin America, Weil (2007) demonstrates that variations in the adult survival rate for men are an important medium to explain cross-country differences in gross domestic product (GDP).

The third channel by which health is hypothesized to affect economic growth is by reducing the burden of disease. The intuition here is that sick individuals are not able to function at their peak physical or mental capacities thus limiting the extent to which they can contribute effectively. Although evidence for this pathway is somewhat less compelling, using data from

Africa Weil (2010) finds that diseases such as HIV, malaria, diarrheal and childhood diseases, and tuberculosis have had an impact on growth by affecting productivity and levels of educational attainment. But these impacts are not overwhelmingly large because a consequence of improving health is population growth which can erode income in per capita terms (Weil 2007, Ashraf *et al*. 2013).

What is known in general regarding these channels in the Indian context? In the case of the nutrition pathway, there is some evidence that this factor plays a role in determining agricultural labor productivity and fertility in rural India (Behrman *et al*. 1988, Deolalikar 1988). But mediating influences, such as inequality in the ownership of assets, also need to be taken into account in understanding the impact of nutrition on productivity. For instance, Dasgupta and Ray (1986, 1987) demonstrate that malnutrition can be linked to a labor market equilibrium with involuntary unemployment, and importantly, asset market inequalities (ownership of land) can have labor market implications since workers with access to non-wage (rental) income earn higher wages in the labor market. There has been debate in this area regarding the evidence for autoregulation, where the body adapts or adjusts to lower nutrient intake levels, implying that measures that rely on caloric requirements overstate the true extent of poverty (Sukhatme and Margen 1982). What is generally accepted is that while statistical evidence in favor of short term adjustment (with costs) is present, there is little to no evidence for long term adaptation to lower intake (Dasgupta and Ray 1990).

Evidence on the second channel in India – the link between longevity and economic growth – is less clear-cut. For example, Dreze and Sen (2002) makes the point that improvements in the rate of GDP growth that followed the liberalization of the early 1990s in India was accompanied by a slow-down in the rate at which infant mortality was declining. Life

expectancy in India has improved over time; this measure has risen by close to 30 years since 1950 (Cutler *et al*. 2006). But the extent to which this has contributed to boosting standards of living is unclear. On the contrary, there is some evidence that child malnutrition and child mortality in particular have remained high despite improvements in nutrition that accompanied overall levels of prosperity (Deaton and Dreze 2009, Das Gupta 2010). Reasons include behavioral and socio-cultural aspects that importantly influence health, child survival and women's autonomy. The link between longevity and economic growth in the Indian context may also be less evident because of the mediating impact of population growth. As noted before, improvements in health may raise fertility in the initial stages of the demographic and development transition, thus contributing to lower levels of per capita income particularly if output levels do not keep pace.

Although the relationship between longevity and economic growth may be less clear-cut, a factor that influences these aspects and on which we have more evidence is the quality of primary medical care in India. In general, this quality is poor in that medical practitioners often undertake the bare minimum in terms of effort (care and service). Moreover, there is evidence of substantial resource waste in both urban settings where there is an over-prescription of medicines that are not needed and in rural settings where subsidies to public health facilities do not translate into better care. Furthermore, there is evidence that even providers with little to no formal training have experience practicing in local areas for considerable periods of time, and the absence of medical infrastructure (including material and drugs) has less of a role to play in explaining the low quality of health care as opposed to insufficient effort on the part of medical providers (Das and Hammer 2007, Das *et al*. 2012, Das and Hammer 2014). This paucity of

access to adequate health services and competent medical professional care plays a role in defining the size of the disease burden in India and the capacity to contain it.

On the link between eliminating this burden and augmenting growth, it is clear that reducing the incidence of both communicable and non-communicable diseases would, at the very least, serve to liberate resources that may be put to alternate competing uses. For example, there were 10.4 million TB cases worldwide in 2015 among which cases in India, Indonesia, China, Pakistan, Nigeria and South Africa composed the bulk of the burden at 60 percent of this total (WHO 2016). The disease is a significant health challenge in India, is under-detected and under-treated often because of the associated stigma, and can be extremely debilitating even when not fatal. Moreover, as discussed above, health care facilities are limited in their treatment ability (but perhaps not capacity), and there is often little to no oversight to ensure a minimum standard of care. Reducing the disease burden would have direct welfare implications for India's households given the evidence that health problems and the associated substantial healthcare expenditures constitute one of the main reasons why households fall into poverty (Krishna 2003, 2005, 2011).

Characteristics of the disease burden in India are also influenced by the lack of adequate sanitation and waste disposal facilities that promote the spread of germs which importantly influence the incidence of health hazards such as diarrhea. Lack of sanitary facilities has been tied to the high rate of stunting among children in India (Spears *et al*. 2013), and an evaluation of India's Total Sanitation Campaign shows that by reducing the prevalence of illnesses such as diarrhea and other gastro-intestinal diseases, this initiative increased cognitive scores among children (Spears and Lamba 2016). Other recent evidence indicates that a reason why average

caloric intake has declined in India may be attributed to the improved disease environment which lowered needs (Duh and Spears 2016).

With this general understanding of the extensive and multi-faceted association between health and economic growth in the Indian context, we turn next to the evidence that may be garnered on these features from health related IGC studies in India.

