

# What Do We Know about the Role of Infrastructure in Achieving Health Outcomes?

Infrastructure investments are designed with the objective of improving access or efficiency, rather than maximizing health benefits.<sup>1</sup> Yet common sense suggests that there is some connection between infrastructure and health. For example, infrastructure investments in air, roads and railways contributed to increasing the global mobility of people; they also made national boundaries meaningless, especially in terms of disease transmission.<sup>2</sup> Similarly, global health risks have been lowered with the emergence of new surveillance and monitoring ICT-based infrastructure systems.<sup>3</sup> If linkages between infrastructure and health exist, why are they not more systematically exploited?

In reviewing the literature, this Note invalidates the hypothesis that we do not have sufficient evidence to link these sectors.<sup>4</sup> While there are many knowledge gaps in existing literature, it has nonetheless been a productive field of empirical research. We show below that each infrastructure sector can be connected to some form of health impact. If many studies provide empirical evidence of causality, they often do so assuming “all other things are being equal”. This

assumption often makes the operationalization of those results more difficult.

**Case for an Integrated Approach.** The emphasis on linkages among sectors is not new to the development literature.<sup>5</sup> Several studies, for example, recognized the role of infrastructure investments, and other multi-sectoral linkages, in the achievement of the MDG-like goals.<sup>6</sup> Additionally, it is increasingly argued that an integrated approach to development offer the best available framework to address regional or global issues, such as climate change.

## Macro-economic Literature

From a public finance angle, infrastructure services and health expenditures compete for the use of scarce public resources. Few empirical papers have been published on the sectoral composition of public expenditure in developing countries. The focus of the literature has been on assessing the sustainability of *total* expenditure levels from a macroeconomic point of view; less attention has been on matching sector-specific expenditures with health and infrastructure outputs. More recently, however, in an effort to increase public

The principal authors of the Note are Nancy Vandycke and Michele Diez, Energy Transport Water Department. The Note benefited from the research conducted by Milena Gaviria and from comments on earlier draft from Peter Kolsly and Jae So. Technical guidance was also given by Marc Juhel, Jae So, Amarquaye Armar, Andreas Kopp, Julie Babinard, Daryl Fields, Oeyving Lier, Marcelino Madrigal and Ashok Sarkar. Special thanks to Jamal Saghir, ETW Director, for his guidance and support to this work.

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sector accountability to taxpayers, various governments in OECD countries have made progress towards linking public expenditures with outcomes. But progress is slow. One of the major limitations lies in the poor measurement of sectoral expenditures and outcomes. This has made progress to conclude on the effectiveness of sectoral resource allocation difficult. Below we review the evidence from the literature on how public expenditures in these two sectors contribute to: (a) growth: and (b) health outcomes.

**Infrastructure, Health and Growth.** There is ample literature on the relationship between infrastructure and growth.<sup>7</sup> The relationship between infrastructure and health is a matter of on-going research. In fact, many authors argue that the causality may run both ways.<sup>8</sup> Additionally, several papers have attempted to identify the impact of health on growth/income (see Bloom and Canning, 2003), but overall they found no impact of health changes on aggregate GDP (Bleakley, 2006). The problem with both infrastructure and health lie in the poor quality of data that makes all technical exploration of causality complex.

