Assessing the Efficiency of Sub-National Units in Making Progress Towards Universal Health Coverage: Evidence from Pakistan

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ABSTRACT
The World Health Report 2010 encourages countries to reduce wastage and increase efficiency to achieve Universal Health Coverage (UHC). This research examines the efficiency of divisions (sub-provincial geographic units) in Pakistan in moving towards UHC using Data Envelop Analysis. We have used data from the Pakistan National Accounts 2011–12 and the Pakistan Social Living and Measurement Survey 2012–13 to measure per capita pooled public health spending in the divisions as inputs, and a set of UHC indicators (health service coverage and financial protection) as outputs. Sensitivity analysis for factors outside the health sector influencing health outcomes was conducted to refine the main model specification. Spider radar graphs were generated to illustrate differences between divisions with similar public spending but different performances for UHC. Pearson product-moment correlation was used to explore the strength and direction of the associations between proxy health systems organization variables and efficiency scores.

The results showed a large variation in performance of divisions for selected UHC outputs. The results of the sensitivity analysis were also similar. Overall, divisions in Sindh province were better performing and divisions in Balochistan province were the least performing. Access to health care, the responsiveness of health systems, and patients' satisfaction were found to be correlated with efficiency scores.

This research suggests that progress towards UHC is possible even at relatively low levels of public spending. Given the devolution of health system responsibilities to the provinces, this analysis will be a timely reference for provinces to gauge the performance of their divisions and plan the ongoing reforms to achieve UHC.

Introduction
There is a wide consensus among governments of the importance of making progress towards Universal Health Coverage (UHC) target, so that all individuals and communities receive the health services they need without suffering financial hardship. The process of making progress towards UHC is viewed as essential to not only improve health outcomes, but also health equity and financial protection.

According to the World Health Organization (WHO), achieving UHC requires more than just raising sufficient resources for country health systems. In the 2010 World Health Report, WHO argued that strategies to promote efficiency and eliminate waste in health systems are also needed, and cited evidence that suggests that 20% to 40% of resources spent on health are lost due to inefficiency. Common sources of inefficiency include: unnecessary expenditures on medicines; supplier-induced demand; inappropriate or costly staff mix; medical errors and suboptimal quality of care; inappropriate balance of prevention promotion and treatment interventions; and corruption.

Most previous studies on the extent of efficiency of country health systems have focused on health outcomes. For example, Evans et al. carried out a cross-national comparative efficiency analysis of 191 national health systems in 2001, and concluded that, although increasing per capita health expenditures are crucial for the poor countries, significant gains can be made with existing resources in most countries. Countries with similar socio-economic profiles often have wide variation not only in their health outcomes, but also in their health systems' capacity.
service coverage rates and degree of financial protection. As a result, researchers have begun to compare the performance of national health systems in making progress towards UHC goals. For example, in 2012, Moreno-Serra and Smith assessed and compared the performance of 79 countries towards UHC. Acknowledging that a desirable condition of UHC is the establishment of pre-paid pooled public funding to finance improvements in financial protection and health service coverage, the performance of a health system in extending health coverage and access was measured against pooled funding levels. Building on the methodology used by Moreno-Serra and Smith, WHO recently assessed the performance of 83 low- and middle-income countries in producing UHC outputs. Pre-paid pooled public spending on health was taken as the input, and five health service coverage indicators and one proxy indicator for financial protection were taken as outputs. Based on the results, the authors contest the view that low- and middle-income countries below a certain target of health spending cannot make progress towards UHC.

Because most country health systems have some degree of financial and managerial decentralization, the decisions regarding the design and implementation of UHC programs are often made at both the national and the sub-national levels (i.e. provinces). However, despite the importance of the sub-national level, there are no previous studies that have focused on the efficiency of producing UHC goals at the sub-national level.