II. Evidence from IGC Studies in India

The section above illustrates that health's impact on economic growth across the world and in India is clearly defined in terms of characterizing and augmenting individual productivity. Other channels that are evident include the relationship between declining mortality levels and prosperity, and the feedback from eliminating disease burdens on saving resources and elevating an individual's capacity to function at an optimal level. Hence strategies for enhancing growth should recognize that health is an integral component, and health improvements are critical inputs in the overall set of tools used to increment per capita income in the long run. This section of the paper broadly describes the evidence from IGC health-related studies in India on these channels in order to illustrate the manner in which lessons from these studies have contributed to our understanding of how to improve economic growth. Specific details of these studies are discussed in the subsequent section.

IGC research that may be used to guide our thinking on the first channel through which health influences growth by incrementing worker productivity may be broadly classified into three areas – those that highlight the extreme shortcomings that arise from nutritional deficiencies and address how to deliver adequate levels of sustenance to target populations in optimal ways (Afridi *et al*. 2013, Schofield 2014, Kjelsrud 2016, Sekhri 2016, Berry *et al*. 2016), those that recognize the inhibiting role of pollution in constraining worker productivity

(Adhvaryu *et al*. 2016a), and in a similar spirit, those that experiment with novel technologies to limit the impact of pollution which shackle individual output and overall growth (Adhvaryu *et al*. 2016b). These studies shed light on the economic consequences in adult and child populations of inadequate nourishment, and underscore the fact that both the quality and quantity of consumption are features that policy makers need to be cognizant of while thinking about influencing broad measures like adult labor supply (which decides wages) and cognitive development at very young ages. Moreover, the overall environment in which workers operate is a complementary aspect that also needs to be taken into consideration. That is, even well-nourished workers will not be able to function effectively in circumstances that severely limit their capacity to operate due to excess heat or ambient pollution. One of the broad policy lessons that we learn from IGC research in this area is that while individual nutrition is critical, resources spent to further that objective would have an even higher return if attention is commensurately paid to the overall environment in which individuals function.

Evidence from IGC projects on the second channel that emphasizes the relationship between longevity (life expectancy) and human capital accumulation as inputs to economic growth may be categorized into three areas – those that focus on improving health care, health services and health insurance (Lemos and Scur 2012, Berg *et al*. 2012, Barnwal *et al*. 2017, Debnath and Jain 2015, Kinnan *et al*. 2016), those that highlight the importance of culture, religion and gender-differentials in health outcomes and health seeking behavior especially of women and children (Jayaraman *et al*. 2013, Jayachandran and Pande 2017, Menon 2017), and those that illuminate the environmental consequences of agricultural and industrial practices in terms of impacts on the health of vulnerable populations (Brainerd and Menon 2014, Do *et al*. 2016). In broad terms, we learn much from the first strand of these studies – those on health

care, health services, as well as health insurance in India. Related work emphasizes the importance of competent management in delivering health goals, devising innovative ways to compensate health officials such that they are able to circumvent social structures that may restrict access and the flow of information, the creation of new ways of making health services available to target groups especially for detecting hazards such as arsenic in water, and broader thinking on how social networks may be used to increase uptake of insurance schemes. These lessons are of central value because they highlight effective ways to improve access and distribution of health services to groups that may be at most risk.

Related to the second channel, IGC studies that emphasize the importance of socio-cultural aspects such as caste, religion and gender illustrate the importance of these themes in mediating the impact of approaches that seek to enhance longevity and improve general quality of life for individuals across all income strata. The subset of these studies that turn our attention to the well-being of infants and children taps into the understanding that environmental and other insults at these young ages have long lasting consequences in terms of both cognitive and non-cognitive development (Almond and Currie 2010). This, in turn, influences later life outcomes including educational and occupational choices, which has consequences for long run growth.

The evidence from IGC health research in India on the association between reducing the burden of disease and fueling growth is compelling and spans two broad component themes – those projects that seek to improve sanitation, and by highlighting the costs of lack of asepsis, bring the need for adequate infrastructure for delivering clean water for example, into the limelight (Banerjee *et al*. 2010, Coffey *et al*. 2015, Glick *et al*. 2016, Wadhera 2016). The second component theme seeks to improve disease detection methodologies especially in circumstances where communities may be segmented along caste and other lines, and where

diseases carry social stigma (Goldberg *et al*. 2014). Together these studies accentuate two different aspects that are of public health concern. Recognition that sanitation, whether in the form of provision of clean drinking water or appropriate disposal of waste, is important and cannot be over-emphasized. Hence understanding arguments that govern the provision of sanitation infrastructure and how to create functioning markets for public goods in both poor and well-off localities in India is critical to the design of well-thought out policy that seeks to address these challenges. However, research and public discourse has documented that even when the facilities exist, people often do not avail of them. This is where comprehension of behavior as shaped by social and cultural circumstances plays an important role. The first set of studies under this channel (those that focus on improving sanitation) helps us understand the need for appropriate services and significantly, the motivations that underlie people's use of them. These insights are crucial to our ability to encourage adoption of practices that may be more in line with safe health behavior and outcomes. Goldberg *et al*. (2014) on optimal strategies for detecting and treating diseases in stratified communities falls in this latter sphere. In particular, instead of subverting structures that have been in place for generations, we learn lessons on how to utilize those structures to address major health concerns such as TB in India.