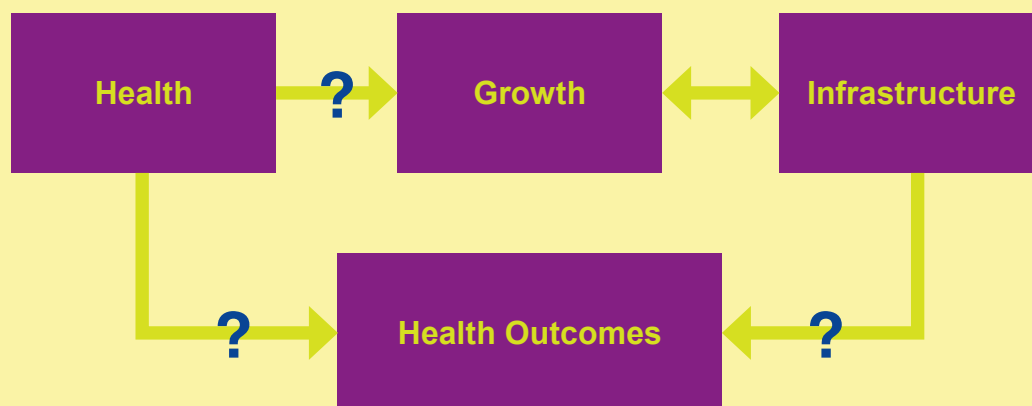
**Health—Public Spending and Outcomes.** There have been many attempts to link public expenditures with specific sectoral outcomes.<sup>9</sup> Yet, the extent to which public finance allocative decisions affect micro-economic outcomes, and the channels of transmission, are poorly understood. Empirical studies on the link between health care spending and health status are not encouraging (Jack and Lewis, 2009). Debates continue over what effect, if any, public spending on health care has on health outcomes. Filmer and Pritchett (1999) found that health spending is more or less uncorrelated with health outcomes: independent variation in public health spending explains one-seventh of 1 percent of the variation in child mortality. Wagstaff and Claeson (2004) found that health spending does not reduce

under-five mortality as long as the quality of governance, as measured by the CPIA (country program and institutional analysis) index is high. Flawed institutions would be expected to produce limited and poor-quality health services. One channel through which public spending may affect health is its impact on the poor. Bidani and Ravallion (1997) found that public spending in health significantly affects the health of the poor, but not aggregate health.

**Public Spending in Infrastructure and Health Outcomes.** There is a growing literature showing that improvements in health outcomes can be attributed to public investments outside the health sector (e.g. education, early childhood development programs). However, these studies focus on individual and household investments, rather than macroeconomic investments. Often, evidence from health impact studies have been used to advocate an increase in public spending in the infrastructure sectors.

## Micro-economic Literature

**Infrastructure for Access and “Enabler” of Changed Behavior.** The adoption of the Millennium Development Goals revived the research on how improvements in health outcomes could be achieved by factors outside the health sector. Several studies supported the argument that achievements of the MDGs were dependent on investments in infrastructure as well (i.e. those that would favor the access to water, roads, electricity and provide sanitation).<sup>10</sup> In contrast, “poor infrastructure” (such as inadequate supply of water, sanitation, hygiene; indoor air pollution from household solid fuels; urban (outdoor) air pollution; and exposure to lead) can have serious economic costs in terms of disease-specific mortality and morbidity. Estimates of the economic costs range from 1.2 percent of GDP (Tunisia) to more than 4 percent of GDP (China) (World Bank, 2008).

**FIGURE 1:** Health, Growth and Infrastructure (macro-economic angle)

Another group of studies added that hard-core infrastructure (for access) would have to be combined with soft-infrastructure (behavioral change) to make these investments most effective in improving health outcomes. For example, poor families may not have to wait for clean fuels or clean stoves to enjoy significantly cleaner air when basic modifications in cooking behaviors may produce cleaner conditions (Dasgupta and others, 2004).

**“All things being Equal”.** Table 1 shows that there is a wide variety of connections between these two sectors, both negative and positive. While the main ways access to infrastructure sectors relates to health are broadly understood in theory, its translation into project interventions is far more complex. For example, several health impact studies have shown that the availability of water and improved sanitation will lead to better maternal and child health outcomes and will decrease the morbidity rate of children. It is, however, difficult to link these achieved health benefits back to specific policy/project interventions. Health impact studies are not yet an operational tool for project evaluation and

“fine-tuning” of project-level interventions (Kolsky and others, 2009).

