

What Makes Cities Healthy?

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Abstract

The benefits of good health to individuals and to society are strongly positive and improving the health of the poor is a key Millennium Development Goal. A typical health strategy advocated by some is increased public spending on health targeted to favor the poor and backed by foreign assistance, as well as by an international effort to perfect drugs and vaccines to ameliorate infectious diseases bedeviling the developing nations. However, if the objective is better health outcomes at the least cost and a reduction in urban health inequity, our research suggests that the four most potent policy interventions are: water and sanitation systems; urban land use and transport planning; effective primary care and health programs aimed at influencing diets and lifestyles; and education. The payoff from these four in terms of health outcomes dwarf the returns from new drugs and curative hospital based medicine, although these certainly have their place in a modern urban health system. We find moreover that the resource requirements for successful health care policies are likely to depend on an acceleration of economic growth rates which increase household purchasing power and enlarge the pool of resources available to national and sub-national governments to invest in health related infrastructure and services. Thus, an acceleration of growth rates may be necessary to sustain a viable urban health strategy which is equitable, and to ensure steady gains in health outcomes.

I. Competing Objectives

The returns from improvements in health are estimated to be very large. Whether it is an increase in life expectancy, health during early childhood, or health during peak earning years, or health in the twilight years, the benefits to individuals and to society are strongly positive and according to some researchers, overshadow the gains from most other investments.¹ For example, Murphy and Topel (2005) have calculated that between 1970 and 2000, the increase in longevity added \$3.2 trillion annually to the national wealth of the United States.² The cumulative welfare cost of the AIDS epidemic in Sub-Saharan Africa (SSA) is estimated to have risen to \$800 billion by 2000, equal to the output of the whole SSA region (Philipson and Soares 2005).³ Hence, it is not surprising that improving the health of the poor—particularly of the most disadvantaged—is a key Millennium Development Goal.⁴ A typical solution advocated by some is increased public spending on health targeted to favor the poor and backed by foreign assistance, as well as by an international effort to perfect drugs and vaccines to ameliorate infectious diseases bedeviling the developing nations (Commission on Macroeconomics and Health 2001). The Commission on Macroeconomics and Health proposed that per capita spending on health be raised to between \$30 and \$40 per annum from the current level of \$24 in low income countries and \$13 in the least developed countries, only \$7 of which comes from budgetary outlays (Commission on Macroeconomics and Health 2001, p. 16). The proposed solution, even if it could be substantially implemented is not by any means unproblematic. Better health is one of several major objectives of policymakers in developing economies and it is an objective that is closely intertwined with the increase

¹ This is a part of the reason why close to 7 percent of global GDP was spent on health related expenditures in 2001, with high income countries averaging close to 8 percent and low income countries, a little under 5 percent of GDP (Schieber and others 2006). Partly also, because the relative costs of health services and products are also rising (Bloom and Canning 2003).

² According to their calculations, reducing the cancer mortality by 1% could be worth \$500 billion (Murphy and Topel 2005).

³ The valuation of life was calculated through the marginal willingness-to-pay approach (Philipson and Soares 2005).

⁴ In fact, three out of eight goals specified in the MDGs are directly related to health. These are: reduction in child mortality; improvement in maternal health; and combating HIV/AIDS, malaria, and other diseases. In addition, eight of the 18 targets are health-related. When Bjorn Lomborg recently asked 10 ambassadors to the UN as to their priorities if they had \$50 billion to spend, their top three choices were scaled up health services to protect against communicable diseases; improved water supply and sanitation; and increased education ("Lomborg, Bjorn" 2006).

in incomes—life expectancy is inversely related to poverty (Deaton 2004). While some microeconomic evidence suggests that healthier people can have higher incomes, other findings indicate that rising incomes lead through multiple channels to reductions in infant mortality, a lower incidence of morbidity, and increasing life expectancy.⁵ This interrelatedness—the endogeneity of income and health and of health and education⁶—makes causality difficult to establish. Perhaps it is not necessary for policymaking purposes to establish strict causality. It can be argued, for instance, that income, health and in this context, education objectives are not mutually exclusive and should be pursued in tandem. Actions which promote growth and the efficient delivery of education may, for instance, make it possible to substantially achieve health objectives. As Deaton (2006a, p. 23) puts it, “there are common third factors that are good for both growth and health...particularly women’s education.” In other words, for the purposes of resource allocation in the development context, it is desirable to be able to define competing pathways to what are often complementary objectives and to be able to rank the relative attractiveness of different sequences of policy actions.

Now that most developing countries are at the stage of rapid urbanization and many have begun to industrialize, there are multiple and urgent claims on scarce resources. If more resources are channeled to specific health related initiatives, this diverts spending from other priority areas. Whether health programs receive precedence over other expenditures should depend on an assessment of individual programs and a weighing of alternative approaches which could yield similar results more expeditiously. It is important to keep in mind that because the evidence is still fragmentary and at times conflicting, any judgment must be provisional, nevertheless, judgments must be made.

⁵ Deaton (2006a, pp.27-28) points out in a recent paper that “there is no cross country correlation between reductions in infant and child mortality and rates of economic growth [for] 1960-2000. Some countries achieved major improvements in mortality without economic growth, while others who grew very rapidly, most notably China after 1980 and India after 1990, showed little improvements in health... These results make it hard to believe that improvements in health are the engines of economic growth. They also present some difficulties for the ‘wealthier is healthier school.’”

⁶ The interrelationship between individual health and academic performance is examined by Ding and others (2006).

II. Income, urbanization, and Urban Health: The View from Stylized Facts

The purpose of this paper is to present a number of stylized facts and an assessment of the relationship between economic growth, human capital, and urban health based on cross-country empirical evidence, on the analysis of country level time series data, and on a selective review of the literature on factors influencing urban health and health equity. From these, it is possible to arrive at a menu of policies that strikes a balance between the complementary objectives of rapid income growth and improvements in the health, especially of the poorer segments of expanding urban communities.

Population and Economic Growth will be urban centered

In 2006, more than half of the world's population was living in urban areas and the trend is definitely upwards, and heading towards 60% by 2030 ("60% of World" 2004). China with an urbanization rate of 43 percent in 2006 is likely to experience a shift of as many as 200 million people to urban areas within the next 20 years and by 2020, India's urban population, currently less than 29 percent, should be approaching 50 percent. While the majority of the rural inhabitants will migrate to small and middle sized cities, a large percentage will very likely end up in mega cities. The number of such cities will increase to 22 by 2015 and it is expected that the populations of individual cities such as Karachi and Jakarta will rise significantly (see Table 1).⁷

From this follows the first, and widely accepted, stylized fact which is that, *The worldwide trend towards urbanization is irreversible and could accelerate. The urban sector currently accounts for more than 55 percent of GDP in the low income countries and 85 percent in the industrialized countries (de Haan 2000). It will generate the bulk of future economic growth and most of the new employment. For these reasons, the urban sector will be the focus of economic policies encompassing growth and health.*⁸

⁷ The pace at which urban populations are expanding has accelerated. London took 130 years to grow from one million residents to 8 million. Bangkok took 45 years, Dhaka 37 years, and Seoul 25 years ("60% of World" 2004).

⁸ See also Galea, Freudenberg, and Vlahov (2005).

Table 1: Megacities

2003			2015		
Rank	City	Population (million)	Rank	City	Population (million)
1	Tokyo, Japan	35.0	1	Tokyo, Japan	36.2
2	Mexico City, Mexico	18.7	2	Mumbai (Bombay), India	22.6
3	New York, United States	18.3	3	Delhi, India	20.9
4	São Paulo, Brazil	17.9	4	Mexico City, Mexico	20.6
5	Mumbai (Bombay), India	17.4	5	São Paulo, Brazil	20.0
6	Delhi, India	14.1	6	New York, United States	19.7
7	Calcutta, India	13.8	7	Dhaka, Bangladesh	17.9
8	Buenos Aires, Argentina	13.0	8	Jakarta, Indonesia	17.5
9	Shanghai, China	12.8	9	Lagos, Nigeria	17.0
10	Jakarta, Indonesia	12.3	10	Calcutta, India	16.8
11	Los Angeles, United States	12.0	11	Karachi, Pakistan	16.2
12	Dhaka, Bangladesh	11.6	12	Buenos Aires, Argentina	14.6
13	Osaka-Kobe, Japan	11.2	13	Cairo, Egypt	13.1
14	Rio de Janeiro, Brazil	11.2	14	Los Angeles, United States	12.9
15	Karachi, Pakistan	11.1	15	Shanghai, China	12.7
16	Beijing, China	10.8	16	Metro Manila, Philippines	12.6
17	Cairo, Egypt	10.8	17	Rio de Janeiro, Brazil	12.4
18	Moscow, Russian Federation	10.5	18	Osaka-Kobe, Japan	11.4
19	Metro Manila, Philippines	10.4	19	Istanbul, Turkey	11.3
20	Lagos, Nigeria	10.1	20	Beijing, China	11.1
			21	Moscow, Russian Federation	10.9
			22	Paris, France	10.0

Source: United Nations, World Urbanization Prospects: The 2003 Revision database.

Note: For the purposes of this table, megacities are those with a population of 10 million or more.

More of the Poor will be Living in Cities

As people transfer from rural to urban areas and from agricultural to other occupations, poverty which hitherto has been concentrated in the primary sector could become much more pervasive in urban regions. In 2000, approximately 30 percent of the poor lived in cities—a number which could rise to one half by 2035 (Meeting the Urban Challenge 2002). Their absolute numbers are sure to rise as is their share of the urban population with the increase depending upon the economic performance of urban economies. Thus a second stylized fact is that, *Poverty is on a trend line to becoming a predominantly urban phenomenon, with its scale largely determined by how many and what kinds of jobs are created in cities.*

Urban Poverty Begets Slums

The changing geography of poverty draws attention to the spread of urban slums (Davis 2004). In many but by no means all developing countries, migrants to cities end up living in urban slums—more than 1 billion were classified as slum dwellers in 2002, a third of the urban population, and a quarter of the urban housing units were substandard, temporary structures (Meeting the Urban Challenge 2002). The spread of slums is closely related to the acute shortage of affordable urban housing and to urban land use policies. But ultimately, the persistence of slums is a function of household incomes and the flow of investment into housing and associated urban infrastructure. Once slums take root, they are difficult to eradicate,⁹ although the experience of the Republic of Korea for example, suggests that slums can be removed under certain conditions, conditions determined by the rising incomes of city dwellers in general and slum households in particular, urban land and housing policies, the level of investment in urban infrastructure, and municipal policies to contain and reverse slum formation.¹⁰ The stylized fact here is that, *Migration to urban centers all too frequently results in the emergence or spread of slums. These slums can adversely affect the business climate in cities and they can be the source of poverty traps for slum dwellers. Continuing and even accelerating migration to cities unless matched by investment in suitable urban infrastructure, will lead to an increasing incidence of slums which could constrain the economic prospects of major urban centers.*¹¹

Poverty and Slums Equals Greater Health Inequity

Slums are first and foremost a symptom of the low incomes of a high percentage of migrants to cities, poverty among migrants can be prolonged and exacerbated by joblessness, reliance on low paid casual employment, and by the percentage of female headed households with multiple dependents (30 percent of the total, World Health Organization Centre for Health Development 2004). Low and unstable incomes together

⁹ See the discussion of the tenacious persistence of slums and their causes in Lagos, Istanbul, Rio de Janeiro, Nairobi, and Mumbai in "The Megacity" (2006) and Neuwirth (2005).