The discussion above paints a general picture of the IGC research in India that has provided evidence on how and why health matters for economic growth. This evidence stresses that increasing health should be an important component of strategies to enhance growth – it should not just be a tool for redistributive considerations. For purposes of clarity, this discussion has been categorized in order of the channels through which growth is impacted by health including incrementing worker productivity, improving life expectancy and human capital accumulation (education), and reducing the burden of disease. The evidence from these studies

emphasizes that improving health is an integral component of fueling economic growth. In the following sections, we discuss these IGC studies in detail in order to gather evidence on policies that promote health. However, now that we comprehend that the discourse on increasing growth must include conversations on how to improve health, we delineate specific policies based on a detailed discussion of IGC India research using a classification that focuses on categories that span public health issues and non-public health issues. Such a strategy increases transparency for policy development, highlights the mechanisms at work, and is more in keeping with the format through which health policy may be carefully thought out, structured, and implemented.

III. Policies to Promote Health

A. Public Health Issues

1. Nutrition

One of the key points that we have learnt from research on the impact of health on economic growth is that an important mediating channel is worker productivity which is determined by nutrition. Malnutrition is an issue that is particularly relevant in India where, for instance, the precarious state of the health of children under five led the previous Prime Minister Manmohan Singh to declare the matter to be one of "national shame" (Times of India, 2012). Nutrition includes not just an adequate number of calories but also optimal levels of micro nutrients such as iron, iodine and zinc. Furthermore, there are two broad paths through which insufficient nutrition may result. First, food is scarce and food security is an issue, or second, even when levels of nutrition are adequate, there is capture through various channels which results in scarcity among the intended beneficiaries. Nutrition related IGC studies on health in India speak to both these pathways as we describe below.

There are three studies that address the topic of ensuring sufficient levels of nutrition in various contexts. Afridi *et al*. (2013) evaluates the extension of school meal programs to higher grades in the public schools of Delhi and finds that students who benefitted were likely to exhibit additional classroom effort as measured through improved performance on maze puzzles that required the ability to concentrate for sustained lengths of time. This study thus provides evidence that improved nutrition has a direct impact on cognition and educational outcomes of children, and in terms of policy, underlines the effectiveness of subsidizing and/or providing free meals. However the nuances of this IGC research are also revealing. The sample consisted of urban students who were better nourished as compared to the average child in India. The positive impact of school meals in this context indicates that the returns to such investments are likely to be even higher in cases where nutrition levels are comparatively lower. Further, the quality of the school (as measured by higher scores in school-level tests that were curriculum specific) plays a complementary role – that is, the impact of meals is amplified in contexts where school quality is high. This suggests that improving the human capital (health and education) of children requires attention to both the means by which health is improved and also the environment in which the intervention is implemented. Returns to nutrition investments may be more pronounced if policies are simultaneously cognizant of improving school quality.

Schofield (2014) directly addresses the consequences of low caloric intake among adults in India. This research has two prongs which together show that poor nutrition incurs large penalties in the wage labor market, and even medium amounts of increments in caloric intake can result in substantial improvements in labor supply, productivity, and earnings. The first prong considers the impact of an additional 700 calories per day for cycle-rickshaw drivers in Chennai and shows that a consequence of this is about a 10 percent increase in earnings in little

over a month (fifth week). The second considers the implications of fasting during Ramadan in a population of Muslim agricultural laborers and shows that when Ramadan and the labor intensive seasons of the agricultural cycle coincide, there is a sizeable drop in individual level productivity of up to 20-40 percent. These relatively large negative impacts beg the question of why people do not invest in improving nutrition when returns from doing so are sizable. An aspect that Schofield (2014) reveals is that individuals have incorrect beliefs about which foods are high in nutritional content, and the population's awareness of the caloric densities of foods is often inaccurate. India already spends a large fraction of its GDP on food subsidies through its public distribution system. The lesson for policy from this study is that instead of increasing levels of subsidies, raising knowledge among the target population on basic nutrition and its sources may be more useful in combatting malnutrition.

The third IGC India study that addresses nutrition levels directly is Kjelsrud (2016). This is work in progress and the aim is to evaluate the efficacy of the Food Security Bill of 2013 in increasing consumption levels by analyzing whether the nationally assured minimum entitlement of 5 kilograms of grain per person per month is viewed as an income transfer or has price impacts given differences in regional incentives and the efficacy with which the distribution system works in some states versus others. Income and price effects have different implications in terms of behavior, and forthcoming details on these mechanisms will shed light on how effective the Bill has been in reducing malnutrition levels throughout the country.