### Unanswered Questions

Two questions, which are not addressed in this Note, are (i) from a project design perspective, how can we integrate better health considerations into infrastructure projects, so that they achieve both access (or sustainability) objectives and health benefits; and (ii) from a policy point of view, how to advise client countries on infrastructure interventions when health considerations are taken into account. For example, investments in wastewater treatments are, by and large, designed to achieve ecological objectives, not public health ones. If strict environmental standards are adopted in poor countries, the resulting high costs of wastewater treatment infrastructure may come at the expense of other infrastructure needs. (for example, depriving the poor of basic access to sanitation). Yet, both types of infrastructure investments do carry health benefits. Thus, the costs and benefits of wastewater treatment may have to be balanced against the health benefits and costs of basic access to sanitation.

**TABLE 1:** Selected Micro-economic Studies on the Linkages between Infrastructure and Health Outcomes

| ENERGY                |   |   |   |
|-----------------------|---|---|---|
| SECTOR/AREA           | HEALTH LINKAGES   | EVIDENCE  | HEALTH OUTCOMES   |
| Access to electricity | Electrification reduces indoor air pollution, and associated health risks.            | <ul style="list-style-type: none"> <li>■ Rural Tamil Nadu: exposure of women to respirable particles ranges from 500 to 2,000 mg/m<sup>3</sup> during cooking with biofuels, but decreases to 70 mg/m<sup>3</sup> while cooking with cleaner fuel, and to 50 mg/m<sup>3</sup> when cooking exclusively with cleaner fuels (WHO, 2000).</li> <li>■ India: stoves with chimneys are associated with a lower incidence of cataracts in women (Pokhrel AK, 2005).</li> </ul>  | Mortality, acute respiratory infection, pneumonia, lung cancer, cataracts, tuberculosis |
|                       | Electrification of health facilities permits safe storage of vaccines and medication. | <ul style="list-style-type: none"> <li>■ Cold chain (vaccines kept between 2° and 8°C from the point of manufacture to the point of use) significantly stronger in electrified clinics than in those without electricity (IEG, 2008)</li> <li>■ Child mortality rate decreases with higher GDP per capita, greater access to electricity and vaccination (Wang 2003).</li> </ul>  | Mortality   |
|                       | Electricity increases awareness to health issues, and reduces fertility.              | <ul style="list-style-type: none"> <li>■ Median impact of a reduction in fertility of 0.6 children as a result of electrification/television (IEG, 2008).</li> </ul>  | Fertility   |
| Fossil Fuels          | Elimination of coal production is associated with premature deaths.                   | <ul style="list-style-type: none"> <li>■ US: a 66 percent reduction in coal-fired electric power generation would reduce GDP by \$371 billion, household income by \$142 billion and employment by 2.7 million. Moreover, every 1 percent increase in unemployment results in a 2 percent increase in premature deaths (Trisko, E., 2006).</li> </ul>   | Mortality   |
|                       | Removal of lead from gasoline is associated with low lead blood levels.               | <ul style="list-style-type: none"> <li>■ U.S: the elimination of leaded gasoline resulted in a 77% decrease in the average blood lead level of the population between 1976 and 1991. UK: a 50% drop in gasoline lead levels corresponded with a 20% drop in blood lead levels (Alliance To End Childhood Lead Poisoning, 1995).</li> </ul>  | High blood levels, liver and kidney damage, impaired fertility                          |
|                       | Fossil fuel use leads to indoor air pollution.  | <ul style="list-style-type: none"> <li>■ Burning solid fuels on an open fire or traditional stove indoors creates a dangerous mixture of hundreds of pollutants. Globally, 1.5 million people died from diseases caused by indoor air pollution in the year 2002 (WHO 2006).</li> <li>■ Biomass is the main source of energy for about 3.5 billion people and is a major health risk factor. Need to increase in the use of cleaner, more efficient stoves that burn solid fuels, replace biomass and coal for modern fuels, along with better ventilation and behavior change (e.g. switching to liquefied petroleum gas and electricity) (Barnes, 2005).</li> <li>■ Access to cleaner fuels has a larger health impact on the population than improved stoves (Mehta and Shahpar, 2009).</li> </ul> | Respiratory diseases (pneumonia, lung cancer)/mortality.                                |