¹⁰ China is now struggling to contain the spread of slums as migrants pour into its cities. See "Welcome to Megacity" (2006).

¹¹ The fear of slum formation was a part of the reason why China strictly controlled migration through the *hukou* (household registration) system now being relaxed.

with substandard housing, crowded living conditions, and the absence or insufficient provision of public services ensures that the majority of slum dwellers, especially children who are rarely vaccinated¹² are more susceptible to infectious disease (including new threats such as SARS and the West Nile virus), more prone to accidents, and more exposed to violence and crime. The average slum dweller also has limited access to education and health services and to clean water, sanitation, and publicly provided electricity.¹³

The worldwide efforts to eradicate slums or failing that, to upgrade the physical infrastructure and services in slum areas, has clearly established the high cost of even partial success. More broadly, increasing access to social services in urban areas so as to reduce health, housing and education inequities is a task calling for a massive investment of resources. This is fully recognized for instance by the “Commission on Macroeconomics and Health” (Commission on Macroeconomics and Health 2001). Diverting these resources from other areas or finding additional resources to raise the health status of the urban poor is also harder if the overall economic pie—and public revenues—are growing slowly or worse, not growing at all. Put differently, the health, education, and housing deficits—to name only the ones which are most obtrusive—plaguing the urban poor cannot be closed on the cheap. Additional financing has to be found mainly from national and subnational budgets and preferably not by increasing user charges and co-payments on the urban low income groups and slum dwellers which decrease consumption of services and involve high costs of collection (Schieber and others 2006). Moreover, any interventions which over a period of time could enhance the human capital of the poor—through better health and education—need not translate immediately or ever into better paid jobs or a faster expansion of the urban GDP that would offset the initial expenditure of resources. Policymakers confronting tradeoffs must, therefore, weigh the merits of specific interventions to reduce health inequities for example and factor in the likelihood of gains in health or education becoming self-sustaining because they become self-financing. The essential point is that the return in

¹² Thirty percent of the disease burden is borne by children under 5 years (World Health Organization Centre for Health Development 2004).

¹³ In Dhaka, only a third of all households have a piped sewage connection and two thirds have access to relatively safe drinking water (McGee 2001).

terms of realized GDP growth from investment in lessening urban health inequities and improving the health status of the poor, should be equal or superior to the return on competing expenditures. The presumptive microeconomic evidence on the gains in productive potential from improved health is reasonably firm. The macroeconomic evidence quantitative or qualitative which leads from health outcomes to sustained growth income is less easy to find.

It is generally accepted that the poor are more subject to ill-health from the neo-natal stage all the way through old age. Health inequity is a function primarily of income, although education (literacy), location, and other factors also contribute. The poor in urban areas can suffer from insufficient intake of calories, with children and women being among the worst affected.¹⁴ Even when calorific consumption is adequate, the diet can be slanted towards sugars and fats and low on micro-nutrients, principally zinc, folic acid, vitamin A and iodine which effect growth, immunity to disease and cognitive development (Caulfield and others 2006). Higher income groups, who are also generally better educated, can more easily afford private providers and the ‘out of pocket expenditure’ entailed when using public services. They are more likely to utilize primary care facilities retailing preventive medicine and to seek providers who offer superior services (Cutler and Lleras-Muney 2006). The well-to-do are also able to afford increasingly costly medications and diagnostic/invasive care, and the health of individuals in the uppermost deciles is underpinned by their ability to seek out and access the latest technologies (Glied and Lleras-Muney 2003).

Other factors also impinge upon the health of the poor. Life in slums or crowded substandard housing facilities in the least salubrious parts of a city, exposes the poor to infectious diseases¹⁵ and the risks of injury from violence, drug abuse or accidents. Manual work which is more often the lot of the poor, whether living in cities or in rural areas is strongly associated with the earlier decline in health and with physical

¹⁴ Fogel (1997a) has made a strong case for the role of nutrition in improving health. In comparing calorie intake over time, Logan (2005) finds that the average for low income countries today exceeds the average for the United States and the United Kingdom in the late nineteenth century.

¹⁵ This partly explains the tenacious hold of TB and sustains pneumonia as one of the leading causes of child mortality (Wardlaw and others 2006).

disabilities.¹⁶ Lastly, when poverty goes hand in hand with marginal literacy or illiteracy, the capacity to seek out appropriate healthcare (e.g. vaccination for children, Koenig, Bishai, and Khan 2001) and to derive the full benefit from the care provided by following an at times lengthy and complex therapeutic regimen (e.g. for TB or HIV), is often extremely limited. The fifth stylized fact is that, *Slums are largely a consequence of mismatches between migration to cities and the absorptive capacity of cities. Once formed, slums perpetuate and even worsen the health status of the inhabitants and widen urban income inequality often by trapping slum dwellers in low end casual jobs.*

Raising Incomes Improves Health Status

If poverty is at the root of ill-health, then raising incomes is the necessary first step. One of the most robust stylized facts is that, *Raising the growth of GDP is the surest way of reducing poverty.*¹⁷ *This is borne out by cross country analysis, and by longitudinal country studies in China and India for example. Moreover, growth generates the resources for additional expenditure on social services which can lead to further gains in health and health equity and reinforce the effects of higher household incomes.*

Growth generally rides on the back of rising productivity and is directly correlated with the increase in employment. When growth is sustained, it results in many more jobs with higher added value which pay better wages.

One response to this stylized fact can be that growth is partly a function of human capital which is built up through investment in health and education. This can be buttressed by voluminous microeconomic evidence on the benefits to the individual of additional schooling and on healthcare. But such evidence is overshadowed by the findings which underscore the greater importance of capital investment and productivity.

Capital (physical and human) and TFP Drive Growth in Industrializing Countries

Whether we look at the cross country growth regressions or at estimates of the sources of growth in individual countries based on time-series, the stylized fact to note is

¹⁶ See Case and Deaton (2004).

¹⁷ Dollar and Kraay (2002), Bourguignon (2002), and Moser and Ichida (2001).

that, *The principal determinant of growth in developing countries and most notably the industrializing economies of East Asia, is always capital, followed by labor—human capital—and then by total factor productivity (TFP). Developed countries derive most of their growth from TFP.* Contrary to the view that grant assistance and capital inflow from abroad can accelerate growth, the recent finding is that foreign capital inflows are associated with slower growth (Prasad, Rajan, and Subramanian 2006). In the earlier stages of development, TFP overwhelmingly reflects the productivity windfall from a transfer of workers from the primary to the urban sector. Fogel (2006b) observes that 30 percent of China’s growth is likely to derive from intersectoral shifts in the workforce coupled with a small increase in labor force participation rates. At later stages of development, TFP depends more on gains in allocative efficiency and advances in knowledge. In this macro framework, education plays a modest role; health none at all. A representative paper by Bosworth and Collins (2003) highlights the role of capital while the findings presented in Lau (1996) make clear the contribution of capital, labor, and TFP at different levels of development. This is an issue to which we return below.

Income Inequality Follows the Wake of GDP Growth

For developing countries growth is arguably the leading objective, however, both recent international experience and experience of industrializing economies from the late nineteenth and early twentieth century indicates that growth and the intersectoral transfer of workers has in many cases come hand-in-hand with rising inequality in the distribution of income. Whether we take the United Kingdom from the late seventeenth century until 1867, United States in the last few decades of the nineteenth century through the first two decades of the twentieth, or the Nordic countries or Japan in the first four decades of the twentieth century, inequality was rising in all those countries to startlingly high levels (Bourguignon 2006; Lindert 2000). The Gini coefficients for these countries ranged between 0.50 and 0.65 in the first few decades of the twentieth century.¹⁸ This pattern has been repeated in China and India during the past 20 years—a period of rapid growth. And it is a tendency apparent across the developing world ranging from Brazil to

¹⁸ That such an increase was not always the case is reflected in the experience of France and Italy where inequality declined with growth (Frazer 2006).

Pakistan. According to Ravallion and Chen (2006), urban income growth is inequality increasing in the aggregate though this is not the case in rural areas. Two economies where inequality changed little during a long stretch of high growth are Korea and Taiwan (China) because both economies underwent a massive distribution of landed assets just prior to the start of modern economic growth. In other words, the stylized fact here is that, *In the vast majority of cases, economic growth in the developing world has been associated not just with rising incomes but also with rising income inequality (at varying rates). This inequality stems from household income cleavages between the rural and urban sectors, among regions—with coastal regions often registering more favorable economic outcomes—and, to a lesser extent among households in urban areas. Income inequality is severe in cities such as Sao Paulo and Hong Kong and it is high and worsening in cities such as Singapore,¹⁹ Karachi and Jakarta.*

Governments view the widening inequality of incomes as an unwelcome development.²⁰ But as yet, no mix of policies and institutions has arrested or effectively reversed income inequality in rich, middle income, or poor countries. The United States and Japan for a variety of reasons have been unsuccessful in containing creeping income inequality. Similarly, China among the middle income countries, and Pakistan among the lower income ones are both subject to rising income inequality. Although there is no dearth of strategies, policy prescriptions, recipes for institutions, and volumes of macro- and micro-level experiences, few economies have been able to achieve the sustained rate of growth they are seeking and even fewer have been able to avert the trend towards a greater concentration of incomes.

Income Inequality Does Not Impact on Health Conditions

Which matters more for urban health, income growth or income inequality? We will argue in the balance of the paper that income growth is critical and with reference to our penultimate stylized fact, income inequality is surprisingly not significant. A careful review of the empirical findings to date by Deaton (2003a) and Wagstaff (2002) suggests

¹⁹ The Department of Statistics in Singapore reported that the Gini coefficient rose from 0.49 in 2000 to 0.52 in 2005 ("Singapore's Falling Living Standards" 2006).

