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# Under-Five Mortality

## Comparing National Levels and Changes Over the Last Decade in South Asia and Other Low-income Countries

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**ABSTRACT:** *This article analyzes institutional factors associated with under-five mortality at two intervals (2000-03 and 2010-13) among low-income countries, with an emphasis on South Asia. The factors considered fall in four broad categories: health sector inputs (national per capita ratios of professional health care providers and hospital beds, plus public health spending as percent of GDP), performance of public health institutions (access to safe water and sanitary toilet facilities, child immunization, total fertility rate, and access to mosquito nets in malaria-prone countries), social determinants of health (female literacy, percent under $1.25/day and per capita GDP), and effectiveness of national governments in providing services. In explaining changes in mortality levels between decades, four factors are significant: increase in percent above $1.25/day, in vaccination rates and in rates of use of mosquito nets, plus average government effectiveness over the decade. In explaining mortality levels, the top quarter of countries ranked by under-five mortality outperform on average the comparable averages for the three other quarters on nine factors assessed. Achieving top-quarter mortality levels requires superior performance among most of the complex institutional factors such as schools and sanitary infrastructure.*

KEYWORDS: ***under-five mortality, governance, institutions, low-income countries, South Asia, Bangladesh***

IN THIS ARTICLE we assess factors associated with under-five mortality among a sample of 77 low-income countries, with an emphasis on six countries in South Asia.[1] We examine mortality levels at two intervals a decade apart: early in the 2000s immediately following launch of the Millennium Development Goals (MDGs) and the most recent data, covering years early in the present decade. The factors we consider as potentially explaining national mortality rates fall into four broad categories:

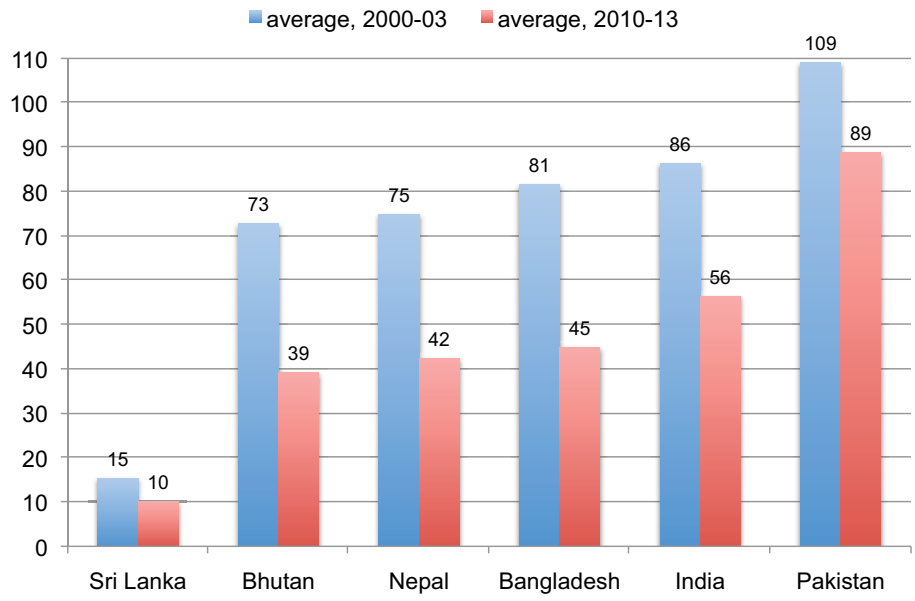
- **Health sector "inputs":** national per capita ratios of professional health care providers (nurses and doctors) and hospital beds, plus public health spending as share of GDP (a widely used crude proxy for national government commitment to financing programs that, in turn, are potentially relevant to child mortality rates);
- **Public health institutions:** national level performance of institutions – run by some combination of government, NGOs, private firms, and religious groups – that, directly or indirectly, impact five public health goals (access to safe water, access to sanitary toilet facilities, total fertility rate, child immunization, and access to mosquito nets in malaria-prone countries);
- **Social determinants of health:** female literacy, percent living below $1.25/day and per capita GDP;
- **Perceived effectiveness of national governments:** the perceptions by survey respondents as to the effectiveness of their respective governments in delivering services. The measure used, "government effectiveness", is one of six dimensions employed by the World Bank (2014b) in constructing the Worldwide Governance Indicators (WGI).