There are two IGC studies that seek to provide lessons on delivering nutrition in an effective manner. Both are relatively new studies and so results are not forthcoming as yet, but we discuss them here as the implements they highlight to tackle nutritional deficiencies are useful. Sekhri (2016) aims to study the adoption of low cost ICT technology platforms in Bihar

and Uttar Pradesh in order to improve the delivery and evaluation of India's mid-day meal scheme. Specific aspects of the scheme that are to be evaluated include take-up at more disaggregated levels, cost effectiveness, and nutritional and educational outcomes. Adoption of technology has been shown to reduce price variations; the aim of this project is to understand whether technology can improve transparency in the mid-day meal program. The second IGC project in this area considers effective strategies for delivering micronutrient fortification, again in the mid-day meal program. Berry *et al*. (2016) studies whether a centralized provision of fortified meals or whether the current decentralized system (with additional monitoring) would work better in reducing leakages and improving overall quality. The intervention is being fielded in Orissa and outcomes to be evaluated include child health, fortification take-up (including that of the Iron and Folic acid program) and school attendance. Results from these newer studies will reveal strategies to address current weaknesses in delivery of national programs and should provide lessons to guide thinking on what works better given circumstances and characteristics of the target population.

2. Sanitation and Provision and Management of Water

The discussion on the impact of health on growth emphasized that one of the mechanisms that aids sustained increases in per capita income is a reduction in the burden of disease. Reductions in this burden depend critically on improving sanitation, facilitating the hygienic disposal of solid and other waste, and access to clean drinking water. As mentioned above, improvements in sanitation in particular have been found to affect a range of outcomes from reducing low height-for-age in children to improving cognition and explaining the puzzle of low calorie intake among adults in India. In this section, we discuss the policy lessons of relevant

IGC studies on this topic. Since some of the needs and features of sanitation and provision of clean water vary between rural and urban settings, this discuss is organized along sectoral lines.

Urban India

We begin by thinking about sanitation in a context of economic growth which fuels urbanization and subsequently, migration into cities and urban centers. There are two IGC studies in this area that are especially relevant. Banerjee *et al*. (2010) directly addresses the issue of urbanization, the concomitant rise of informal housing (shanty towns), and inadequate infrastructure by studying public goods provision (including sanitation and water quality) in Delhi's slums. A focus on slums is important because these are often the first place where rural-urban migrants arrive and stay for sustained periods of time, and where the tightness in housing and other markets in established cities and localities manifests itself most clearly. Using two surveys conducted among households in Delhi slums and among heads of Delhi Resident Welfare Associations respectively, Banerjee *et al*. (2010) identifies several markers of public goods provision that are lacking in quality. In terms of those that matter for health, these aspects include restricted access to clean water and sanitation (the study also considers education, healthcare, access to government transfers including pensions and food subsidies). Banerjee *et al*. (2010) finds that those living in slums express sizeable unhappiness in receipt of public services along these lines. Explanations for why this is the case are informative. Provision of clean water and sanitation is lacking not because of lack of resources or lack of consensus on identifying basic needs, or absence of political activism on the part of slum-dwellers over 80 percent of who were found to be registered voters. Essentially provision is lacking because of lack of delivery of these public goods on the part of officials who are responsible for these tasks. There is also a general lack of awareness among dwellers themselves on what the actual levels of

their entitlements are, and many have little to no information regarding the size of the resources available for local development projects. NGOs have not been helpful at all in this context. In terms of policy, these results indicate that rather than investing in additional resources, what is required is a strategy to leverage what already exists in a more effective manner. In particular, options such as creating incentives on the part of public officials to deliver on tasks and raising awareness, perhaps through straightforward information programs, would go a long way toward improving the quality of life in Delhi's slums.

The second IGC study that is of relevance in thinking about sanitation in a context of urbanization is Wadhera (2016) which is also based in Delhi, and which analyses the effective disposal and management of solid waste generated by households. Existing rules dictate that generated waste is to be segregated into three broad streams – biodegradable, non-biodegradable and domestic hazard waste, before collection (Municipal Solid Waste Handling Rules 2016). The objective of Wadhera (2016) is to understand motivations at the household level in adhering to these requirements, and whether provision of information and involvement of community groups such as Resident Welfare Associations (RWAs) assist in improving household's compliance. This research is new and has just completed the piloting stage. But there are several lessons of policy significance that we can already learn, most importantly, the role of RWAs in communicating rules and requiring their implementation seems to be of paramount importance. Hence while households may act in isolation in sub-optimal ways when it comes to solid waste management, mere oversight from a coordinating body such as the RWA appears to be sufficient to align behavior in ways that are optimal. This alignment facilitates effective disposal of waste, thus reducing the potential for the spread of diseases in urban areas of India.

Rural India

While sanitation and provision and effective management of drinking water are important in urban settings, these hold equal relevance in rural areas of India. There are two IGC projects that may be used to guide health policy in rural India in these areas: the first sheds light on sanitation related behavior in rural parts of North India (Coffey *et al*. 2015), while the second postulates the construction of markets for drinking water in rural Rajasthan (Glick *et al*. 2016). Coffey *et al*. (2015) reveals that social, cultural and religious factors have a role to play in explaining India's slow transition to safe sanitation. In particular, open defecation remains high by standards of other countries at similar levels of per capita income for several reasons including the fact that affordable pit latrines are viewed as ritually polluting by caste Hindus, and open defecation is associated with good health and strength. Hence, while the Government may invest in building toilets to promote hygiene, they remain largely unused given prevailing cultural and religious norms. Changing behavior in these circumstances is difficult to accomplish because it involves going against centuries of tradition and social programming. More than resources, a strategy that has found success in other countries like Bangladesh is encouraging an active role for local NGOs in spreading health awareness and knowledge on the negative health repercussions of practices such as open defecation which spread bacterial, viral and parasitic infections including diarrhea and cholera.