²⁰ On the concerns expressed by the authorities in China, see Yusuf and Nabeshima (2006).

that, “Income inequality does not appear to affect population health directly. Poverty, however, is correlated with intra-urban health inequity and poverty does influence mortality—especially infant and child mortality—through several channels.²¹ Poverty and inequality together may lead to the erosion of social capital in urban areas and aside from eroding community support systems, could be responsible for increasing crime and violence against persons and property.” (Demombynes and Ozler 2005; Wilkinson 2005). As Deaton (2003a, p 151) notes, the social environment and an individual’s position in the social hierarchy does matter for the perception of health. His views are supported by a study of 22 European countries which found that people lower ranked on the social scale and with limited education had lower self-rated health (von dem Knesebeck, Verde, and Dragano 2006). This might be traced to the erosion of social capital. When income inequality diminishes the closeness and quality of social relations, social capital starts to fray, and the health conditions of the poor deteriorate (Miller and others 2006; Wilkinson 2005).²²

Clean Water and Sanitation make Healthy Cities

Rising incomes pull people out of poverty and higher incomes make possible the pooling of capital to finance urban infrastructure. In particular, infrastructure which provides urban residents with clean water, efficient sanitation, and solid waste disposal services has proven to be a highly significant determinant of urban health outcomes. This was the case in nineteenth century Britain, in the United States during the early twentieth century, and in developing countries during the latter part of the twentieth century. The stylized fact which emerges from this experience is that, *Rising per capita urban incomes can set the stage for investment in water and sanitation infrastructure so as to provide the broad mass of the urban population with access to affordably priced and reliable services. Furthermore, investment in urban infrastructure was and is a key driver of growth and employment.* Although many factors contribute to improvements in urban

²¹ See Waelkens and Greindl (2001, pp 24-27) and Wagstaff (2002).

²² A study by Miller and others (2006) finds a positive relationship between community-level social capital and good health. A similar study exploring the effect of neighborhood effect on health finds that having wealthier neighbors can improve health for young black males. This is equivalent in fact to a 40% increase in their income (Miller and Paxson forthcoming). See also Demombynes and Ozler (2005) on crime and inequality in South Africa.

health especially of the poor,²³ the volume of (relatively) clean water²⁴ and waste disposal services are the first and strongest line of defense against several of the principal infectious diseases including diarrhea and malaria. Such infrastructure is a public good which affects the urban population and reduces health inequality (Soares 2007). Five childhood conditions (diarrhea, respiratory infections,²⁵ malaria, measles, and perinatal conditions) that can be reduced through preventive measures or treated through antibiotics, other antimicrobials and ORT are responsible for 21% of all deaths in low- and middle-income countries, while these account for only 1% of deaths in high-income countries (Bloom and Canning 2003).²⁶

The incidence of diarrhea among children in low income countries has changed little over the past decade (3.5 episodes per child per year), although oral rehydration therapy (ORT) has reduced mortality. G-I problems also affect the ability of children to absorb nutrients and make them more prone to chronic diseases later in life.

Infrastructure to supply the amount of water needed per individual and remove waste, which is the basis for a healthy city, requires major initial capital expenditure and continuing subsequent investment to maintain,²⁷ expand and upgrade the facilities. Thus the capital outlay is a fundamental consideration and an adequate infrastructure only becomes affordable once urban incomes have crossed a certain threshold.²⁸ The level of

²³ Landers (1993) ascribes the easing of the extremely high mortality rates in London towards the close of the eighteenth century to the gradual improvement in housing conditions as a result of increased construction, the greater availability of cotton clothing which permitted frequent washing and killed lice, and possibly, the spread of inoculation. These three factors might have lessened the mortality from typhus, typhoid, and smallpox. The incidence of pneumonia among children is partly the result of indoor air pollution linked to substandard housing and use of biomass fuels.

²⁴ Specter (2006) vividly describes the predicament of the poor in Delhi and in Chennai (India) where water is scarce. All inhabitants are affected but the poor most acutely. Slum dwellers in New Delhi spend more on (substandard) water than households with water supply connections. And Chennai residents often carry pails with them in the hope that they might chance upon clean water.

²⁵ Pneumonia kills 2 million children under the age of 5 years annually (Wardlaw and others 2006).

²⁶ Almost two million children die annually from diarrhea worldwide. For close to 90% of these, diarrhea is caused by lack of access to an adequate quantity of water and to effective sanitation (Cairncross and Valdmanis 2006; Kolsky and others 2005). Provision of basic sanitary facilities can reduce child mortality by 30% or more, with the provision of flush toilets having larger impact than pit latrines. A cost of such deficiencies in water and sanitation infrastructure is estimated as \$170 billion (\$23.5 billion in Sub-Saharan Africa, \$29 billion in Latin America, and \$34 billion for South Asia and \$66 billion for East Asia) (UNDP 2006).

²⁷ Maintenance usually requires expenditures equal to 7-10% of the initial capital costs of the facilities (Cairncross and Valdmanis 2006).

²⁸ Szreter (2004) writes that urban life expectancies in Britain dipped below the national average in the 1830s and 1840s and did not start to rise above the national average until the 1870s even though per capita

urban economic development also affects the regulation, management and pricing of services, the maintenance of facilities and the capacity to both harness current technologies as well as to keep abreast of advances.

The Story from Stylized Facts

These nine stylized facts, when threaded together, present us with a particular perspective on the dynamics of urban economic growth and its relationship to population health. In capsule, the momentum of urbanization shows no sign of abating and as the center of gravity of most economies has shifted towards industry and services, the urban sector is where most of the GDP is now concentrated and which leads to growth. With urbanization, poverty is also migrating to cities. As rural inhabitants relocate in urban centers, the inadequacy of housing and services is resulting in the spread of slums which because of massive overcrowding, inadequate sanitation, and the scarcity of public services, is compounding the health problems associated with poverty (Brockerhoff 2000). Because poverty underlies the parlous state of population health across cities in the developing world, rapid growth in incomes is a necessary step to alleviating health conditions though it may be by no means sufficient.²⁹ The bulk of the research on growth points to the primacy of capital and human capital inputs and of gains of total factor productivity in propelling growth.

Income growth is the surest way of reducing poverty, however, experience shows that growth is frequently paralleled with worsening income inequality. Inequality, although it is a less desirable consequence of rapidly increasing GDP, need not apparently affect population health as measured by longevity.

The more positive aspect of GDP growth for health is that it can facilitate the financing of the water, sanitation, and housing infrastructure which is a precondition for a healthy city. Providing an adequate volume of services requires a large initial investment

incomes and calorific intake was increasing through this period. He cites Edwin Chadwick's work in order to note that as of the 1840s, the importance of personal hygiene and cleanliness was well known but the needed investments were not made until two decades later.

²⁹ It is important to emphasize that this is a necessary but by no means a sufficient condition because we do not always find this correlation between growth and health conditions except in the long run. "If growth by itself is no guarantee of health improvement," as Deaton observes, "then some sort of public action whether through public health or provision of health systems is required. Economic growth frequently needs help to guarantee an improvement in population health." (Deaton 2006b, p 111).

and then continuing outlay on maintenance, expansion, and improvement.³⁰ This does not seem practically feasible until urban GDP has crossed a certain threshold and is on an upward trend.³¹

In the balance of the paper we will examine the empirical links between income growth and health and also between infrastructure spending, education and urban health to suggest why the GDP growth, infrastructure-led, and education supported approach is key to a strategy for improving urban health and sustaining the gains achieved.

III. Selected Empirical Studies on Health and Growth

The correlation between health and wealth has long been documented in the literature on public health and development economics. In the words of Nobel Laureate Amartya Sen, health is among the basic capabilities that gives value to human life (Sachs 2001) and has been hailed as the foundation of development. However, empirical research on the relationship between income and health has been plagued by the endogeneity. While good health can be considered as a part of human capital with a beneficial effect on growth, wealthy individuals can also consume many health-enhancing goods and services to improve their health (Lopez-Casasnovas, Rivera, and Currais 2005b).

Income to Health

In order to sidestep the problem of endogeneity in conducting such tests, some researchers have relied on instrumental variable approach and natural experiments to isolate the independent effect of income or economic growth on health.³² Using terms-of-

³⁰ Improved access to sanitation and better hygiene practices have a larger impact on health than improvement in the quality of drinking water. This is because most diarrheal diseases are transmitted from person to person through poor hygiene, contaminated food and the improper disposal of excrete (Cairncross and Valdmanis 2006; World Bank 2003). For a household of five, the minimum consumption requirement of water is about 50 liters per capita per day for maintaining basic hygiene, while 100 liters will represent modest usage (Foster and Yepes 2006). Europeans use on average 200 liters per day and Americans, more than 400 liters per day (UNDP 2006).

³¹ In a decentralized fiscal system, this also depends on the development of local financing options. See Cutler and Miller (2005) for an assessment based on past U.S. experience.

³² Causation runs both ways and omitted variable biases such as technologies, differences in health sector institutions, and specific interventions remain sources of bias and error, especially for cross-country analysis (Acemoglu and Johnson 2006). Using detailed data on mortality in seven European countries, Janssen, Kunst, and Mackenbach (2006) find that GDP levels prevailing at specific ages effect the

trade shocks as an instrument for GDP growth, Pritchett and Summers (1996) find that 40% of the differences in mortality rates across countries can be attributed to differences in the growth rates in the previous decades. However, 60% of the variation is still unexplained and significant improvements in health are rarely seen after rapid expansion of an economy (Bloom and Canning 2003).³³ Based on the data from the Panel Study of Income Dynamics (PSID) and using inheritance as an instrument, Meer, Miller, and Rosen (2003) find that in the short-run, changes in wealth are unrelated to the health of individuals. Other studies such as one by Levine and Rothman (2006) seek to draw a link running from trade to health, again using the instrumental variable approach to take account of endogeneity.

The fall of the Berlin Wall and the collapse of the Soviet Union offer two 'natural experiments' to assess the effect of changes in income on the health. Frijters, Haisken-DeNew, and Shields (2005) use the German unification as a "natural experiment" because the unification was mostly unanticipated and there was a large jump in incomes of East Germans at the time of unification. They find a small but statistically significant positive effect of income on self-reported measures of health satisfaction. Using household panel data spanning the Russian Pension Crisis and triple difference-in-difference method, Jensen and Richter (2004) find that among affected pensioners, poverty rates doubled, and the intake of calories and protein and the use of health services and medications declined significantly. Pensioners were also 5 percent more likely to die in the two years following the crisis. Adams and others (2003) take advantage of the fact that in elderly populations persistent hidden factors will often be manifest in observed covariates and therefore, can be controlled for. They find that there is no direct causal

subsequent mortality rates. This differs significantly between men and women. Men are affected by the GDP at the age of 20-49, while women are affected the most by the GDP when they are 50-64. Another point of view is that "The direct influence of wealth on health may be strongest during childhood and early adulthood when levels and trajectories of health stocks become established ... The dominant causal direction may then reverse as health largely affects wealth among those age 50 and older" (Smith 1999).