Our emphasis is on the performance of institutions.[2] The hardest to measure of the institutional factors we include is a measure of citizens' perceptions of the general effectiveness of their respective national governments in delivering services. The WGI define government effectiveness as "perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment

1 The sample includes all countries with available data, having an average per capita GDP below a threshold of $5300 per capita GDP during the first four years of the millennium (2000-03). The World Bank defines various categories of countries based on per capita income. The $5,300 cut-off is the average per capita GDP among all countries over the years 2000-03 that it designates as "medium income".

2 In addressing the poor record of South Asian child health outcomes in the 1990s, Osmani (1997) raised three distinct perspectives. Our organization of relevant factors into four categories is a somewhat similar categorization. Drèze and Sen (2013, 51-53) assess India's social policy performance against 15 low-income countries outside Sub-Saharan Africa. Our list of factors overlaps theirs. The factors they measure include per capita GDP, life expectancy at birth, infant and under-five mortality rate, total fertility rate, access to improved sanitation, mean years of schooling, male and female adult literacy rate, undernourishment among under-five children and child immunization rate.

**Figure 1: Under-Five Mortality Rate per 1000 Live Births, South Asian Countries, 2000-03 and 2010-13**



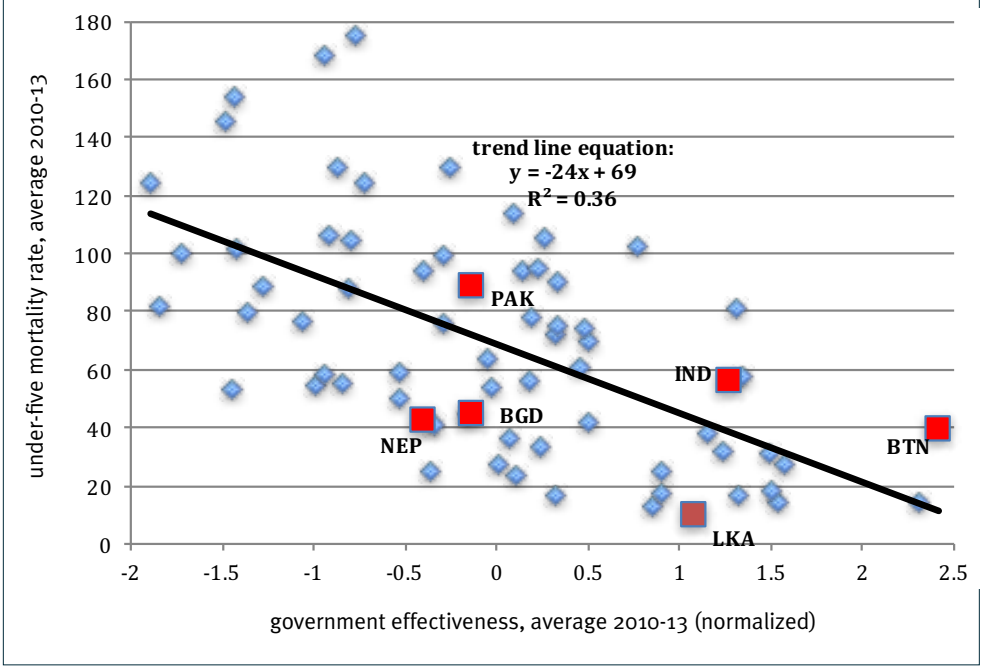

to such policies" (Kaufmann et al. 2010).[3] The WGI summarize a large number of surveys that in turn assess perceptions by respondents of the relative quality of the governance in their own and in other countries. The distributions of WGI country scores for each year and each dimension are standard normal. A country's score on any dimension is an estimate of its governance quality relative to the world average, which is set at zero. This normalization procedure implies no change from year-to-year in average global quality of governance.

Child mortality is a tragedy. Two-thirds of under-five deaths are estimated to result from weak infectious disease control (pneumonia, diarrhea and malaria being the three most prevalent of these diseases). As of 2012, global under-five deaths were estimated at 6.6 million, with nearly half in Sub-Saharan Africa and nearly a third in South Asia (UN, 2014, 25).

The UN's MDG campaign, launched in 2000, was intended to realize a set of ambitious social policy goals, the reduction of child mortality prominent among them. The fourth MDG specifically aims to lower the 2015 global

3 The other five dimensions are voice and accountability (a measure of freedom of speech and government accountability), political stability, rule of law, regulatory quality, and control of corruption.