In this article, we address this gap in the literature by investigating the sub-national UHC performance in Pakistan, a country in South Asia that has experienced significant decentralization over the past decade. We assessed and compared the performance of all 28 divisions in Pakistan against a set of UHC performance indicators relative to health systems inputs. We have used data envelopment analysis (DEA), as applied by Moreno-Serra and Smith and Jowett et al., and taken division-level indicators on UHC performance (health service coverage and financial protection) as outputs and per capita public spending in health as inputs for the DEA model. The results are used to compare the performance of divisions with similar levels of public spending in producing UHC tracer indicators. By using Pearson correlation analysis, we build a case for exploring health system organization and socioeconomic determinants of better efficiency at the sub-national level. As provincial governments are in the process of setting up local governments and launching health financing reforms, this research will be of interest to provincial ministries of health, development partners, district governments, health financing practitioners, and researchers engaged in these reforms.

**Background on Pakistan**

The size and the increased role of provinces in the health system makes Pakistan an interesting case study. Pakistan, the fifth most populous country in the world, is a lower-middle-income country in the Eastern Mediterranean Region (EMR). The country’s health system has been chronically under-funded, as Pakistan’s government is one of the lowest spenders on health amongst both lower-middle income countries globally and in the region. Current health expenditure (CHE) has been marginally increasing in recent years, and has gone from USD 16 per person in 2000 to USD 40 per person in 2016. Government spending as a percentage of CHE was 35% in 2000 and with some spikes and dips, it was 28% in 2015 and 2016. This has been supplemented by an increase in aid spending from 2000 to 2015, but the total aid share is still limited at around 4% of CHE. The low government spending has led to a high out-of-pocket payment (OOP), which has been consistently over 60% in the last 15 years. The most recent estimate shows that OOP in Pakistan was 65% in 2016. Given this regressive mechanism of financing, health services provision in the country has been poor. Pakistan scores 40 on the UHC service coverage index, which is a single indicator estimated to monitor coverage of essential health services and is presented on a scale of 0 to 100; Pakistan is well below the EMR and global averages of 53 and 64, respectively.

With the passage of the 18th Constitutional Amendment in 2010, health became a provincial government mandate in Pakistan, and required provincial governments to create local governments at the district level, a process that is still ongoing. As a result of the political process and three smooth democratic transitions from 2008 to 2018, health sector reforms have become a high priority on political agendas; three major political parties promised “healthcare for all” in their election manifestoes in 2018. Through the National Health Vision 2016–25, ministries and departments of health in all provincial governments have committed to both enhancing public health spending and improving the efficiency of health systems in their geographical domains for achieving UHC.

There is very limited empirical research literature on health systems efficiency in Pakistan. Two previous studies compared the efficiency of health units within a small geographical region using data envelope analysis, and while two previous multi-country studies, including the WHO study mentioned above, have assessed and compared country-level performance on agreed indicators for coverage and financial protection, there are no available studies that assess sub-national performance in Pakistan and elsewhere.
**Methodology**

**Estimation Strategy**

DEA is a linear programming method which determines how well an entity—commonly referred to as a decision-making unit (DMU)—converts a set of inputs (e.g. pooled public expenditure on health) into a set of outputs (e.g. performance on a set of UHC indicators). The method works by estimating a frontier indicative of the ‘most efficient’ input-to-output conversion possible by a DMU and assesses all other DMUs in relation to that frontier. The efficiency frontier is constructed by joining these observations in the input-output space. The frontier thus comprises a series of linear segments connecting one efficient observation to another. The construction of the frontier is based on ‘best observed practice’ and is therefore only an approximation of the true, unobserved efficiency frontier. Inefficient DMUs are ‘enveloped’ by the efficiency frontier in DEA. The inefficiency of the DMUs within the frontier boundary is calculated relative to this surface, which is bounded by 0 and 1.\(^22\)

DEA is one of the most commonly used methods to assess efficiency in health care and in many other sectors of the economy, and the biggest advantage of DEA against parametric models is the ability to deal with more than one output, which for this study was key to assess financial protection and UHC coverage altogether.\(^23\)