³³ For instance, Chile and Costa Rica were better able to reduce infant mortality and increase life expectancy compared to Korea and Taiwan (China) during 1960-1995, despite slower growth in Chile and Costa Rica. The success in improving the health conditions in Chile and Costa Rica can be attributable to policies aimed at disease control, health care, nutrition intervention, provision of safe water, and sanitary works in these two countries (McGuire 2001). In addition, at least for the under-5 mortality, simply increasing the public outlay on health may not be as effective as focused spending on improving access and quality of maternal and infant health care (McGuire 2006).

link running from socio economic status (SES) to mortality and to the incidence of most sudden onset health conditions (accidents and some acute conditions) for the elderly American population, once initial health conditions are controlled. But there is some association of SES with the incidence of gradual onset health conditions (mental conditions, and some degenerative and chronic conditions) possibly through genetic and behavioral channels.³⁴

Human Capital to Income

An alternative approach to the one discussed above views health as an important part of human capital accumulation with a direct bearing on the productivity of an individual and on the overall economy, following the endogenous growth theory first introduced by Romer (1986) and Lucas (1988). The importance of health and nutrition in the formation of human capital along with education was pointed out by Mankiw, Romer, and Weil (1992).³⁵

According to this chain of reasoning, the causality runs from health to income.³⁶ There are four different channels through which health affects wealth.

Demographic transition

The first pathway by which health affects income is through improvements in sanitation, and the widespread use of antibiotics, and antimicrobials, which lowers mortality and eventually fertility. However, because there is a lag between lower mortality (almost immediate, especially for infant mortality) and lower fertility (the effect is felt over the medium to longer term), the initial outcome is the appearance of a baby-

³⁴ The context of the study is that Medicare covers most acute care and pension income is not affected by ability to work.

³⁵ See Lopez-Casasnovas, Rivera, and Currais (2005a) for a collection of papers on health and economic growth. The empirical evidence of returns to education in the microeconomic literature is well-established (see, for instance, Harmon, Oosterbeek, and Walker (2003)) with estimates ranging from 5% to 15% depending on countries and time periods of the study (Temple 2001).

³⁶ Health may be a necessary condition only. In 1965, Latin America and East Asia had broadly similar health outcomes (life expectancy of 60 and 59 years respectively) and both had entered the demographic transition (working age population growth rate of 0.5% and 0.7% respectively from 1965 to 1990). But the growth outcomes of these two regions were vastly different (Bloom and Canning 2003). Jamison, Lau, and Wang (2005) show that improved health has a positive impact on the level of income, but not on the growth rate.

boom generation. As long as this generation is effectively integrated into the labor force through increased investment in education and in fixed capital assets, an economy can reap the demographic dividend of higher growth as in East Asia during the 1970s through the 1980s (Bloom and Canning 2003; Bloom and Williamson 1998). However, using the cross-country differences in the timings of key medical inventions in the 20th century as instruments, Acemoglu and Johnson (2006) do not find any effect of an increase in life expectancy on per capita income growth nor on the overall size of the economy.³⁷ Such an effect can be seen only when the increase in population is also accompanied by a corresponding increase in capital accumulation, in line with neoclassical growth theory (Acemoglu and Johnson 2006).

Education

Although the actual magnitudes and effects of education on income and growth also bear the taint of endogeneity (as does health), many consider it plausible that education influences the level of income and growth. In fact, Jamison, Lau, and Wang (2005) show that education affects both the income and the growth, although the effect seems to be small. There are a number of links between health and education. One such link runs from lower fertility typically to a higher level of investment in children's education by parents. In addition, lower mortality will lead to an increase in investment in human capital because the investment can be recouped over a longer time-horizon (Bloom and Canning 2003; Morand 2005). Acemoglu and Johnson (2006) do not find any support for this claim but the effect of health on education is noted in other studies.³⁸

Healthy children are more likely to pay attention during the class, will attend schools more often, and they tend to fare better in school. Using a longitudinal survey from Guatemala, Behrman and others (2003) find that children receiving nutrition supplements given at an early age (6-24 months) tend to have superior educational

³⁷ Acemoglu and Johnson (2006) estimate that a 1% increase in life expectancy leads to 1.5% increase in the population size.

³⁸ Education is also a key determinant of an individual's health. A study of 22 European countries finds that people with low educational attainment tend to report lower self-reported health. However, the inequality in health status arising from education attainment varies greatly among different countries, sex, and age groups (von dem Knesebeck, Verde, and Draganò 2006).

outcomes (see also Caulfield and others 2006).³⁹ Such positive results from interventions in early childhood have also emerged from studies on the use of nutritional supplements conducted in the Philippines (Behrman and others 2005), from the administering of iron supplements in India (Miguel 2005), a deworming campaign in Kenya (Miguel 2005), and from the use of iodine supplements and zinc supplements (Caulfield and others 2006). Similarly a study in Zimbabwe which used drought and civil war to instrument for the height difference among siblings, height-for-age has a large impact on grades completed. Had these children attained the average height-for-age in developed countries (4.6cm taller), they would have completed an additional 0.7 grades of schooling (Alderman, Hoddinott, and Kinsey 2003).

Labor Market

Many studies have established that healthier workers are more productive (Weil 2005) and earn higher wages (Rivera and Currais 2005; Schultz 2005). In Latin America, workers with 6 years of education earn 50% more than those without any education. Such wage premia increase with the levels of schooling, 120% for 12 years and 200% for 17 years of education (Bloom and Canning 2003). This is especially so in developing countries where a large proportion of workers are manual labors. In addition, with lower fertility rate and smaller family size, female labor participation rate may be higher (Bloom and Canning 2003). The productivity of Indonesian workers with anemia was 20% less than those without this condition. Once the anemic workers were treated with iron supplement to increase the red blood cell counts, their productivity level was restored to normal (Bloom and Canning 2003). Using data at the individual level, Weil (2005) finds that health outcomes significantly affect hourly wages. In his regression analyses, he used the log of hourly wages as dependent variables and various childhood health indicators as instruments. The coefficient estimates range from 0.078 to 0.090 for the height, are 0.18 for the body mass index, and -.261 for the age of menarche. Using

³⁹ The measure of education outcomes used are: probability of attending school, passing of the first grade, the grade attained by age 13, completion rates, adult Raven's test scores, and adult cognitive achievement scores (Behrman and others 2003).

these and results from other studies, Weil (2005) finds that 9.5% to 29.5% of the variation in the log of income can be explained by the variation in health outcomes.

Investment

Healthier people live longer, and may save more for retirement. Thus, savings can rise as the average level of health improves. This in turn can affect investment. A healthier labor force can attract more foreign direct investment, and health conditions also directly affect certain industries, especially tourism (Bloom and Canning 2003). Alsan, Bloom, and Canning (2006) showed that one year increase in life expectancy is associated with 9% increases in gross FDI flows to the lower- and middle-income countries.

IV. Testing for the Income-Health Causality

To further explore the relationship between income and health we conducted two tests described in this section. First, we examine how income levels relate to people's health using cross-country data from 1965 to 2004. A "Granger causality" test is used to identify the direction of causality. Secondly, we exploit the natural experiment arising from the sharp decline of employment in China following the privatization and divestiture of state owned enterprises in 1997. With this data, we can test for causality in China between income levels caused by enterprise reform and health during 1996 to 2004.

Cross-Country Test

Data on life expectancy, literacy, per capita GDP, and the GDP by sector (agriculture, industry, and service) was obtained from the World Development Indicators database for all the available countries from 1960 to 2004.⁴⁰ Literacy data are available for 1990 and 2004 only. We selected GDP per capita (constant 2000 US \$) and relied on the data base assembled by Maddison (2006) because it provides a continuous series from

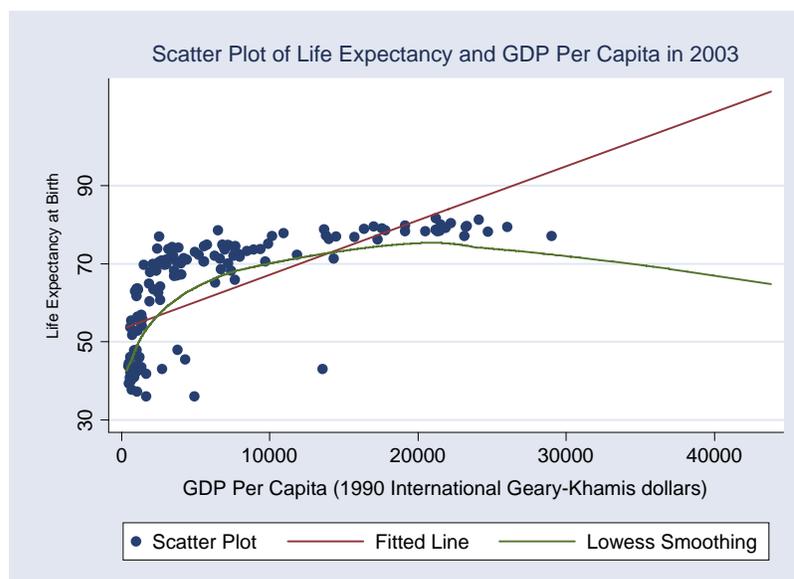
⁴⁰ The data for 2005 include too many missing observations to be useful and therefore, are excluded from the analysis.

1950 to 2003 for the majority of countries.⁴¹ The indicator we used for measuring health outcomes is life expectancy.

We excluded from our sample small islands or territories as well as the former Soviet Union countries and East European countries because the data is unavailable or inconsistent. This still leaves us with gaps in the data which had to be imputed using linear interpolation. The final sample contained longevity and GDP per capita data for 122 countries over 44 years (1960-2003).⁴²

A plotting of the cross-section data for 2003, reveals a clear non-linear relation between GDP per capita and a country's life expectancy (see Figure 1). As per capita income increases, the improvement in health outcomes measured as life expectancy slows down.

Figure 1: Scatter Plot of Life Expectancy and GDP per Capita in 2003



⁴¹ The Maddison data, however, do not include the data for Democratic Republic of the Congo and Republic of the Congo, Cyprus, Fiji, Guyana, Iceland, Luxembourg, Macao (China), Maldives, Malta, and Papua New Guinea. They are relatively small countries, so omitting them does not bias the results. In addition, Maddison only have data for former USSR countries and East European countries from 1989 to 2003.

⁴² In the scatter plot shown above, former Soviet Union countries and East European countries are not included.