We end the discussion of policies that aid in promoting sanitation and access to water by discussing Glick *et al*. (2016) which aims to understand markets for drinking water in Rajasthan. This project has important relevance since optimal design of mechanisms for efficient allocation of scarce resources is crucial. Using data from two districts of Rajasthan, this IGC research tries to understand the nature of markets that currently exist, whether there are market failures that limit optimal distribution, and if so, what are the sources of these failures, whether government

intervention is required to correct these, and the consequences of changes in the price of drinking water on a sub-set of the population that bears the brunt of the work involved in collecting water – women and girls. The results of this study are not forthcoming as yet but portend to be informative on the types of policies that may be required to regulate markets for scarce commodities in arid rural India.

3. Improving the Detection of Diseases

As discussed above, the stratified nature of communities along caste and religious lines in India is a complication that health policy needs to take into account in constructing schemes to improve public health. Instead of working against social networks and groups, an option to achieve desired objectives is to utilize these structures towards those aims. This is the motivation behind Goldberg *et al*. (2014) which formulates more effective ways of increasing detection of TB in India. India has one of the highest rates of TB infection and as the disease carries significant social stigma, rates of detection and thus treatment are comparatively low. This IGC research proposes a novel scheme – providing incentives (various fixed and variable cost schemes are considered) to current patients to make referrals – to improve TB detection and treatment. This strategy is compared to an alternative one which depends on outreach by health care workers. Results from the pilot study that was fielded showed that referrals by current patients were not common at all, thus indicating the absence of networks among people affected by the disease. Price incentives in terms of improving detection revealed some threshold effects where the optimal level appeared to be at Rupees 500 per TB-positive symptomatic detected. What policy lessons can we glean from this study? The absence of complete and final results limits the formulation of clean instruments but given that existing health facilities have been less successful in tackling this disease, reliance on innovative alternatives such as using social

networks and creating incentives among network members to ameliorate the disease's incidence seem prudent. These lessons may then be applied to our understanding of how to control other infectious diseases in India as well.

Along these lines of improving detection of ailments, Jayaraman *et al*. (2013) is an IGC health study that investigates characteristics of individuals who seek eye-care in India. Much has been written on the sources and manifestations of gender-related health differentials in India and the aim of this study is to understand origins of these differentials in eye-care. The results of the study are revealing – women have worse diagnoses than men on indicators of symptomatic illnesses (they have lower visual acuity and are more likely to be sight impaired and prescribed surgery or diagnosed with cataract) when measured at an eye-care facility. However after prognosis and treatment, there are no differentials by gender when it comes to indicators of surgical care or seniority of medical professionals attending the case. No differentials by gender exist for asymptomatic diseases either. Together these results indicate that while women may be going for routine preventative checkups at the same rate as men, they are likely to seek delayed treatment for detectable illnesses as compared to men. The research sheds light on the fact that the source of inequalities in health care is one of access rather than treatment, at least when it comes to eye care, and men (and parents of boys) appear to be more responsive in the case of symptomatic eye illnesses. Since eye-sight is critical for both men and women, health policies in this area should recognize undercurrents that straddle economics and culture in driving behavior in this domain. Creating incentives to achieve timely detection and treatment of eye problems in women with symptomatic diseases seems necessary. Pro-active information campaigns that highlight the additional and potentially increased costs of delayed detection and treatment may be an effective policy instrument.

4. Pollution

One of the largest threats to health and worker productivity is pollution, both air and water. High levels of particulate matter in air or agrichemical and other pollutants in water may result from both intentional actions on the part of agents but also from unintentional consequences of policies with laudable motives. There are four IGC health related projects in this area. Focusing first on water pollution and considering impacts on a section of the population that is most vulnerable – infants and young children – two projects improve our understanding of the mechanisms at work. Brainerd and Menon (2014) considers the impact of the adoption of high yielding varieties of seeds as part of the Green Revolution in India and the concomitant exponential rise in the use of fertilizers that were required for these seeds. The subsequent seepage of agrichemicals - nitrogen, phosphorus and potassium – into water is found to have several negative health consequences. In particular, exposure in early stages of fetal development increases the likelihood of infant mortality, especially neonatal mortality which is influenced by things that happen *in utero*. Surprisingly, such early exposure manifests itself even in older children where both height-for-age and to a lesser extent, weight-for-age, are negatively impacted from the presence of these pollutants in water. Since women are at the forefront of farming activities in India, there are several policy implications centered on them (and men) that involve raising awareness of the impacts of agrichemicals, interventions to mitigate consequences of exposure, and nutritional and other supplements to populations who are most affected. This project directly addresses the argument that improving food security to fuel economic growth must go hand-in-hand with policies to mitigate any unexpected negative consequences if growth is to be sustained over the long run.