**Figure 2: Under-Five Mortality Rate by Government Effectiveness, Low-Income Countries 2010-13 (n = 69)**




under-five mortality rate by two-thirds relative to the 1990 rate. The global average rate of child mortality in 1990 was 90 deaths per 1000 live births. By 2013 it was nearly half that: an impressive improvement. The rate of decline in the mortality rate accelerated in the early years of the new millennium. Unfortunately, the rate of decline has slowed since 2007, and the MDG child mortality goal will not be met by 2015.

Figure 1 displays the average 2000-03 and 2010-13 under-five mortality rates for six South Asian countries. Sri Lanka is the outstanding performer. Not only does it enjoy the lowest mortality rates among South Asian countries in both intervals, Sri Lanka enjoys the lowest rates among all 77 countries in both decades. If we rank the 77 countries by under-five mortality rate this decade, Bhutan, Nepal, Bangladesh and India all fall in the second quarter. Pakistan falls in the third quarter.

Figure 2 is a scatterplot of average 2010-13 under-five mortality and average 2010-13 government effectiveness scores among 69 low-income countries (those with complete observations on all factors).[4] The implication of the trend line is that a one standard deviation

4 Among eight of the 77 countries, missing data prevent their inclusion in the regression analysis and in construction of the figures. Average effectiveness scores for the 69 countries have been transformed into standard normal format.

improvement in government effectiveness is associated with a (per 1,000 live births) reduction of 24 in the national under-five mortality rate. While there is a negative relationship, the data are not tightly concentrated along the trend line. Among the six South Asian countries, three (Nepal, Bangladesh and Sri Lanka) perform better than predicted based on the trend line; three (Pakistan, India and Bhutan) perform worse. Obviously, factors other than general governance effectiveness must be part of any explanation.

In our regression analysis we included the factors introduced above. Even after inclusion of these factors, general government effectiveness remains an important statistically significant factor in the explanation of child mortality. Not all analysts agree. A relevant exception is Quibria (2014) who argues that an emphasis on governance indicators exaggerates the importance of the national government. He cites Bangladesh as a relevant example. Its WGI indicators are, for all dimensions other than voice/accountability, below the average for countries in our sample. Despite this, he notes, Bangladesh scores better than many low-income countries on public health outcomes, including under-five mortality. Quibria argues Bangladesh has developed civil society substitutes (NGOs and private firms) to deliver services that, in better-governed countries, are reliably supplied by the state or by closely regulated private firms. We agree with this explanation, but Bangladesh is an outlier among low-income countries in having very large effective NGOs that, in the health sector in particular, substitute for low quality of state governance (Lewis 2011; Smillie 2009). In general, bypassing the state is not a feasible strategy for improving health outcomes in low-income countries (Ramesh et al. 2015).

To summarize the results of the regression analysis (not shown in this article), five variables are closely associated with lower national child mortality *levels*: government effectiveness, child immunization rate, an index of access to safe water and sanitary toilets, total fertility rate, and female literacy.[5] Variations in other variables are less closely associated with child mortality. This second set includes public health spending as share of GDP, an index of health sector "inputs" (per capita ratios of nurses, doctors and hospital beds), access to mosquito nets, and per capita GDP. Collectively, the variables account for approximately three quarters of the cross-national variation in child mortality levels.

In attempting to explain *changes* in national child mortality between the first interval (2000-03) and the second (2010-13), only three variables are statistically significant in difference form: change in immunization rate, change in use of mosquito nets (largely in Sub-Saharan Africa), and change in percentage living below $1.25/day. These results suggest that small "on the ground" improvements in governance quality, for example the wider distribution of mosquito nets, can be important.

In difference form, government effectiveness as measured is not significant. However, average levels of national governance over the decade affect the change in national mortality rates in a statistically significant and intuitively understandable manner. All else equal, those countries experiencing below-average government effectiveness over the decade

5 The regression results are available from the authors by request.

achieved less in terms of mortality reduction. Furthermore, a "unit" increase in effectiveness contributed more among countries with below-average governance than among countries with governance above the sample average.

## Characteristics of Top-Quarter Countries

The *change* regressions suggest the importance of average government effectiveness and improvements since 2000 in three variables. Improvements in immunization and in use of mosquito nets do not require what we would normally consider "high level" government effectiveness. In contrast, the level regressions imply that low child mortality is associated with superior outcomes on a second set of factors, many of which are outcomes of administratively complex institutions – for example, success of schools in achieving female literacy, success of infrastructure agencies responsible for sanitary toilet facilities and safe drinking water, and of a range of government and civil society organizations seeking to lower total fertility.