Granger Causality from Panel Data—Health in relation to income

The purpose of the Granger (1969) causality test is to determine whether one selected variable is helpful in forecasting another variable in the context of time series data. According to Sims, causality here refers to a “recursive ordering among things determining something [and it] has also been used to refer to one-sided distributed-lag relationships in which the right-hand-side variables are exogenous” (Hansen 2004, p.278). A time series X is said to Granger-cause Y if lagged values of X provide statistically significant information on future values of Y. For example as Hamilton (1994) shows for a linear function: X fails to Granger-cause Y if

$$MSE[\hat{E} = (y_{t+s}|x_t, x_{t-1}, \dots)] = MSE[\hat{E} = (y_{t+s}|x_t, x_{t-1}, \dots, y_t, y_{t-1}, \dots)]$$

Usually we conduct an F test of the lagged values of X. But with panel data, the estimation becomes much more complex. Holtz-Eakin, Newey, and Rosen (1988) proposed an estimation and testing of vector autoregression with panel data by applying instrumental variables to the quasi-differenced autoregressive equations.⁴³ From this they have devised a crude test in the spirit of Granger-causality using fixed and random effects models where f_i is an unobserved individual effects, m is the number of lagged periods.

$$y_{it} = \alpha_{0t} + \sum_{l=1}^m \alpha_{lt} y_{it-l} + \sum_{l=1}^m \delta_{lt} x_{it-l} + \psi_t f_i + u_{it}$$

$(i = 1, 2, \dots, N; t = 1, \dots, T)$

Using this equation, we test for the direction of causality (from per capita income to longevity and from longevity to per capita income) with different values of m (1-3). The F test results for the joint significance of the lagged independent variables are shown in Table 2. Only the fixed effects model results are presented in Table 2 because the sample represents close to the universe of the available countries and also because it is hard to think of countries as random draws from a large population (Wooldridge 2002).

⁴³ Erdil and Yetkiner (2004) classify two types of approaches that deals with this: the first one is pioneered by Holtz-Eakin, Newey, and Rosen (1988) along others which considers estimation and testing vector autoregression (VAR) coefficients in panel data leaving the autoregressive coefficients and regression coefficients slopes as variable; the second approach proposed by Hurlin and Venet (2001), Hurlin (2004a), Hurlin (2004b), and Hansen and Rand (2006) treats the autoregressive coefficients and regression coefficients slopes as constant.

The fixed effects models indicate that there is no causality from longevity to per capita income and per capita income may Granger-cause longevity, except in high-order lags.

Table 2: Model Selection

	Longevity Equations	GDP Equation
M=1	0.0364	0.7698
M=2	0.0376	0.7488
M=3	0.3987	0.7457

Note: The columns report the p value for the F test of the joint significance of lagged independent variables.

Table 3 shows the coefficient estimates for the fixed effects models. As we have mentioned before, GDP per capita has significant forecasting power on longevity when first and second order lagged terms are included. But the effects are small. A one thousand dollars increase in GDP per capita will only translate into a 0.0053 years (approximately two days) improvement in life expectancy. As with the other results reported above, the effects of income on health as measured by longevity are small. Health in this schema has no Granger causal link with income.

Table 3: Coefficient Estimates for Fixed Effects Model

	1 Lag		2 Lag		3 Lag	
	Longevity Equ.	GDP Equ.	Longevity Equ.	GDP Equ.	Longevity Equ.	GDP Equ.
Life expectancy t-1	0.9841 (0.0013)	0.0003 (0.0019)	1.553 (0.0116)	-0.007 (0.0122)	1.4080 (0.0123)	-0.0102 (0.0152)
Life expectancy t-2	-	-	-0.5652 (0.0114)	0.0075 (0.0120)	-0.0969 (0.0225)	0.0173 (0.0269)
Life expectancy t-3	-	-	-	-	-0.3129 (0.0124)	-0.0061 (0.0015)
GDP per capita t-1	0.0053 (0.0025)	0.9937 (0.0022)	-0.0013 (0.0130)	1.234 (0.01)	0.0116 (0.4400)	1.22 (0.014)
GDP per capita t-2	-	-	0.0068 (0.0131)	-0.2439 (0.0138)	-0.0015 (0.0188)	-0.1706 (0.0224)
GDP per capita t-3	-	-	-	-	-0.0005 (0.0116)	-0.0628 (0.0144)

Note: Statistics in parentheses are standard errors. GDP per capita is measured in thousand dollars.

A Test Using Chinese Provincial Data on SOEs

The above Granger causality test is a powerful tool but it does not deal with the causality head on. We therefore, utilize the “natural experiment” made possible by the economic restructuring of state-owned enterprises (SOEs) in China and the consequent massive layoff of workers across thirty Chinese provinces.⁴⁴ This “exogenous” shock allows us to identify the effect of income on health outcomes. Because individuals could not affect the economic restructuring by changing their health status, we do not have to worry about reverse causality in this case. It is possible that other unidentified factors may affect both the drop in SOE employment and people’s health outcomes. To minimize that risk, we control for per capita GDP and the urbanization rate of each province, and use the fixed effects model to control for any unobserved time-invariant individual province effects.

From the 1950s onwards, China’s SOEs more or less kept their promise of providing lifetime employment, housing, health care and pensions until the mid-1990s. However, the relative inefficiency of these enterprises and the costs they imposed on the rest of the economy resulted in a succession of reforms starting in the early 1980s and culminating in a massive divestiture, closure and privatization of small and medium sized SOEs starting in 1997 (Yusuf, Nabeshima, and Perkins 2005). It administered a real employment shock with 4.37 million SOE staff and workers being forced out of jobs. This dramatic drop in employment affected million of workers’ welfare and their families through wage and pension arrears and sharp decline in health benefits. The employment shocks were particularly hard on older workers and women (Giles, Park, and Cai 2006).

Data

The tests were run using panel data on provincial total population, rural population, GDP, death rates, birth rates, the total number of staff and workers, SOE staff and workers, industrial production as a share of GDP for 31 provinces from 1995 to 2004. These were drawn from the China Statistical Yearbook and China Data Online. GDP data for 1995, death rate and birth rate data for 2000 data, for Chongqing for 1996

⁴⁴ Chongqing became a provincial-level city in 1997. The data for Chongqing in 1996 is missing and we used the data for 1995 instead.

were extracted from China Data Online. Linear interpolation was used to impute the death rate and birth rate for Heilongjiang and Shaanxi in 2000. This yielded a 10 year panel data set for 31 provinces in China.

Regression Analysis—Panel Data

The panel data were used to test for contemporaneous correlation between the size of laid-off workers and the death rate. This is the so-called “instantaneous causality” in the sense used by Granger.

$$Death_{it} = \alpha_i + \beta_1 SOE_{it} + \beta_2 GDP_{it} + \beta_3 Urban_{it} + \beta_4 Industry_{it} + \psi_i + \varepsilon_{it}$$

$Death_{it}$ indicates the death rate for a province in a specific year; SOE is the number of workers laid-off by province for a given year. GDP_{it} , $Urban_{it}$, $Industry_{it}$ are respectively province-year specific GDP per capita, urbanization rate, and industrial GDP as a percentage of total GDP. As was the case earlier, fixed effect panel regression models are used to identify the contemporaneous correlation since all the provinces are included.

Preliminary Results

Our preliminary regression results suggest that the number of laid-off workers from SOEs is positively correlated with the death rate. The effects become smaller after controlling for GDP and industrial production but remain marginally significant at the 10 percent level (see Table 4). Urbanization rate and GDP per capita are found to have a negative effect on the death rate whereas industrial production is positively correlated with the death rate. This positive correlation may be because the industrial production includes the mining industry which experienced a high incidence of accidents and a number of catastrophic events.

Future research

Our results are based on the assumption that loss in employment affects health instantaneously. However, it is also reasonable that the loss of jobs may not lead to a significant change in health outcomes in the same year. The existing literature does not offer any guidance as to the correct or optimal lag structure on this matter. Hence this

regression analysis could be extended by incorporating different structure lag so as to refine the basic specification. In addition, the link between the percentage change in employment and the cumulative change in employment and the health outcomes could be further explored.

Table 4: Contemporaneous "Fixed Effects" Panel Regression: Dependent variable=Death Rate

	(1)	(2)	(3)	(4)
Drop in SOE employment	0.023** (0.01)	0.022** (0.01)	0.014 (0.009)	0.016* (0.009)
Urbanization Rate		-5.465*** (0.985)	-3.359*** (1.045)	-2.961*** (1.033)
GDP per capita			-0.045*** (0.009)	-0.053*** (0.010)
Industrial Production as a share of GDP				4.058*** (1.254)
Observations	279	279	279	279
Number of provinces	31	31	31	31
R-squared	0.02	0.13	0.2	0.23

Note: Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Number of observations drop to 279 because the key independent variable is defined as change in SOE employment. SOE employment change is denominated in 100 thousand units and GDP per capita is denominated in thousand Chinese Yuan.

V. Policy Menu for Health in Cities

The findings presented in the preceding section suggest with some qualifications, first, that income growth can positively influence the health of populations usually measured by longevity. Second, microeconomic research points firmly to large private gains from improvements in health. In our view, so long as these results are fairly robust, it is desirable to trace the steps leading from rising incomes to better health in urban settings without investing further effort in determining the direction of causality between income and health. We maintain that it is only with the growth of GDP—and possibly increased education—that countries are in a position to effectively tackle existing and emerging health problems (see also Sala-i-Martin 2005). Whether they do so is a separate matter but the nature of the problems is such that at low levels of income, it is far harder to mobilize the needed resources and the skills for this purpose. A very small

number of countries such as Sri Lanka, Cuba, and China in the 1960s and 1970s developed public health systems dispensing primary health care which were able to halt or even reverse the spread of communicable and vector borne diseases and reduce infant and maternal mortalities. In the majority of cases, progress especially in urban settings, is correlated with the expansion of per capita GDP and this progress has been notably uneven because of resource and institutional constraints, and constraints imposed by the availability of skills, organizational capabilities, the capacity to manage the provision of health services and the ability to influence behavior as well as the consumption of items ranging from sugary drinks to cigarettes.

Growing economies can more fully attain higher standards of urban health and urban health equity by focusing on five areas. Each entails substantial start up and/or recurrent costs. The five are:

- (1) Clean water and sanitation infrastructure adequate for the needs of the vast majority of the urban populace.
- (2) Planning and design of cities so as to enhance the supply of housing, control reliance on automobiles, and provide dwellers with green/recreational spaces.
- (3) Raising the average level of education and ensuring that there is no discrimination against women.
- (4) Provision of a basic health safety net which offers primary health care/preventive care to urban dwellers and at least minimum health insurance to lower income groups to contain health shocks which are frequent cause of poverty (Baeza and Packard 2006).
- (5) Investment in IT facilities and health R&D so as control costs, widen coverage, raise quality of services, and benefit from advances in the technology of health care.