Do *et al*. (2016) is the second IGC study that focuses on water pollution by analyzing the "Ganga Pollution Cases" of 1987 which was India's first environmental litigation ruling by the Supreme Court that required tanning industries along the Ganga river in Kanpur, Uttar Pradesh to clean-up pollution. This project finds that neonatal mortality declined significantly as a result of the policy ruling. Importantly, there is a spatial externality associated with river pollution where pollution travels impacting communities downstream thereby reducing the probability of infant survival. What lessons can we take to health policy from this study? The externality aspect of water (and air) pollution suggests a role for Government in pricing and creating markets for bargaining across different jurisdictions such that efficient outcomes result. We have learnt much from our thinking on how to regulate different categories of pollution in developed countries and from, for example, how to control greenhouse gases that contribute to climate change, at least in principle. Perhaps some of these insights may be adopted for controlling the negative impacts of air and water pollutants in India, once these have been tailored (to the extent possible) to the country's ground-realities.

Although the impacts of water pollution can be debilitating, much of the literature has focused on air pollution for a variety of reasons. Delhi has the dubious distinction of having the worst air quality in the world, and two IGC studies help us to understand the impact of air pollution (which can drive temperatures) on workers. Adhvaryu *et al*. (2016a) studies the impact of fine particulate matter (PM) on worker productivity in a garment factory and shows that good managers can mitigate the impact of shocks to worker productivity that arise from PM. Levels of PM tend to be highest in the winter months and later on in the week. By reallocating workers across tasks and by monitoring production lines more frequently, good managers are able to contain the negative impact of air pollution on worker output. The health policy implications of

this study require our thinking less on the efficaciousness of good managers but more on the impact of PM on worker health and output so that even in the absence of competent management (which is critical of course), the impact of pollution on individual productivity is minimized. Establishment of monitors in firms would help to accurately judge levels of particulate and other matter (which the study uses) to signal when levels rise beyond acceptable thresholds. More importantly, subsidies to firms to use and invest in equipment and inputs that are less polluting would also aid in this domain.

Along this dimension of investing in equipment and technology that can importantly impact worker productivity, an aspect that has been examined in IGC research is the adoption of energy-efficient LED lighting. Adhvaryu *et al*. (2016b) considers the mediating effect of LED technology in a factory environment where worker productivity is measured along production lines, and where normal lighting can significantly increase temperatures on the factory floor especially during hot days. Where the productivity-temperature gradient is non-linear, adoption of LED lighting significantly reduces temperatures in the work environment, raising average productivity levels (up to 85 percent of the negative impact of temperature on worker efficiency is eliminated, particularly on hotter than average days) for the adopting firm. These productivity co-benefits importantly compensate for the costs of LED adoption by reducing the pay-back period. The policy implications of this study are clear – subsidies for energy-efficient technologies would serve to increase their rates of use with measurable impacts on long-run firm and worker productivity.

5. Culture

Although culture in of itself has no direct public health relevance, it is an important mediating factor in India as some of the discussion above had made clear. For example, cultural

and religious beliefs play a role in explaining the low take-up of pit latrines among Hindus. An aspect that has explanatory power in explaining the widespread prevalence of stunting among very young children and which is culturally related is son preference. This is the finding in the IGC study Jayachandran and Pande (2017) which documents reasons for why stunting – an indicator of when height-for-age is two standard deviations below the mean of zero – is so prevalent among Indian children. The comparison that has gained much mileage is that rates of stunting in India are higher than in some Sub Saharan African countries with lower levels of per capita income and higher levels of child mortality. Jayachandran and Pande (2017) finds that Indian firstborns are actually taller than African firstborns but this is true only for firstborn sons. Thereafter height declines with birth order and depends on sibling's gender, pointing to the importance of intra-family allocations as a key contributing factor. There are also the standard variations by region of India and religion, where southern states and Muslims exhibit lower amounts of unequal investments in their children in the hopes of having an eldest son. One of the disconcerting findings of this research is that the birth order gradient in height of children is stronger among richer households.

Finally, the role of religion in deciding investments in children especially girls is also a factor in Menon (2017). It turns out that even though average rates of stunting are high in India, these rates are comparatively low among Christian children, especially girls. Menon (2017) ties this to the coming of Christianity to India and the spread of its progressive egalitarian principles that indirectly influenced health and sanitation related behaviors while emphasizing the equal treatment of girls and boys. The Christian advantage is especially pronounced in infancy underlining the importance of mother's health and demonstrating that the advent of Christianity had inter-generational consequences for India's children. Together these two papers show that

history, culture and religion play decisive roles in defining health of populations in India, and thus in order to be effective, health policy needs to be aware of the influences they exert.

B. Non-Public Health Issues

1. Better Management and Service Quality

A factor that has been of particular relevance in India in terms of holding back economic growth is poor management which translates into low levels of firm productivity. Over and above the focus on manager skills in improving worker productivity as in Adhvaryu *et al*. (2016a), management matters on a larger scale as well. Better management is a factor in the health care sector of India and is a topic that has been studied in the IGC research Lemos and Scur (2012). Using a sample of approximately 7000 established hospitals (with either an Orthopedics or Cardiology department, those that provided acute care, and those that offered overnight beds) across urban and rural areas, Lemos and Scur (2012) finds that healthcare management practices in India, using four benchmarks including operations, monitoring, targets and people management, fall far short of those in developed countries even after controlling for hospital size. In the full sample of all countries, Indian hospitals are on average 1.8 standard deviations behind the best managed ones which are in the US. Considering three ownership structures in health care in India – hospitals that are private for profit, private not for profit, and public - as expected private hospitals (both for profit and not for profit) are better managed than public hospitals. What can be done to improve management? Bloom *et al*. (2010) suggests that competition increases the quality of management in a study of the English public hospital sector and that is a lesson that we might take, with caveats, to the Indian context. Other indicators amenable to policy action from Lemos and Scur (2012) include the fact that although nearly all hospital managers in the Indian sample reported having a graduate degree, only a relatively small

proportion of them also held a business degree. Furthermore, Indian managers appeared to have overly optimistic views regarding quality of their establishments. This is an important hiccup since if the perception is that there is little need for change, steps in the right direction towards improving best practices are unlikely to be implemented.