In DEA, a DMU is assessed based on the ratio of a weighted sum of its outputs divided by a weighted sum of its inputs, which results in an efficiency score. To do this, each DMU is assigned its own unique set of input and output weights, which allows us to make an appropriate analysis by accounting for the priorities of the DMU.\(^22\) While this flexibility in determining weights is an appealing characteristic of DEA, one potential drawback is that if a DMU performs extremely poorly on some outputs but very well on others, the DEA program may assign a 0% weight to the poorly produced outputs (or alternatively, assign a 100% weight to a very high performing output). In our analysis, this is of importance as we are concerned with performance in both dimensions of UHC. A low level of out-of-pocket expenditures may indicate either very good financial protection, or high unmet need (i.e. if the high cost of care deters utilization of services, and no expense is incurred).

Various researchers have suggested ways of imposing restrictions on the weights.\(^22\) We assigned a simple constraint that each UHC performance indicator will be given a weight greater than 0. This assures that all indicators are evaluated for all DMUs, while still permitting a considerable degree of flexibility in the weights. However, we also estimated a DEA model with no weight restrictions and found similar results.

There are a number of variations to the DEA approach. Between an input-based and output-based model, we chose to use an output-based model with a fixed input and variable returns to scale. This allows us to look at how performance varies for a given level of pooled spending on health, and therefore we can see how far output levels can be proportionally increased without changing the government expenditure. For this study, given the limitations in the healthcare sector to reflect the market value (prices) of outputs, we restricted the analysis to the calculation of technical efficiency rather than allocative efficiency or total economic efficiency. To perform the method explained above, we used the Efficiency Measurement System (EMS) software to calculate scores. A sensitivity analysis was also performed to test whether the efficiency scores remain stable after adding or removing additional variables to the main model. Further, we believe that environmental variables that could influence the efficiency of a DMU but are not traditional inputs and are outside the direct control of a health system, are relevant to this analysis. Inadequately accounting for the environment in which DMUs operate may lead to faulty conclusions. However, there remains an active and unresolved debate about how to incorporate such environmental variables into DEA; using sub-samples to assess any difference in the mean efficiency of the two sub-samples, including an environmental variable (either categorical or continuous) as one of the inputs in the production model, a two-stage analysis, or a three-stage approach to account for environmental effects.\(^22,24\) It is therefore inadvisable to draw firm conclusions using conventional statistical tests. Rather, indicating which environmental variables appear to have the most influence on performance, could be considered exploratory. Therefore, due to the lack of consensus on how to incorporate environmental effects and additionally the small sample size of 28 divisions to perform regression analysis, we decided to complement the analysis with a Pearson product-moment correlation, aiming to explore the influence of key factors (with the data available) over the efficiency of the health system.

**Data and Indicators**

Because of the devolution of power in Pakistan from the central to local governments,\(^11,15\) this analysis should ideally have been done at the district level.
However, the division was chosen as the unit of analysis (DMU) due to the unavailability of district-level data on financial protection outputs. The division is a geographic unit larger than a district, but smaller than a province. There are 28 divisions in four provinces of the country. The population per division ranges from 0.6 to 16.0 million and the number of districts in each division ranges from three to eight.

Input—Prepaid Pooled Public Spending on Health
Data on pooled public spending on health comes from the health expenditure section of Pakistan’s National Accounts 2011–12. Of the two main categories of health expenditure, development and current (recurrent), division-level estimates were only available for some but not all categories of current expenditure. The division level aggregates used for this study made up an estimated 70% of the total current expenditures; these aggregates were divided by the 2011–12 population of the respective divisions to obtain per capita health expenditure.