Water and Sanitation

Among the various factors which have improved urban health conditions, clean and ample quantities of water together with sanitation technologies are the most important public health interventions of the 20th century, more important than nutrition and new medications (see Fogel 2004; McKeown 1976; McKeown 1979 who emphasize

nutrition and Cutler, Deaton, and Lleras-Muney 2006; Deaton 2006b; Livi-Bacci 1991; Szreter 1988 who stress the role of public health interventions and in the latter case, institutions). In 1900, water borne diseases accounted for one quarter of reported infectious disease deaths in major (U.S.) cities (Cutler and Miller 2004, p.2). Largely because of investment in clean water and sanitation infrastructure, U.S. “mortality rates fell by 40 percent from 1900 to 1940. Nearly all the mortality decline is accounted for by reductions in infectious diseases” (Cutler and Miller 2004, p.1).⁴⁵ These technologies which had developed in the latter part of the nineteenth century only began to be adopted by urban centers when it became possible to raise the capital (from capital markets or local sources) to cover the fixed costs of bringing water from distant places, purifying and distributing it. In addition, urban centers also needed to mobilize the local finances on a continuous basis to maintain the system. The same applied to the sewerage and drainage infrastructure (Cutler and Miller 2005).

Currently, one quarter of all deaths worldwide are the result of infectious diseases mainly concentrated in developing countries—13 million in total (“Infectious Disease” 2006a; Meeting the Urban Challenge 2002). Diarrheal diseases from water borne pathogens affect close to 2.5 billion people across the world. They are responsible for the death of 3-4 million people, a large fraction of whom are children and infants.⁴⁶

Although 82 percent of the world’s population supposedly has access to “improved water supply,” this is belied by the statistics on mortality from infectious diseases. The challenge of providing clean water and removing waste remains vast.⁴⁷ At present, urban uptake is 30 percent of the global usage of freshwater with households accounting for a third and industry for the balance (“Withdrawing Liquid Assets” 2005). As more people transfer to urban centers, the share of urban consumption and especially household usage will rise dramatically. Supplying clean water and sewerage facilities will

⁴⁵ In England, 60 percent of deaths were because of infectious disease in 1848. The share of mortality arising from infectious disease fell by 95 percent from 1848 to 1971 and this contributed greatly to the increase in life expectancy (Cutler, Deaton, and Lleras-Muney 2006).

⁴⁶ Significant numbers of people are affected by water borne diseases. Cholera, for instance remains a seasonal problem in many countries and *Vibrio cholerae* which has passed through the human gut, is more infectious under-scoring the need for hand washing-and the availability of water for doing so. (Codeco and Choelho 2006).

⁴⁷ The coverage of sanitation services lags behind that of water (UNDP 2006). There are 1.1 billion people around the world without adequate access to clean and safe water and 2.6 billion live without basic sanitation (“Clean Water” 2006).

be, as it was in the nineteenth and the twentieth centuries, one of the principal vehicles for improving the health of the current urban inhabitants and meeting the needs of newcomers. For this reason, the new UNDP report calls for recognition of access to clean water as a human right ("Clean Water" 2006; UNDP 2006). Life expectancy and urban health did not begin to rise in nineteenth century Britain until the "massive investment in urban preventive infrastructure and on accompanying regulatory and inspection systems" was forthcoming in the last quarter of the century (Szreter 2004, p.82).

It almost goes without saying that from the perspective of health care, building modern water delivery and sanitation systems equal to the needs of expanding cities under conditions of global climatic changes, deserves the highest priority (Boberg 2005; World Health Organization Centre for Health Development 2004). If so, countries confront large capital costs and recurrent expenditures. It is only with rapid growth that investible resources in sufficient volume are potentially available for those purposes. Whether municipalities actually undertake the investment needed to supply the services and ensure equitable, affordable provision is a function of public choices, social and political priorities, and organizational capabilities (Szreter 1988; Tortajada 2006). Even at the growth rates achieved by China, water and sanitation infrastructure does not command the resources it deserves.

Managing Cities, Lifestyles and Diets

While the threat from infectious diseases has been barely checked—SARS, avian flu, multi (and extensively) drug resistant TB, the West Nile virus and AIDS⁴⁸ argue against any complacency—cities in middle and lower income countries are in the throes of an epidemiological transition.⁴⁹ The diseases of urban lifestyles and diseases of urban consumption preferences have emerged as the main causes of morbidity and mortality.

⁴⁸ In 2005, 2.8 million people died of AIDS, of which 2.0 million were in sub-Saharan Africa (UNAIDS 2006). Because of the spread of AIDS, 12 million children were orphaned and the number of orphaned children is predicted to reach 40 million by 2010 (Lopez-Casasnovas, Rivera, and Currais 2005b). As Soares (2007) observes, it is AIDS in particular which has affected the gains in longevity experienced by all countries and the convergence in life expectancies between the 1950s and the early 1990s.

⁴⁹ Still one quarter of deaths worldwide are because of infectious diseases. What is worrisome is that the overuse of antibiotics has resulted in the emergence of resistant strains of these diseases. In addition to human diseases, diseases affecting animals and plants which can jump the species barrier (as they have done in the past) cannot be ignored ("Infectious Disease" 2006b).

Cardiovascular disease, stroke, pulmonary disease and cancer are the leading urban killers in the middle income countries as they are in the high income ones. The sharp rise in these diseases and of diabetes and the projected increase through 2030 (see Table 5) is related to a number of factors. These include the increased intake of refined carbohydrates, processed foods and fats associated with a decline in the relative prices of foodstuffs, in the time needed to prepare food,⁵⁰ to sedentary living habits typical of urban living and urban sprawl, to cigarette consumption, and to pollution caused by urban transport and industry.

Table 5 : Changes in Rankings for 15 Leading Causes of Death, 2002 and 2030 (Baseline Scenario)

Category	Disease or Injury	2002 Rank	2030 Rank
Within top 15	Ischaemic heart disease	1	1
	Cerebrovascular disease	2	2
	Lower respiratory infections	3	5
	HIV/AIDS	4	3
	COPD	5	4
	Perinatal conditions	6	9
	Diarrhoeal diseases	7	16
	Tuberculosis	8	23
	Trachea, bronchus, lung cancers	9	6
	Road traffic accidents	10	8
	Diabetes mellitus	11	7
	Malaria	12	22
	Hypertensive heart disease	13	11
	Self-inflicted injuries	14	12
	Stomach cancer	15	10
Outside top 15	Nephritis and nephrosis	17	13
	Colon and rectum cancers	18	15
	Colon and rectum cancers	18	15
	Liver cancers	19	14

Source: Mathers and Loncar (2006).

⁵⁰ The decreased time needed to prepare food and the greater reliance on processed foods e.g. French fries has meant that in the western countries, “groups who previously spent most time preparing food in the early 1970s – primarily married women – have increased most in weight” (Propper 2005, p.989).

Changing lifestyles and consumption habits underlie the new epidemic of obesity. Worldwide 1.1 billion people are overweight including 10 percent of all children and 300 million are obese ("Health Experts Warn" 2006).⁵¹ In Indonesia and China, the incidence of adult obesity in urban areas is twice as high as in rural areas, and rates of obesity are rising steeply among the urban poor, especially women in Brazil, Chile and South Africa (Popkin 2000). This trend has led to a steep rise in diabetes with nearly 200 million affected in Asia alone, the increase being especially sharp in urbanizing countries such as China and India (Beran and Yudkin 2006; Birt 2006; Yoon and others 2006).^{52,53}

Controlling obesity and chronic diseases will require a number of policy initiatives, including efforts at modifying the emerging nutrition habits.⁵⁴ However, the problems of sedentariness and air pollution require specific interventions which affect land use in cities and control urban sprawl (Frumkin, Frank, and Jackson 2004),⁵⁵ the provision of adequate and efficient public transport services, and limitations on the use of automobiles.⁵⁶ Displacing slums and preventing the emergence of new slum areas as migrants pour into cities, will prove to be an uphill battle without a huge expansion of the housing supply catering particularly to the needs of lower income households.

⁵¹ Now there are more overweight people in the world (1.1 billion) than undernourished (600 million) ("Health Experts Warn" 2006).

⁵² The number of Indians suffering from Type 2 diabetes has increased to about 35 million in 2006. In 20 years, the number is projected to reach 75 million. Much of the rise in the increase in diabetics in India is attributed to the genetic disposition to the disease and increase in obesity caused by shifting diet towards fattier foods, sedentary lifestyle, and high stress ("Modern Ways" 2006). The projections for Asia are that 333 million people will be suffering from type 2 diabetes by 2025 (Yoon and others 2006).

⁵³ The WHO expects that by 2025, there would be 350 million diabetics worldwide, three-quarters of them living in developing countries ("Modern Ways" 2006; Narayan and others 2006). The mortality among men with diabetes is 1.8 times and among women, 2.6 times the rate for those without diabetes.

⁵⁴ If middle income countries are going to avoid the road traveled by some industrial countries, governments will have to curb the consumption of some fast foods (Lambert 2004; Rashad, Grossman, and Chou 2005; Schlosser and Wilson 2006).

⁵⁵ Children are most seriously at risk from air pollution and more likely to suffer long-term ill effects and hence the gains from reducing child morbidity are large (Mead and Brajer 2005). Apart from the health related problems associated with sprawl and automobile dependence, suburbanization also eats into valuable agricultural land (Tacoli 2000).

⁵⁶ On urban air pollution in China, see Yusuf and Nabeshima (2006) and Mead and Brajer (2006). Curitiba is a oft-cited example of a city which was able to introduce an efficient low cost public transport system. Attempts to curb the use of automobiles in downtown areas through the use of tolls are underway in a number of cities including Singapore and London (Brockerhoff 2000).

Healthy cities will require major investment in housing,⁵⁷ recreational amenities, and public transport ("Curbing the Obesity" 2006). This promises a handsome payoff in terms of better health, lower incidence of crime, greater energy efficiency, and lower environmental spillovers. But these must be purchased through capital expenditures which can absorb several percent of GDP annually for decades. Only growth can widen the domestic resource envelope to accommodate the desirable outlay on infrastructure (Stephens 2000).

Health and Education

From the vast literature on the return to education in OECD countries, Harmon, Oosterbeek, and Walker (2003) find that the average return to education in OECD countries is between 7% and 11%.⁵⁸ Education and health outcomes are highly correlated to each other. Healthier people tend to also have higher educational attainment and vice versa. A large body of literature exists that examine the causal link between education and health (see recent review of this issue by Cutler and Lleras-Muney 2006).⁵⁹ Education promotes important behavioral changes such as the use of condoms, of ORT, face washing to ward off trachoma, and of breast feeding.⁶⁰ Of particular interest here is the contribution of mother's education on child health, which is convincingly supported by many studies (see also Deaton 2006a).

The exact pathway in which maternal education affect child health is still being explored (see for instance, Boyle and others 2006). Frost, Forste, and Haas (2005) using

⁵⁷ Substandard and slum housing greatly exacerbates the toll exacted by infectious and parasitic diseases, accidental deaths and indoor pollution (OECD 2002).