2. Improving Delivery, Detection and Affordability of Health Care

There are four IGC studies that increase our knowledge on how to improve delivery of health practices in India, two of these improve our understanding of how to use existing social structures to further health objectives and the third sheds light on cost-effective ways of testing for a public health hazard. A theme that has continually appeared is that diffusion of knowledge and health practices, including disease detection and adoption of sanitary behaviors, is limited by socio-cultural constructs that include caste distinctions and religion. Instead of trying to subvert centuries of tradition, a strategy to further aims in this area is to rely on these structures for intended purposes. This is the spirit of the IGC study Debnath and Jain (2015) which studies the role of caste networks in villages and urban wards to increase take-up of a health insurance program in Andhra Pradesh. Individuals in these networks are likely to share information on how to avail of treatment in hospitals and from specific doctors, and referrals within caste may be viewed as more appropriate and socially acceptable. The study finds evidence that within caste referrals significantly increases health insurance utilization by 16-19 percent. Furthermore, networks are more effective in driving utilization in cases of oncology, cardiology and other big surgical procedures. These are circumstances where the information required is likely to be dense and more specialized, unlike instances of general medicine for example, where information needs may be lower. Hence reliance on caste lines may be an effective strategy to reduce the

retarding impact of social distance when it comes to utilization of healthcare and other welfare programs in India.

A related study considers how to improve health insurance take-up when those charged with spreading information on the benefits of the program themselves have social preferences. The IGC health study Berg *et al*. (2012) sheds light on this by considering the role of incentive pay in increasing knowledge transmission when agents prefer interacting with one group over another. It is found that incentivizing agents in charge of dispensing knowledge – by moving them from a flat pay contract to an incentive pay contract where pay depends on how a randomly surveyed household responds to a knowledge test about the scheme – increased transmission of know-how to beneficiaries who were not socially proximate to the agent. This is an important insight where in addition to common problems such as leakage and excessive red-tape, lack of awareness about the potential benefits of health schemes may impede the effectiveness of public service delivery in India.

The studies above reveal health policies that may be used to improve delivery and take-up of public health insurance programs. In this context, improving detection of health hazards through affordable means is also of interest and evidence from an IGC study helps guide our thinking in this realm. Barnwal *et al*. (2017) experiments with different pricing schemes to understand thresholds at which households in Bihar are willing to have their tubewells tested for arsenic. Arsenic is a severe health hazard and has been found to impair intellectual and motor development, especially among children. Results indicate that as testing fees were increased from Rupees 10 to Rupees 50 in ten-Rupee installments, the proportion of households buying the test declined from 69 percent to 22 percent. In addition to flagging potentially unsafe sources of water, detecting arsenic can help demarcate wells in villages suitable for drinking and cooking

versus only washing for example, since arsenic is spatially variant but not temporally so. Evidence indicates that only about a third of households that were flagged as having unsafe sources of water moved to more safe sources; a potential explanation is stigma associated with sharing water across caste groups. Barnwal *et al*. (2017) makes two further points – first, the willingness to pay for the test is not associated with the probability of switching to a safer source and second, households appear to avoid reporting results when arsenic is detected revealing strategic motives in sharing private information that could potentially affect mitigating strategies such as switching to an alternate source. Such behavior may also be motivated by households seeking to avoid stigma and endeavoring to maintain property values.

3. Improving Evaluations

Several IGC studies including Berg *et al*. (2012) and Debnath and Jain (2015) have studied improving utilization of health insurance schemes and demonstrated alternative means by which such utilization maybe improved. In this section we discuss Kinnan *et al*. (2016) that evaluates hospital insurance where the aim is to make health care and hospitalization affordable for low-income families. Evaluations of such insurance often involve a combination of both experimental methods and data collection at the household level. Kinnan *et al*. (2016) proposes a new survey instrument called the Post Health Event Survey (PHES) to improve cost efficiency of data and to reduce the recall error of annual surveys. Reductions in cost are to be achieved by surveying selected sub-samples of households in person and collecting hospitalization information from only those who report a major health event. Recall error is to be reduced by asking about events in the past two months and collecting information from households that report events within two weeks. This study is currently in the field where it is being implemented as part of the larger India Health Insurance Experiment (IHIE) that is being used to

evaluate the Rashtriya Swasthya Bima Yojana (RSBY), India's health insurance scheme that began in 2008. No rigorous evaluation of RSBY currently exists and lessons from the PHES pilot discussed in the study are revealing. First, measurement error increases at longer intervals when it comes to out of pocket expenditures and expenditures on medicines. On the other hand, there is less error in collecting information related to the "time-use consequences" of health events. Using the vernacular to define health insurance also increased comprehension of questions in the PHES and reduced measurement error. Finally, fielding the PHES as part of the IHIE was significantly more cost-effective than collecting survey data. The results in Kinnan *et al*. (2016) thus far provide useful insights into effective ways of collecting information on a household's multi-dimensional response to health events, facilitating accurate evaluation of these schemes and easing barriers to designing improvements in the future.