The difference between the two sets of factors is an example of the distinction that the Nobel-winning economist Douglass North (1990) drew between "institutions" and "organizations". Institutions embody the formal and informal "rules of the game" and constrain decisions; organizations maximize subject to the rules established by relevant institutions.[6] When a government contracts with a NGO or firm to distribute mosquito nets, the successful organization presumably maximizes its net benefit while doing so. It is relatively easy to monitor performance, and audit for corruption. This is not the case with school systems or water and sanitation systems. These are complex institutions that embody many formal rules and informal conventions, which are politically hard to change and often seriously inefficient in terms of realizing stated goals. Drèze and Sen (2013) discuss complex inefficient patterns of rent-seeking prevalent in India's contemporary education system. Plummer and Cross (2006, 10) discuss analogous problems with respect to water and sanitation systems in Sub-Saharan Africa:

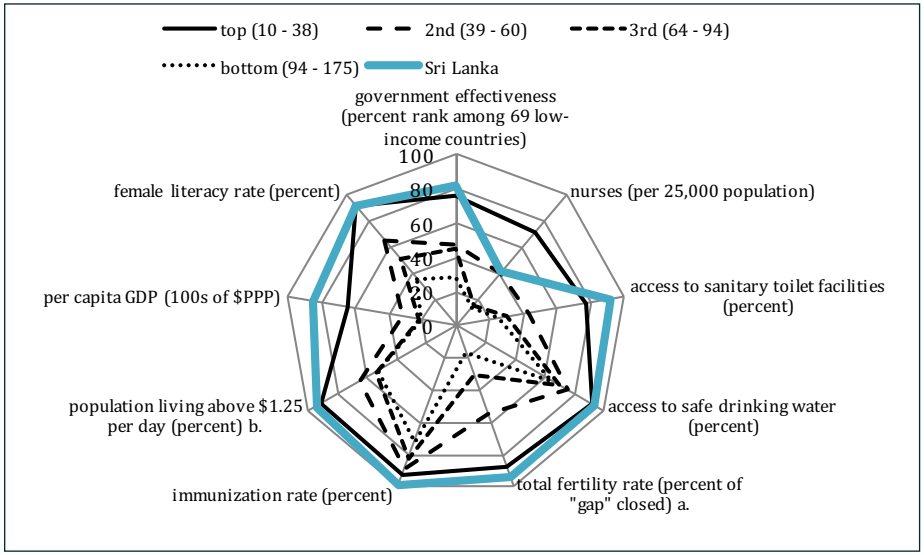
> *[Water and sanitation] sector corruption involves, to some degree, a vast range of stakeholders. The list of actors includes international actors (both donor representatives and private companies and multinationals), national and local construction companies, consultancy firms and suppliers, large and small-scale operators, a range of middlemen, consumers and [civil society organizations] as well as national and subnational politicians, and all grades of civil servants and utility staff. Corrupt activities between these partners occur at a range of institutional levels, with different stakeholders often involved in one or more types of corruption.*

In constructing Figure 3 we rank the 69 countries in terms of under-five mortality. All panels of the figure show the average value of the selected variables within each quarter, the quarters defined by the under-five mortality quartiles. (We rescale some variables to facilitate comparison.) In each panel we