**TABLE 1:** Selected Micro-economic Studies on the Linkages between Infrastructure and Health Outcomes (continued)

|                               |  |  |   |
|-------------------------------|--|--|---|
| Nuclear Energy                | Low-dose radiation is beneficial for human health (enhancement of biological responses to immune systems, enzymatic repair, physiological functions, removes cellular damage including prevention and removal of cancers).   | <ul style="list-style-type: none"> <li>■ Nuclear Shipyard Workers Study (1991): nuclear worker groups had a lower death rate from leukemia and lymphatic and hematopoietic cancers than the non-nuclear group (Muckerheide, J., 1998).</li> </ul>  | Cancer (misleading)                                       |
| Transmission and Distribution | Electric and magnetic fields from power lines may be associated with cancer.   | <ul style="list-style-type: none"> <li>■ Scandinavian study: incidence of leukaemia increased 3.8 times for the population exposed at 0.3 microTesla, and about 2 times at 0.2 microTeslas (cited in M J O' Carroll, 1993).</li> <li>■ Research about power lines and potential health effects is inconclusive (EPA).</li> </ul>   | Childhood Leukaemia                                       |
| <b>TRANSPORT</b>              |  |  |   |
| <b>SECTOR/AREA</b>            | <b>HEALTH LINKAGES</b>   | <b>EVIDENCE</b>  | <b>HEALTH OUTCOMES</b>                                    |
| Roads and Highways            | Roads improve access to health facilities and emergency responses.<br><br>It facilitates mobile services to hard to reach areas.<br>It is essential for distribution of drugs, blood and other supplies to health facilities.<br>It increases the demand for care. It is necessary for an effective referral system. | <ul style="list-style-type: none"> <li>■ Rural Tanzania: 84% of women giving birth at home intended to deliver at a health facility but did not due to distance and lack of transportation (Bicego et al, 1997).</li> <li>■ Rajasthan, India: better roads and transport helped women reach referral facilities (Pendse, V. 1999).</li> <li>■ Transportation system and road infrastructure influence the demand for care delivered through the impact on time cost (Wagstaff, A. and Claeson, M. 2004).</li> <li>■ Many rural families are worst affected because transport is often unaffordable.</li> </ul> | Mortality mothers/infants, injuries, communicable disease |
|                               | Road safety can prevent injuries and fatalities.   | <ul style="list-style-type: none"> <li>■ Every year, 1.2 million people are known to die in road accidents worldwide (over 3,000/day) and as many as 50 million more are injured, with some suffering permanent disabilities (WHO, 2004).</li> <li>■ 80 percent of the deaths and 90 percent of losses because of road traffic injuries occur in low and middle-income countries (World Bank, 2008).</li> </ul>  | Mortality, injuries, permanent disabilities               |
|                               | Road traffic congestion leads to transport-related pollution.  | <ul style="list-style-type: none"> <li>■ The WHO estimates that suspended particulate matter leads to the premature death of over 500,000 people per year (WHO, 2002).</li> </ul>  | Mortality, respiratory disease                            |
|                               | Roads can increase risks (HIV and sexually transmitted infections) through greater mobility and connectivity.  | <ul style="list-style-type: none"> <li>■ In India: HIV prevalence rates of 16% along one particular route in southern India, while the national rate was less than 1% (ADB, 2008; ILO, 2005).</li> <li>■ In Bangladesh: long distance truck drivers have the highest prevalence of HIV (ADB, 2008).</li> </ul>   | Communicable disease, mortality                           |