IV. General Health Policy Lessons

What general health policy lessons can we learn from the evidence presented in the IGC research discussed above? A theme that recurs throughout many of these studies whether they are on public health topics such as nutrition or sanitation or other areas such as better health care management is that information and awareness levels including those on entitlements are on average low, and improvements in this sphere are likely to reap substantial benefits (Banerjee *et al*. 2010, Lemos and Scur 2012, Schofield 2014, Brainerd and Menon 2014, Coffey *et al*. 2015). This identifies a gap that may be remedied using relatively low-cost options. Appropriate policies may be able to rectify this somewhat easily because there is less of a need to invest additional resources but more thinking on how to channel existing resources in more compelling ways. Raising awareness will certainly involve new investments, but these would be relatively less burdensome as compared to investment in new infrastructure for example. In this context,

there is evidence from IGC India research that relying on NGOs without providing additional leadership and direction may be ineffective in achieving objectives (Banerjee *et al*. 2010).

Another theme that recurs in the discussion is that across domains, delivery of products from public welfare services is weak or often absent, and take-up of schemes is low (Banerjee *et al*. 2010, Coffey *et al*. 2015, Wadhera 2016). Some part of this is tied to lack of knowledge, but importantly, leakage is a factor that has sizable repercussions. In light of this, there are IGC studies that analyze improving methods of delivery through the utilization of ICT technologies for example, or by designing schemes that may be more insulated against capture (Sekhri 2016, Berry *et al*. 2016).

Tied to the above, culture and religion are factors that significantly mediate how services are received and adopted by populations in different parts of India. This is evident in schemes that straddle radically different areas from the utilization of pit latrines to the take-up of health insurance programs (Berg et al. 2012, Debnath and Jain 2015, Coffey *et al*. 2015). In these circumstances, relying on social networks or community and peer groups has been found to increase adoption rates and change behavior (Berg et al. 2012, Debnath and Jain 2015, Wadhera 2016). Socio-cultural aspects are important in understanding existing realities including the high rates of malnutrition that manifests itself in larger than justifiable rates of child stunting, or why certain groups of the population appear to be less impacted by factors that have an important role to play in deciding the health and well-being of majority groups (Jayachandran and Pande 2017, Menon 2017). Since influencing and changing such constructs that have been ossified for generations will take time, relying on them to achieve desired objectives whenever possible seems the appropriate second best option.

Finally, implementing effective health schemes requires accurate information on what works and importantly, on what does not work. Hence designing evaluations that can deliver this information in accurate ways is crucial. Where measurement error and costs are a factor, focusing on sub-samples and using intelligent strategies to gather required information is not only desired but prudent and cost-saving (Kinnan *et al*. 2016).

V. What Do We Not Know and Need to Study Further?

We conclude by highlighting areas in which our knowledge on how to improve health policies to enhance economic growth is limited both in the context of India and in the general cross-country sphere. In this regard, an issue that has been identified is effective strategies for raising health awareness. Evidence from IGC India research teaches us that improving awareness is critical to increasing take-up of sanitation infrastructure, new health technologies, and health insurance. But beyond a few identified means (relying on social networks/ community groups and some evidence for incentive pay), we are still unclear on how to tackle this issue. Importantly, NGOs that have been an effective platform for raising health awareness in other countries appear to function relatively less well in this regard in India. A reason may be the more diversified nature of Indian society along caste and other dimensions which makes changing ingrained behavior a difficult objective to accomplish.

A second area where further research seems warranted is how to improve the quality of care administered by medical providers in India, both individuals and hospitals. We understand from IGC India research and from evaluations of medical care that the quality of primary care is low not because tools or medicines are lacking, but because of insufficient effort on the part of providers themselves. Hence further study on designing effective mechanisms to regulate

providers – both public and private – towards rendering more competent service and care would serve to fill a currently existing vacuum in this area.

Moving beyond health awareness and the quality of health care, other topics on which we have weak evidence include the importance of understanding demographic transitions and fertility dynamics. Population pressures have direct impacts on per capita income and on fixed natural resources such as land for example. In particular, fertility transitions are a means by which health may increase economic growth since declining fertility directly increases well-being per person. Alternatively, rapidly growing populations can have detrimental effects on important inputs such as land with immediate implications for agricultural output and food security. A more comprehensive understanding of these factors would be helpful.

Finally, macroeconomic research from cross-country studies suggests that health can impact growth by increasing physical capital (Weil 2007). The intuition is that an increase in labor provided by a healthy productive workforce augments the marginal product of capital, thus spurring further investments in capital inputs. Hence labor and capital are complementary in the growth process, and initiatives that increase the health of the labor force would reap additional returns through their supplementary effects on physical capital. Although this link has been noted, there is as yet little evidence for it in a more microeconomic within-country context.

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