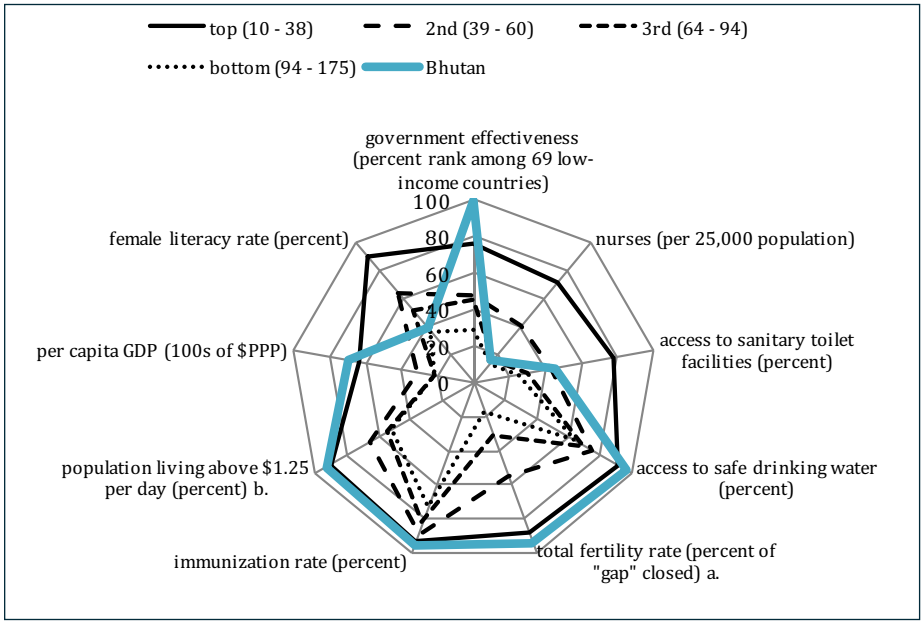
6 Avellaneda (2006) offers an extensive review in a developing country context of neo-institutional analysis inspired by North.

**Figures 3: Profiles for South Asian Countries Relative to Quarter-specific Averages of Selected Variables among Low-Income Countries, 2010-13 (quarters defined for 69 low-income countries ranked by under-five mortality rate)**