Outputs
Data on outputs comes from the Pakistan Social and Living Standards Measurement (PSLM) Surveys Project, conducted by the Pakistan Bureau of Statistics, Government of Pakistan, this was one of the main tools used by the government for tracking its progress towards the Millennium Development Goals and has been recently made a regular activity for monitoring and reporting progress towards the nationally agreed targets every two years. Pakistan could not achieve any of the health-related MDG targets; the chosen indicators for this study are related to basic health services and will still be relevant across the country in the SDG-era and will be in fact part of the next PSLM surveys. Though with the ongoing devolution reforms there may be differences in district level priorities, but it is very unlikely that the chosen indicators will not be relevant.

The comparability of indicators across the districts and provinces was ensured. Each time, a multi-stage sampling technique is used; sampling weights for national representation are available. The universe of each survey consists of all urban and rural areas of all four provinces, as defined by the respective provincial governments.

| Table 1. Indicators of health service coverage and financial protection. |
| Concept | Indicator |
| --- | --- |
| **Service Coverage** |  |
| Full immunization coverage | Percentage of children aged 12–23 months that have received the following vaccines: Bacille Calmette Guerin (BCG), 3 doses of Diphtheria Pertussis Tetanus (DPT), 3 doses of Polio, Measles, and 3 doses of Hepatitis B (based on record and recall). |
| Prenatal care coverage | Percentage of ever married women aged 15–49 years who had given birth in the last three years and who had attended at least one pre-natal consultation during the last pregnancy. |
| Postnatal care coverage | Percentage of ever married women aged 15–49 years who had a birth in the past three years who received post-natal check-up within 6 weeks after delivery. |
| Skilled delivery assistance | Percentage of live births to all ever-married women aged 15–49 years during the past three years (last pregnancy only) that were attended by skilled provider. |
| Treatment of child diarrhea with ORS | Percentage of children less than 5 years that were reported to have an episode of diarrhea in the past 30 days who were given ORS. |
| Treatment of child diarrhea with facility-based care | Percentage of children less than 5 years that were reported to have an episode of diarrhea in the past 30 days and had sought consultation from a health facility. |
| **Financial Protection** |  |
| Catastrophic health expenditures | Percentage of households spending 40% or more of their capacity to pay on out of pocket expenditures for health.

Capacity to pay (CTP) is defined as the difference between total household expenditure and subsistence food expenditure.

“Subsistence level of food expenditure is estimated as the average food expenditure per equivalent adults of households in the 45th–55th food budget share distribution. When actual food spending falls below this amount, then capacity to pay is defined as total expenditures net of actual food spending. This also avoids estimating a negative level of capacity to pay.”

Impoverishing health expenditures | Percentage of households with total household expenditure gross of out of pocket expenditure on health above the amount equivalent to subsistence food expenditures but with total household expenditure net of out of pocket expenditure on health below the amount equivalent to subsistence food expenditures. |
model, comes from the Household Integrated Economic Survey (HIES), which was part of the PSLM project and included income and consumption, along with social indicators. The two financial protection indicators recommended by WHO for assessing UHC progress were estimated at the division level and are outlined in Table 1.

The reference year used for the analysis is 2012. With the data constraints, the time period of all the input and outputs indicators was kept closest to 2012, and it was ensured that the timing of output indicators does not precede the timing of the input.

Data Analysis

For the descriptive analyses, the distribution of UHC outputs versus the input were first plotted, followed by the estimation of the main DEA model, which was used to generate efficiency scores for each DMU.

A spider radar graph was generated to illustrate the differences between two divisions with similar public spending in health facilities but different levels of UHC performance. Sensitivity analyses were performed by adding a different combinations of inputs into the main model. For factors outside the health system which can potentially affect the health outcomes, information on education and poverty at the division level was available. The number of years of schooling was taken as a proxy indicator for education and overcrowding was taken as a proxy for poverty. The Government of Pakistan’s latest report titled “Multidimensional Poverty in Pakistan” was consulted to get aggregate values for both indicators at the division level.