**TABLE 1:** Selected Micro-economic Studies on the Linkages between Infrastructure and Health Outcomes (continued)

|                    |  |  |   |
|--------------------|--|--|---|
| Aviation           | Aviation emissions may detriment air quality.  | <ul style="list-style-type: none"> <li>■ Decrease in the prevalence of respiratory complaints with increasing distance from the airport (Health Council of the Netherlands. 1999).</li> <li>■ The number of epidemiological studies on air pollution and public health near airports are scarce.</li> </ul>  | Respiratory disease                                   |
|                    | Aircraft noise near airports is associated with negative externalities (same for road traffic noise).                              | <ul style="list-style-type: none"> <li>■ Residents in 2005 were more annoyed at the same levels of exposure than were those in 1982 (Moorhouse, A. 2009).</li> </ul>   | Sleep disturbance, cardio-vascular disease, annoyance |
|                    | Air traffic increases the potential for transmission of infectious diseases from one country to another.                           | <ul style="list-style-type: none"> <li>■ Every year, some cases of serious infectious diseases are imported, especially malaria, shigellosis, and typhoid fever (Health Council of the Netherlands. 1999).</li> </ul>  | Malaria, shigellosis and typhoid fever                |
| <b>WATER</b>       |  |  |   |
| <b>SECTOR/AREA</b> | <b>HEALTH LINKAGES</b>   | <b>EVIDENCE</b>  | <b>HEALTH OUTCOMES</b>                                |
| Water Supply       | Access to water supply can improve maternal and child health outcomes (including infant/child mortality rate).                     | <ul style="list-style-type: none"> <li>■ 18% of deaths of children under the age of 5 are caused by neonatal diarrheal disease. (Bryce and others 2005; Jefferson and others 2007; Luby and others 2005; Rabie and Curtis 2006).</li> <li>■ Prevalence and duration of diarrhea among children under five are significantly less on average for families with piped water (spreading supply) than for families without it.</li> <li>■ In a malnourished child, diarrhea can quickly result in life-threatening dehydration caused by loss of water and minerals (Thapar and Sanderson 2004).</li> <li>■ Household connection are considered optimal (Cairness and Valdamanis, 2006).</li> <li>■ Not a good predictor of child mortality (Boone and Zhan, 2006).</li> </ul> | Mortality, communicable disease (infants)             |
| Sanitation         | Access to sanitation can improve maternal and child health outcomes, childhood growth and decrease the mortality rate of children. | <ul style="list-style-type: none"> <li>■ Unsafe water, poor sanitation, and hygiene are the cause of 4–8 % of the overall burden of diseases in developing countries and nine-tenths of diarrheal diseases (WHO, 2002).</li> <li>■ 4 billion cases of diarrhea are reported globally every year, causing 2,2 billion deaths, mostly among children under 5. Intestinal worms infect about 10% of the population in the developing world (WHO-UNICEF 2000).</li> <li>■ Improved sanitation plays a key role in early childhood growth (Kimani-Murage and Ngindu 2007).</li> <li>■ See GATES/WSP review for rural sanitation and hygiene promotion (forthcoming) and other WSP studies.</li> </ul>   | Mortality, communicable disease (infants)             |