⁵⁸ Although there is limited evidence that certain years of schooling may confer higher (lower) return to education, the empirical evidence so far points to the same rate of return for each additional year of schooling (Harmon, Oosterbeek, and Walker 2003).

⁵⁹ A possible channel through which education affects health is the opportunity costs of falling ill. More educated people tend to earn higher wages, which makes ill-health more costly for highly educated workers relative to poorly educated workers. Therefore, the more educated are more predisposed to avoid unhealthy activities now to protect their future income (such as binge drinking and smoking) (Cowell 2006). In this kind of scenario, the policies may be aimed at factors that change future incomes (retirement payments, job placing) rather than taxing unhealthy goods (alcohol and tobacco) (Cowell 2006).

⁶⁰ Education and infrastructure can fruitfully intersect as in the case of malaria eradication in Italy. Malaria was a feared and widespread scourge in Italy endangering almost one-half of the population as recently as the early twentieth century. Removing the threat took almost six decades and involved extensive public works, including drainage schemes, spraying by DDT, the use of quinine, and awareness-raising public education programs (Snowden 2006).

longitudinal data from Bolivia show that in addition to the effect stemming from better socioeconomic status, mothers with higher educational attainment are more willing to accept modern health care and have more health knowledge to improve the nutritional status of a child. The effect of additional education is strongest at lower levels of educational attainment (Soares 2007). A study on mothers' literacy skills in Venezuela also finds that literate mothers can comprehend the public messages on health and can communicate more effectively to healthcare workers about their child's health conditions compared to illiterate mothers (Schnell-Anzola, Rowe, and LeVine 2005). Similarly, Hatt and Waters (2006) note that in Latin America, income levels plus the educational attainment of mothers together contribute significantly to the well-being of their child. The evidence of positive effect stemming from maternal education is fairly universal. Basu and Stephenson (2005) find that even few years of schooling can prepare would-be mothers in India to seek medical assistance and corrective measures when a child becomes ill. More educated mothers are better able to use ORT and more easily persuaded of the advantages of breastfeeding (Medlin and others 2006).⁶¹ Studies on immunization rates point to the large impact stemming from the mother's education level (Parashar 2005; Xie and Dow 2005). Children with better educated mothers in Malawi suffer less from fever and diarrhea (Kandala, Magadi, and Madise 2006). A study based on the data from 42 Demographic and Health Surveys points to strong linkages between maternal education and children's health, in addition to the importance of the level of income (Boyle and others 2006). In other words, the effects of better water and sanitation, especially on the health of children can, be most effectively reinforced by education programs which ensure gender balance.

A Health Safety Net

Reducing health inequity and providing the essential minimum amount of primary and curative care to the urban population requires a public safety net. Many countries make do with a mix of public and private provision of care but this tends to leave large numbers of the urban poor to fend for themselves. In low income countries, out of pocket

⁶¹ This needs to be qualified because breastfeeding is to be avoided if the mother is HIV positive or has been exposed to chemicals/heavy metals.

payments to private health providers comprise one-half of expenditures (Schieber and others 2006).⁶² For low income countries, a health safety net which could provide primary care for the entire urban population is much too costly and virtually no country in this class has one in place. It is only when countries achieve lower middle income and middle income status and acquire a broad enough revenue base, that a national health insurance scheme starts to become feasible (Schieber and others 2006). Even in these countries, publicly provided health services must be supplemented by services from the private sector, however, a decentralized, accountable, client-oriented and adequately funded public health system⁶³ is needed to serve the needs of the vast majority for primary care/preventive medicine.⁶⁴ In China, for example, which has moved from a system of socialized medicine in the 1970s focused mainly on preventive medicine, to a mixed system that is increasingly costly and tilting towards privately provided curative services, the rising scale of medical expenses by lower income households is emerging as a serious issue (Eggleston and others 2006). With incentives and technological advances favoring expensive drugs, diagnostic procedures and hospital-based invasive treatment, the out-of-pocket expenses weigh heavily on low income households, many of whom avoid seeking treatment altogether (Liu and others 2002; Yusuf and Nabeshima 2006). Because incomes across the spectrum are rising rapidly in China, many families have been able to cope thus far. But as in every other country, the cost of medical care is rising faster than incomes, pinching the poorer households and the aged.⁶⁵ The solution, if there is one, lies in a minimum health safety net providing universal coverage. This needs to be financed mainly from public resources,⁶⁶ and its viability can be significantly

⁶² For instance, out-of-pocket expenditure amounted to 44.8 percent of health costs in 2003 in China (Gu and Zhang 2006).

⁶³ Schieber and others (2006) note that “absent resources to fund drug purchases, provide facilities with some discretionary funding and motivate providers, use of primary health care by the poor will remain low because of both low quality and lack of drugs” (p. 297). Many low income countries cannot even afford generic drugs in sufficient quantity.

⁶⁴ Better primary care is the affordable and cost effective option whether in low or high income countries, but the incentives for providers all support specialized, curative, diagnostic and drug intensive services. Few governments are trying successfully to arrest this trend which will be both costly and inequitable (Bodenheimer 2006; World Bank 2006).

⁶⁵ On the state of Chinese urban health care and ongoing changes, see Guo (2003) and Gu and Zhang (2006).

⁶⁶ The public-private schemes are feasible even for the poor is suggested by the innovative program devised by the private Narayana Hrudayalaya cardiac care center in Bangalore, India which has made cardiac

bolstered through country-wide risk pooling and mechanisms for pre-payment which can assure the equitable treatment of different income groups. This would supplement the wider range of health insurance schemes as well as primary and curative services on offer from the private sector. To rein in spiraling costs, these latter services may require closer public monitoring and a greater focus on preventive medicine increasingly against chronic diseases.⁶⁷

China may be able to accommodate such a minimal safety net and achieve a measure of urban health equity, but only because a robustly growing economy is generating the public revenues to cover the substantial and inevitably rising cost of public assistance. Among the lower and lower middle income countries, those with higher levels of public spending are less subject to health inequities (Wagstaff 2002). Only growth widens decision-making choices when it comes to funding expensive social programs enjoying very diffuse political support.

Partial Solutions from Medical Innovation and IT

Looking ahead, technology is likely to become even more important as a vehicle for providing more effective and better quality care, and a means for controlling costs. There are two facets of technology which we will touch upon here. One is the research on new medications, medical devices and procedures, their testing and production. The second is the use of IT for medical care purposes. There is now ample evidence to suggest that the development of vaccines,⁶⁸ drugs, oral rehydration therapy and imaging and endoscopic equipment has had a significant role in improving diagnosis, lessening morbidity (e.g. via polymerase chain reaction), extending life spans and in reducing

treatment including surgery, available to the poor first by reducing costs through specialization and then with the help of ICICI Bank (the second largest private bank in India) providing insurance to entire village communities at roughly 20 cents per person per month (Pralhad 2006).

⁶⁷ In 2005, about 28 million deaths in low and middle income countries are estimated to have been caused by chronic diseases against which the best defense is not expensive curative medicine but preventive medicine specifically aimed at eating habits, exercise, and substance abuse (Strong and others 2005). Effective prevention of HIV is the only viable strategy for low income countries and not treatment with retrovirals, even priced at generic levels (see Canning 2006).

⁶⁸ The most spectacular success being achieved by freeze dried small pox vaccine which was cheap to produce, did not require a “cold chain”, was easy to administer, and provided quick immunity for many years against a disease without an animal vector (Medlin and others 2006).

disabilities.⁶⁹ For example, advances in cataract surgery has returned the gift of sight to millions, ivermectin is helping to control blindness resulting from onchocerciasis, praziquantel can turn back the rising tide of schistosomiasis infections, while surgery, azithromycin, and face washing are reducing the ravages of trachoma (Medlin and others 2006).⁷⁰ Polio has been almost eradicated, there are effective treatments for CVD and for several cancers, both malaria and AIDS are being tackled with some glimmers of success already, and treatments for dementia are on the horizon. But the steady trickle of victories cannot hide the fact that the magnitude of the health care challenge is being whittled down very gradually. The urban population in low and middle income countries remains exposed to a variety of ailments against which remedies are not being found fast enough or against which the potency of existing drugs is being eroded by resistant strains. For example, malaria, TB, diarrhea, dengue fever,⁷¹ pneumonia, and Chagas disease, not to mention AIDS, continue to exact a frightening toll. The pain and costs inflicted by these infectious diseases are being compounded by chronic diseases and by widespread debilitating mental health conditions.

Prevention by means of safe sex, better sanitation and hygiene practices,⁷² breastfeeding and avoidance of smoking, is a significant part of the answer, but we should not discount the contribution of more potent drugs and vaccines which can be produced cheaply and in sufficient volume.⁷³ This requires research on a large scale and the building of production capabilities in industrializing countries, many of which are today dependant upon imports.

⁶⁹ See for instance the findings reported by Lichtenberg (2003; 2006a; 2006b).

⁷⁰ Merck is working with the WHO to supply praziquantel at one half of its current price. Even at 50 cents per dose, the price might be too high ("Manufacturers Urged" 2006; "Merck in Bilharzia Scheme" 2006).

⁷¹ Recent outbreaks in northern India and Pakistan suggest that the battle against dengue is not going well.

⁷² An especially useful hygiene practice is hand washing with soap. Studies have identified that this practice can lead to 47% reduction in diarrhea incidence (Cairncross and Valdmanis 2006; World Bank 2003). However, to be effective, this translates into 32 hand washes in a day which can consume as much as 20 liters of water and quantities of soap. Access to a plentiful supply of water is the key (Keusch and others 2006).

⁷³ Based on the US data from 1982 to 2001, Lichtenberg (2006a) estimates that the cost of extending life by one year through AIDS treatment was \$17,715. While this is reasonably cost-effective in the United States, the cost is high, especially for low- and middle-income countries. In these countries, preventions can be more cost-effective (Canning 2006). A number of policy options exists to contain the spread of HIV/AIDS such as broad-based campaigns for changing (sexual) behavior (Canning 2006) and male circumcision ("Male Circumcision" 2005).

Current health-related research is either in the industrialized countries or a small number of industrializing ones such as China, India, and Brazil. Only 4 percent of this research is on diseases widespread in low income countries (Weatherall and others 2006). To expand public research and provide incentives for the private sector to conduct research demands major long term investments in physical infrastructure for research and in human capital. As Singapore and Korea are finding, the outlay on even a modest research program (on biotechnology) can be sizable and requires support from governments which can draw upon an adequately broad and elastic revenue base. This impression is buttressed by data on the R&D expenditures of the major pharmaceutical and biotech companies. All of them maintain several laboratories and their annual expenditure is in the billions of dollars. Not every developing country needs to be engaged in cutting edge medical research—but more need to embark on this effort as this is a fruitful area in terms of new innovations, e.g. the developing of effective vaccines against retrovirus, and shigella and as a growth industry to produce low cost anti-microbials which are in high demand.⁷⁴ Encouraging evidence suggests that some of the most promising new findings in the biotechnology and bioengineering industries are by small new firms that have pursued fresh and promising research angles. Even low income countries can build up the capacity to adapt medications for local circumstance and variant pathogens, aside from finding solutions for their own specific problems.⁷⁵ Recent history suggests that such efforts are extremely unlikely to take off and acquire organizational momentum as well as a critical mass of researchers in the absence of rapid and substantial growth of the overall economy which brings together the capital and human resources and the public as well as corporate research capabilities as is now occurring in China, India and Chile.⁷⁶ This is not to say that isolated cases of good research in the absence of such growth cannot be identified, only that these are rare.