Private pooled expenditures make 0.59% of total health expenditures in the country and have a very limited role in financing health. Further, no disaggregated information was available on them at the division level. However, division level average aggregates were available in HIES 2011–12 for the private out-of-pocket expenditures (OOP). Though OOP is not a desirable input for the transition towards UHC, but a sensitivity analysis was done to see any differences in efficiency scores between different models. Five models were estimated:

- Model 1 is the main model, representing only pooled public spending in health facilities as the input.
- Model 2.1 has pooled public spending in health facilities and years of schooling as the inputs.
- Model 2.2 has pooled public spending in health facilities and overcrowding as the inputs.
- Model 2.3 has pooled public spending in health facilities and years of schooling + overcrowding as the inputs.
- Model 3 has pooled public spending in health facilities and private OOP as the inputs.

To capture factors that relate to the healthcare service supply environment, we included indicators from the PSLM 2012–13, the data set used for health service coverage indicators. The following four variables, self-reported by the households, were used. Weighted estimations were made at the division level for the response categories of each variable.

- Type of health provider visited
- Satisfaction with the health facility
- Time spent in reaching the nearest health facility
- Reasons for not using a Basic Health Unit (public health facility) once in a while

Pearson product-moment correlation was used to explore the strength and direction of the association between proxy health systems organization variables and efficiency scores. The level of statistical significance of the association between the variables in question was also tested. With just 28 observations (one per division) and limited proxy health system organization variables available at the division level, multiple multivariate regression models were tested, but no logically interpretable model could be estimated, and measurement errors were observed in all the models.

Results

Descriptive Analysis

The descriptive results for the division-level input and outputs are presented in Appendix Table 1. The overall distribution of UHC outputs against the input is shown in two panels of Figure 1. The upper panel shows the two financial protection outputs. Minimum coverage for both indicators is more than 90% in all three terciles. With an increase in public spending, there seems to be a convergence among divisions in the performance for financial protection.
The lower panel displays health service coverage outputs. The medians for both indicators for diarrhea treatment coverage are above 80% for all terciles, but the variation for ORS treatment in the lower spending terciles was substantially higher. The median of full immunization coverage is more than 80% in the lowest, while it is less than 80% in the higher spending terciles. Medians of the maternal care indicators (pre- and post-natal consultation, and skilled birth attendance) are well below the 80% coverage level for all terciles. Our figure also shows that the variation in immunization, skilled birth attendants and prenatal consultation were higher for the highest spending terciles, and all three indicators had a range from less than 35% to over 90%. Overall, very few coverage indicators achieve levels of more than 90%.

**Main Model**

The performance of all 28 divisions was compared and their DEA scores are presented in Appendix Table 2; divisions were ranked for each province to help local decision makers compare the performance of their divisions.

The results of the main model are presented in Figure 2. There is great variation in the overall performance for UHC across the divisions. Five divisions were found to be the best performing. One of the best performers, Islamabad, the capital, had the highest level of spending (37.88 USD per capita), while the remaining four best performing divisions spent less than 10 USD per capita (Karachi and Mirpur Khas from province Sindh; Rawalpindi from province Punjab; and Mardan from province Khyber Pakhtunkhwa (KP)). There were no best performing divisions from...
province Balochistan. Divisions from the province Sindh were found to be relatively better performing—their scores range from 91.42% to 100%. On the other hand, the province of Balochistan had the lowest performing divisions, with division scores ranging from 71.38% to 82.33%.

Figure 3 shows an example of the difference in performance for UHC between two divisions in Punjab province. Each axis of the spider web graph represents the coverage of a UHC output indicator. While per capita pooled public spending was around 5 USD in both divisions (5.16 USD in Rawalpindi and 5.10 USD in Bhawalpur), the performance for UHC was different. Rawalpindi was one of the best performing divisions, securing a 100% DEA score with better coverage for all indicators compared to Bhawalpur, whose DEA score was 83.7%.