**TABLE 1:** Selected Micro-economic Studies on the Linkages between Infrastructure and Health Outcomes (continued)

|   |  |  |   |
|---|--|--|---|
| Water quality                           | Microbial contamination of drinking water (although water quantity is generally more important than water quality).  | <ul style="list-style-type: none"> <li>■ Contamination can occur at the source, through seepage of contained runoff water, or within the piped distribution system (WHO, 2007).</li> <li>■ Household water treatment technologies (e.g. chlorination and solar disinfection) and safe storage can be important interventions in situations where access to water supplies is secure but household water quality is not assured (WHO, 2007).</li> </ul>   | Mortality, communicable disease (infants)   |
| Waste Water                             | <p>Management prevents the introduction, transmission, and spread of communicable diseases.</p> <p>Indirect benefits:<br/>Increase of income.</p>  | <ul style="list-style-type: none"> <li>■ Pakistan: wastewater farmers typically earn 30/40 percent more per year than farmers using conventional irrigation water. Ghana: dry-season irrigation with wastewater allows an average extra income of 40/50 percent. Around Kumasi more than 60,000 people depend on these sources for their living while in the Mezquital Valley in Mexico, the area irrigated with wastewater supports more than 450,000 people (Davis, R., Hirji, R., 2003).</li> <li>■ Insufficient coverage of drainage networks elevated the risk of cholera outbreaks (Sasaki and others, 2009).</li> </ul>   | Communicable diseases (Bacteria, Viruses, Helminths, Protozoa) WHO 2006; Westrell, 2004   |
| Flood control/ Disaster risk management | It prevents/reduces the risks of mortality + “intangible” effects of natural disasters (physical and psychological) that have traditionally been underestimated in assessing the consequences of flooding. | <ul style="list-style-type: none"> <li>■ See Un-World Bank Report on Unnatural Disasters: The Economics of Reducing Death and Destruction (forthcoming).</li> <li>■ A survey conducted nine months after flooding in south-east England in October 2000 suggested that there remained few physical effects of the event but that anxiety and depression were significant and persistent (Abdel-Dayam, Hoevenaars, Mollinga et al 2004).</li> <li>■ Suicides may also occur. Data from the United States collected 36 months before a disaster and 48 months afterwards showed a statistically significant increase in suicide rates following floods, from 12.1 to 13.8 per 100 000 population (Abdel-Dayam, Hoevenaars, Mollinga et al 2004).</li> <li>■ The pollution of the Danube in January 2000 was due to a breach in a dam at the Baia Mare gold mine in Romania, causing cyanide compounds to enter the river (Abdel-Dayam, Hoevenaars, Mollinga et al 2004).</li> <li>■ Czech Republic: a small outbreak of leptospirosis occurred after the flooding in 1997 (Abdel-Dayam, Hoevenaars, Mollinga et al 2004).</li> <li>■ Finland: 13 waterborne disease outbreaks with an estimated 7,300 cases during 1998-1999, associated with untreated groundwater from mostly flooded areas (Abdel-Dayam, Hoevenaars, Mollinga et al 2004).</li> </ul> | <p>Mortality from drowning, heart attacks and injuries.</p> <p>Infectious diseases and vectorborne diseases.</p> <p>Poisoning and post-traumatic stress disorder.</p> |



**TABLE 1:** Selected Micro-economic Studies on the Linkages between Infrastructure and Health Outcomes (continued)

|             |   |  |   |
|-------------|---|--|---|
| Groundwater | Reduction of cancer-related deaths.<br><br>Direct impact: Increase of income, less health bills to be paid.                                 | <ul style="list-style-type: none"> <li>■ At least 60 million people live in arsenic-affected areas and many drink arsenic-contaminated water on a daily basis. (K.Kemper, K. Minnatullah, et al 2005).</li> <li>■ Bangladesh: 6,500 people will die from cancer every year, a total of 326,000 over 50 years and 2.5 million will develop some kind of arsenicosis during the same period. (Maddison, Luque and Pearce 2004).</li> </ul> | Skin cancer, mortality. Arsenicosis cases)  |
| Drainage    | It improves public health, reduces the spread of bacteria and pathogens.  | <ul style="list-style-type: none"> <li>■ Drainage can make substantial contributions to public health, drinking water supply and sanitation. This potential is not generally acknowledged and depends on the quality of operation and maintenance of the drainage system.</li> </ul>   | Rheumatism in rural areas. Incidence of killer diseases such as malaria and schistosomiasis (bilharzias). |
| Irrigation  | Direct benefits: Prevent the introduction, transmission, and spread of communicable diseases.<br><br>Indirect benefits : Increase of income | <ul style="list-style-type: none"> <li>■ Mexico, Chile and Peru: when irrigation projects are centrally managed is most likely to be successful when the crops allowed under the restrictions are of similar profitability and in high demand (IWMI Issue No. 17).</li> </ul>  | Malaria, infectious diseases from human pathogens and certain chemicals.                                  |
| Hydropower  | Greenhouse gas emissions with the creation of reservoirs.   | <ul style="list-style-type: none"> <li>■ Hydropower does not emit any greenhouse gases by itself, and there is strong evidence that the clean energy produced will offset the net changes in the reservoir (World Bank, forthcoming).</li> </ul>   |   |