⁷⁴ The Commission on Health and Research for Development has recommended that at least 2 percent of the national health budget should be devoted to research (Volmink and Dare 2005).

⁷⁵ India, for example, has made some progress in controlling costs of drugs through the development of its pharmaceutical industry. It has also brought down the costs of such key items as sutures for medical procedures and interocular lenses. China, India, and other countries should also soon be able to produce diagnostic equipment such as CT scanners helping to further reduce costs (Pralhad 2006).

⁷⁶ Several countries have shown considerable organizational ingenuity in controlling measles (Southern Africa), eliminating polio (Latin America), reducing the incidence of trachoma (Morocco), and checking goiter and TB (China), AIDS (Thailand), etc (Medlin and others 2006).

Neither governments nor private corporations are likely to give priority to research during lean economic times—it is one of the first areas to be cut when there is an economic downturn in industrialized countries—or have the needed finances to devote to such an activity. Nevertheless, without research in health products and techniques for cost-effectively distributing their benefits in the developing countries themselves, and the acquiring of even modest capabilities to produce some of the needed medical compounds and disposables, health objectives will not be met and the dependence on international corporations to find and develop cures for a variety of infectious diseases will persist.⁷⁷

While medical research presents one promising avenue, IT offers a second. The potential of IT in the medical field is only just beginning to be tapped. Now with the spread of computerization and more importantly, mobile telecommunications, the possibilities are vast. IT offers a cost effective mode for disseminating medical information and medical assistance so as to bolster primary care and self managed care (Mundie 2006). It can cut down administrative expenses. Moreover, by facilitating medical record keeping, stocking and restocking of supplies, transfer of diagnostic information, monitoring of patients, the development of better and cheaper treatments using electronic diagnostic equipment as well as implantable devices, and by making possible paperless transactions, IT can assist in numberless ways. But IT can only fulfill its promise with large upfront and recurring investments in physical equipment, software, training of professionals, changes in organizations, legal institutions and procedures so as to exploit the full potential of this technology, emphasis on research to refine and extend the technology, and campaigns to raise awareness, especially among the poor (see Chinn and Fairlie 2006).

The point to note is that the use of IT for medical purposes while clearly advantageous, entails costly capital investment, a revamping of many procedures, extensive training of providers (doctors as well as support personnel) and a raising of the cognitive capacity of receivers. Even advanced countries are taking their time harnessing IT. For developing countries, IT offers a shortcut to a better and a more efficient health

⁷⁷ Between 1975 and 2004, 1,556 new chemical entities were marketed worldwide. Of these only 21 targeted neglected diseases mostly prevalent in low income countries, malaria and TB ("Global Framework" 2006; Kremer 2000).

system but they too must be ready to put in the investment over a number of years. This brings us back to the issue of growth and resource availability. Health related initiatives can proceed even when an economy is growing slowly. But experience has shown that when only a trickle of resources are flowing into health and the overall ratio of health expenditures to GDP is stationary, improvements are slow to materialize. Only rapid and sustained growth makes decisionmakers readier to seize opportunities and provides them with the resources to do so. Growth also by raising incomes, enables households to increase their consumption of health services.

VI. A Summing Up and Restatement

The good news is that health indicators from most parts of the world have been converging. The disquieting news is that reforms which would increase the volume, quality, efficiency, and equity of healthcare for the broad mass of the population have proven difficult to define, often face strong opposition from labor unions and the medical profession, and rarely command the degree of political support needed (see for instance Kaufman and Nelson 2004). Moreover, implementing health policies is a struggle even for able and powerful public bureaucracies. For run of the mill bureaucracies, it is an uphill battle. One reason noted by Kaufman and Nelson why health and for that matter education reforms pose such hurdles is because, “they lack widely accepted international templates” (Kaufman and Nelson 2004, p. 12).⁷⁸

There are several reasons why a core set of policies have not emerged as frontrunners. One is the complexity of the issues which need to be addressed. But more important perhaps in our view, is the extent to which opinion remains divided over what the empirical evidence is telling us. As relative newcomers, we have been able to cast a fresh eye over a selection of the evidence and to us at least the message is fairly straightforward and suggests an approach to improving urban health conditions and health equity which many low and middle income countries might well consider.

⁷⁸ Another, which is no less important, is that political dynamics may not favor spending on certain kinds of healthcare and infrastructure. The needed national or municipal political leadership might be lacking or the fiscal system and central-municipal fiscal relations might not provide the volume of resources required. If Szreter (2004) is to be believed, it is when these hurdles were overcome that Britain acquired a healthcare system that worked in the late nineteenth century.

Poor health in urban areas is directly correlated with poverty and to the best of our knowledge, rapid economic growth remains the most efficacious way of climbing out of poverty.

Among the leading causes of ill health in urban areas are the unavailability of clean water, the inadequacy of sanitation, and extraordinarily crowded, squalid living conditions.⁷⁹ These not only are responsible for high infant and child mortality but by compromising the growth of young children, their nutritional status, their psychomotor and cognitive functions, and their ability to attend school, they affect their future earnings while raising their susceptibility to chronic diseases at later ages (Case, Fertig, and Paxson 2003; Keusch and others 2006). There are well known solutions to these problems and they take the form of investment in water, sanitation, and housing infrastructure which is capital intensive and absorbs a lot of resources. Achieving the MDG target of halving the proportion of people without access to water and sanitation would cost about \$10 billion per year even using low-cost technology (UNDP 2006). Such resources are more abundant (and less costly) when an economy is growing rapidly, including the resources to maintain and expand this infrastructure in line with needs.⁸⁰

In many low and middle income countries, chronic diseases now loom as large as infectious diseases in urban areas. These diseases are the result of sharply decreased physical activity, air pollution, a higher intake of calories mainly from refined carbohydrates and fats, cigarette smoking, substance abuse, and unsafe sex. They are also traceable to urban poverty which contributes to the low birth weight of babies born to poorly nourished mothers, to inadequate intake of micronutrients during childhood, and to multiple episodes of diarrhea in early years (Keusch and others 2006). These lifestyle trends can possibly be ameliorated through the better design of transport and land use policies, and by means of health campaigns backed up by a primary health care

⁷⁹ The periodic cholera epidemics which hit European cities in the nineteenth century - in particular the severe cholera epidemic that swept through Hamburg in 1892 - were the result of inadequate public and private sanitation and waste disposal as well as the adulteration and contamination of food (Evans 1987).

⁸⁰ The cost of providing safe water is high, estimated to be around \$10 per month per household (Foster and Yepes 2006). Using 5% of income as cut-off for the affordability, 30-50% of urban household in Honduras, Nicaragua, and Bolivia will find it difficult to afford access to water at such price. 35% of the households in East Asia and 55% of households in India and in sub-Saharan Africa countries would also face difficulties ("Clean Water" 2006; Foster and Yepes 2006). Since the price is the most effective way of encouraging economical use of resources, water usage fees which reflect the degree of scarcity would need to be in place ("Clean Water" 2006).

system to modify behavior (Narayan and others 2006). The lasting damage caused by poverty can only be ameliorated by better economic performance. Relying mainly on the heavy artillery of expensive and often ineffectual curative medicine might suit the medical and pharmaceutical industry, but it seems to be manifestly the wrong approach.

Lastly a substantial literature shows that education and skills contribute to overall GDP growth and are closely connected with the industrial dynamism of cities, with the start up of new firms, and with the proliferation of technology intensive activities (Glaeser and Berry 2006; Glaeser and Saiz 2003; Moretti 2003; Shapiro 2005). It is also well known that the education of mothers has a profound bearing on the health and well being of children. In addition, it is becoming apparent that the ability to utilize health care is closely dependent upon education. Even in the United States, close to one half of all patients cannot follow a doctor's instructions on how to take medications or follow a therapeutic regime (Bodenheimer 2006; Flores 2006; "Low Health Literacy" 2000; Marcus 2006). This greatly degrades the effectiveness of health care for TB, AIDS, heart diseases, and diabetes for example. The barely literate among diabetes have a much harder time with managing glucose and cholesterol and monitoring the condition of feet and eyes (Narayan and others 2006). Better educated people are more knowledgeable about how to take care of themselves, when to consult a doctor, and how to take advantage of advances in technology. The poor are more likely to waste their money on worthless medications purveyed by ill-trained practitioners or charlatans (Keusch and others 2006). Thus, education is good for GDP growth, for urban economic performance and employment, and is a precondition for maximizing the benefits of health care. It is a critical multiplier of health expenditures.

If the objective is better health outcomes at the least cost and a reduction in urban health inequity, then the four most potent policy interventions are: water and sanitation systems; urban land use and transport planning; effective primary care and health programs aimed at influencing diets and lifestyles; and education.⁸¹ The payoff from these four in terms of health outcomes would completely dwarf the returns from new drugs and curative hospital based medicine, which we hasten to add have their place in a

⁸¹ Most of these are also the top priorities identified by the Copenhagen Consensus framework (Lomborg 2006).

modern urban health system but deserve less priority in resource-strapped low and middle income countries.⁸²

We have maintained in this paper that reducing poverty and mobilizing adequate resources for building urban infrastructure and providing social services commensurate with needs in developing and industrializing countries depends on sustaining high rates of growth.

Rapid growth does not ensure better health outcomes but without it, the ambitious objectives for improving urban health and lessening inequity cannot be realized. How countries can imitate the East Asian Miracle remains the \$64 million question to which plausible answers are at hand and which is attracting much new research.

⁸² Even in the high income countries, the rising cost of healthcare is becoming a major concern, prompting debates on the cost-benefit analysis of treatments, especially of cancer ("US Experts" 2006). The cost of extending life through the use of modern medical technologies has been rising over the years for all age groups, with the costs for elderly rising most sharply. One recent estimate of the cost of extending the lifespan of a 65 year old in the U.S. by one year was \$145,000 during 1990-2000 (Cutler, Rosen, and Vijan 2006). In many instances, even if cheap generic versions of drugs are available in developing countries, the cost of such drugs is still too high for many to benefit ("Poor Countries Cannot Afford" 2006).

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