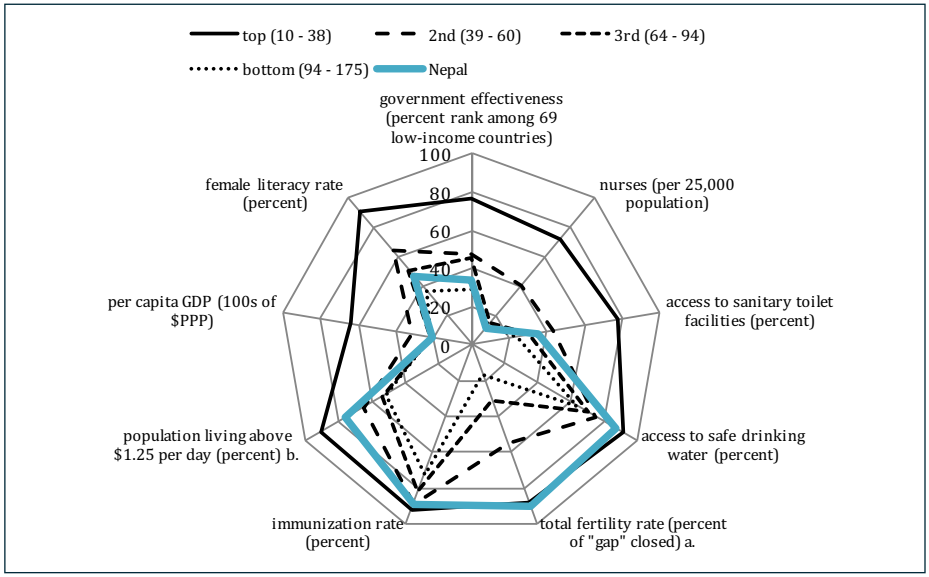
*3a: Profile for Sri Lanka*



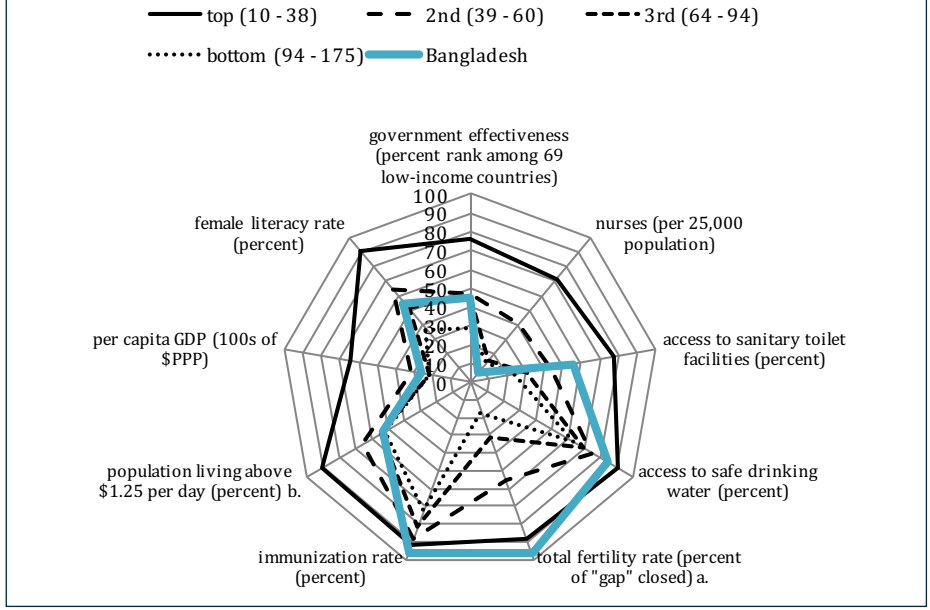

*3b: Profile for Bhutan*



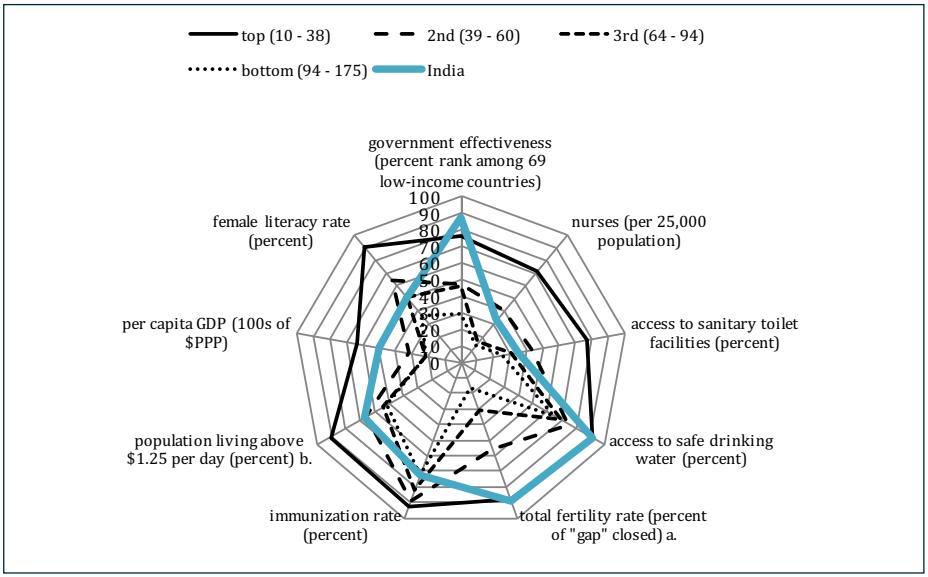
*3c: Profile for Nepal*



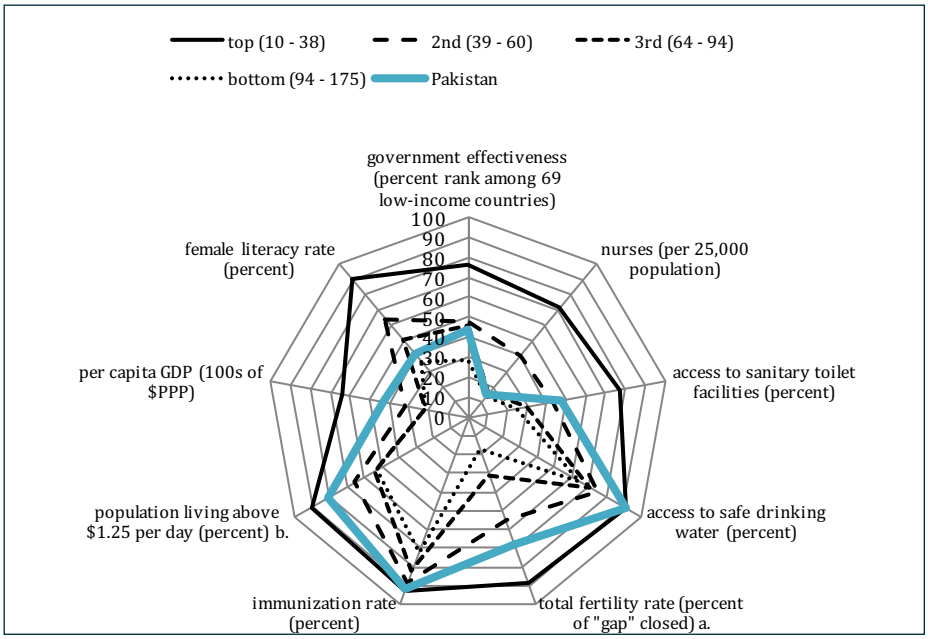

*3d: Profile for Bangladesh*



*3e: Profile for India*




*3f: Profile for Pakistan*



## Notes to Figure 3

a. The "gap closed" is defined relative to the difference between replacement-level total fertility rate (TFR) of 2.1 children per woman and 6.06, the highest quarter-specific average TFR among the sample in 2000-2003. For example, the top-quarter TFR in 2010-13 averaged 2.58, equivalent to 87 percent (100*[2.58 – 6.06]/[2.1 – 6.06] = 87).