**INFORMATION AND COMMUNICATIONS TECHNOLOGY**

| SECTOR/AREA                              | HEALTH LINKAGES   | EVIDENCE   | HEALTH OUTCOMES |
|--|---|--|-----------------|
| Information and communication technology | Information systems can improve health care system.   | <ul style="list-style-type: none"> <li>■ Based in the city of Rajshahi, a computerized system was introduced to replace a manual record-keeping system (Ahmed, 2004). Over a period of three years, the new system was able to increase immunization rates from around 40 percent to more than 80 percent (World Bank, 2006).</li> </ul> | Diseases        |
| ICTs in health care delivery             | Telemedicine improves resource coordination, strengthens urban/rural linkages and connects remote health staff to centralized health expertise and resources. | <ul style="list-style-type: none"> <li>■ Incorporating already existing technology—such as phone or e-mail—into medical practice and routine consultancies can make a significant difference. (World Bank, 2006).</li> </ul>   | Diseases        |
| ICTs and communication                   | ICT can improve communication around health.  | <ul style="list-style-type: none"> <li>■ There is growing evidence that ICTs aid health information dissemination, particularly via online routes. Mass media ICTs, such as radio, remain key aspects in communicating health issues. (World Bank, 2006).</li> </ul>   | Diseases        |



**TABLE 1:** Selected Micro-economic Studies on the Linkages between Infrastructure and Health Outcomes (continued)

| URBAN DEVELOPMENT            |  |   |                     |
|------------------------------|--|---|---------------------|
| SECTOR/AREA                  | HEALTH LINKAGES  | EVIDENCE  | HEALTH OUTCOMES     |
| Urban living                 | <p>Urban populations suffer from a mixture of deaths from infectious and chronic diseases (Bradley and others, 1992).</p> <p>In contrast to higher income urban dwellers and some rural populations, the urban poor have a lower life expectancy at birth and higher infant mortality rate (Bradley and others, 1992).</p> | <ul style="list-style-type: none"> <li>■ High prevalence of diarrhea and parasitic intestinal worm infections in children in slums, shanty towns and squatter settlements.</li> <li>■ Poverty remains the most significant predictor of urban morbidity and mortality.</li> <li>■ Urban poor households have worse nutritional status than rural households, contributing to ill-health related nutrition.</li> <li>■ More exposure of a child from a slum to death associated with violent features of modern urban environments (motor vehicles and homicides).</li> <li>■ Trauma and chronic diseases play a substantial role in mortality/morbidity.</li> <li>■ See Bradley and others, for summary of literature on intra-urban differentials in mortality/morbidity.</li> </ul> | Diseases, mortality |
| Sewer and sewerage treatment | It reduces everyday contact with sewage (especially children).   | <ul style="list-style-type: none"> <li>■ Wastewater treatment is designed to meet ecological objectives (Boeston and others, 2007).</li> <li>■ Urban utilities are not well designed or staffed to address off-network solutions for WSS; yet, important for the urban poor (World Bank, 2009).</li> </ul>  | Infectious diseases |

## Endnotes

**1** Except in water supply and sanitation investments in developing countries.

**2** Tuberculosis and antimicrobial resistance are examples of global health problems that cannot be resolved exclusively within a country borders.

**3** For example, the US-based Institute of Medicine (1997) suggests that the AIDS epidemic might have been contained if international surveillance had been able to detect the presence of a new disease pattern before it had already spread so widely around the world.

**4** For summaries of the literature, see for examples, Bradley and others, 1992 on urban health; and World Bank, 2008 on environmental health and child survival.

**5** See for example, Dervis, de Melo and Robinson, 1982.

**6** See for example, Crosswell, 1981; de Melo, 1981; and Lewis, 1981.

**7** See for example, Estache and Fay (2009) for a discussion on current debates on infrastructure policy.

**8** Indeed, most infrastructure services are both consumption and intermediate goods, and many studies have documented that electricity consumption and demand for cars increase along with disposable income. Similarly, countries tend to increase their investments in environmental amenities as they become wealthier (see Estache and Fay, 2009).

**9** See for example, Devarajan and others, 1996.

**10** contrast, Boone and Zhan (2006) find that the prevalence of common diseases and the supply of infrastructure such as water and sanitation are not good predictors of child mortality (but that parents' education and a mother's propensity to seek out modern medical care are).

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