b. N=50. However, intervals are defined by quartiles of the 69-country sample.

c. Some variables have been rescaled to facilitate comparison.

d. The range of under-five mortality per 1000 live births (2010-13) in each quarter is provided in parentheses in the legend.

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superimpose the profile of one of the six South Asian countries.

The first dimension of the cobweb shows quarter-specific averages for government effectiveness scores. As expected, the ranking is consistent with the ranking of quarter-specific average mortality rates. Proceeding clockwise, the next dimension shows quarter-specific averages for per capita nurses, a proxy for the supply of professional health care providers and hospital beds.[7] While variation in the health inputs index is not significant in any regression, health systems obviously require health professionals. Next are measures of performance of four public health institutions, followed by two measures of economic well-being and, finally, female literacy.

As evidence that immunization is a public health institution less requiring of high-level governance quality than the other public health measures and nurse training, note that it is the dimension displaying the highest average performance among the measures of health institutions. It also displays the minimum range between average performance in the top and bottom quarters.

An important point illustrated by Figure 3 is that the top quarter countries, on average, outperform the comparable averages for the three other quarters on *all* variables illustrated. There are no inversions. The same dominance on all variables is evident in comparing the second relative to the third and fourth quarters, and the third against the fourth. (Albeit, the differences along some dimensions between second and third, or third and fourth, quarter outcomes are small.) While factors requiring little in the way of high-level governance are important in understanding *changes* in mortality rates over the decade, achieving top-quarter mortality *levels* seems to require above-average outcomes among the factors that do require a reasonable quality of high-level governance.

The first panel of Figure 3 concerns Sri Lanka. The allocation of sufficient resources and attention to implementing successful social policy are not automatic. Sri Lanka's profile

7 Of the three components (per capita ratios of doctors, nurses and hospital beds) in the health input index, the most important in comparison of national health systems is probably the ratio of nurses (Berland 2014).

reveals a country whose performance on all variables, except nurse-to-population ratio, is superior to the average among top-quarter countries. On the dimension of female literacy, no other South Asian country reaches the average for even second-quarter countries. Admittedly, on an intergenerational basis the relation between superior health and education outcomes on the one hand, and per capita GDP on the other, is reciprocal. No doubt, Sri Lanka's relatively high per capita GDP contributed to its superior heath and education outcomes, but these outcomes in turn are an important reason for the country's relative affluence.[8]

Bhutan performs above the top-quarter averages on six of nine variables, Nepal and India on four. India's overall government effectiveness score is high but there is a large variation across states, which the WGI do not adequately reflect. Bangladesh performs at or near top-quarter averages for three variables (access to safe drinking water, control of fertility, and immunization). Worth emphasizing, Bangladesh has by far the highest percentage among South Asian countries of its population living below $1.25/day. Child mortality results for Pakistan are disappointing. It performs at or near top-quarter levels on three variables (access to safe drinking water, percent above $1.25/day and immunization).

## Conclusion

In the last decade, there has been some backlash against invoking governance quality in addressing development outcomes (Sachs 2005; Oman and Arndt 2010; Quibria 2014). Our findings, however, are consistent with the idea that the overall quality of government delivery of services does indeed matter.

In conclusion, we emphasize an argument made by many others.[9] Achieving good social policy outcomes is important not only for humanitarian reasons. A sustained political commitment to realizing good education and health services is among the best means whereby governing elites can commit to sharing the benefits of economic growth, and thereby obtain popular support for economically efficient public policies.

8 During the interval 2000-03 Sri Lanka's per capita GDP averaged $5100, during the interval 2010-13, $8500. The $3400 increase over the decade is the sixth largest among the 69-country sample.

9 As example, we note that Acemoglu (2008) makes this argument in the context of a set of essays defining the concept governance.

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