Explaining Efficiency Variations

Table 2 presents correlations between DEA efficiency scores and proxy variables for health system organization. Among the health providers, lady health visitor/lady health worker (a community health worker) and private dispensary/hospital had significant positive

![Figure 2. Main model: UHC performance relative to public spending in 28 divisions.](image1)

![Figure 3. Comparison of UHC progress between rawalpindi and bhawalpur.](image2)
correlations. Informal-untrained providers (hakeem, and one who performs dum “spiritualism”) had a high negative correlation. It is notable to find that visiting a government dispensary/hospital was negatively correlated. Being satisfied with a health facility was positively correlated, while the absence of a doctor and lady (female) staff, and long waiting time were negatively correlated. There is a high positive correlation between efficiency score and lesser time required to reach the health facility. This finding is also supported by a negative correlation with “far away” as the main reason for not using a basic health unit “once in a while.” Health facility “does not suit” is a category which was found to have a negative correlation.

**Sensitivity Analysis**

As shown in Table 3, two divisions—Islamabad and Karachi—remained on the efficiency frontier for all the four models compared with the main one, and two additional divisions that did not appear before as best performers had improved DEA scores (Sahiwal and Zhob). Three other divisions, Mardan, Mirpus Khas, and Rawalpindi, secured a 100% score for the first three models, when education and poverty proxy variables were combined with pooled public spending. The scores for most of the other divisions were also similar in the first three models, signaling the robustness of the results from the first main model.

The results were slightly different for Model 3 when private OOP was combined with pooled public spending; there was a variation of more than 5.2% DEA scores in about 33% divisions and no clear difference in terms of positive or negative influence on DEA scores was observed between the Model 1 (main model) and Model 3.

**Discussion**

Building on the international discussion on variation in performance for UHC among countries with low levels of public spending for health, this research has brought forth an example of within-country variation in UHC performance. To our knowledge, this is the first analysis assessing the performance of health systems for UHC at the sub-national level in Pakistan. The methodology used in the study is along the lines used in two seminal studies assessing health systems performance for UHC. The performance of 28 divisions on a set of UHC outputs relative to their inputs into the health system was assessed and compared through data envelopment analysis. Given the importance of pooled

| Type of provider | Correlation |
|------------------|-------------|
| Private Dispensary/Hospital | 0.3807** |
| Govt. Dispensary/Hospital | −0.3696* |
| Basic Health Unit/Rural Health Center | 0.3058* |
| Lady Health Visitor/Lady Health Worker | −0.5216*** |
| Homeopath | 0.1851 |
| Chemist | 0.0807 |
| One who performs ‘Dum’ (spiritualism) | −0.6420*** |
| Other | 0.1122 |

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* Significant at 10%; ** significant at 5%; *** significant at 1%
public spending in the transition of low- and middle-income countries towards UHC and the limited role of pooled private spending in financing health in Pakistan, pooled public spending was taken as an input and UHC tracer indicators were taken as the outputs.

Acknowledging the direction of devolution reforms in the country, where financial and management autonomy has been passed from the federal to the provincial level and is now being passed to the district level,\(^{11,15}\) this research has generated timely evidence for local policymakers. The priority given to health by the divisions can be judged by comparing per capita public spending on health in a division with neighboring divisions within a province, while the performance of a division in producing UHC outputs can be compared with other divisions spending a similar amount on health.

A few notable findings emerged from the results of the descriptive analyses. The first finding is that there was high variation in per capita pooled public expenditure, which ranged from 1.37 USD in a division in Sindh province to 37.88 USD in Islamabad, the capital. The health service coverage outputs selected for this analysis were all related to the MDGs. Moreover, except for the two indicators for diarrhea treatment, there were huge variations across the divisions in coverage for all other healthcare services. The determinants of this inequitable public spending need to be explored within and between provinces to investigate whether the spending variation is due to genuine differential needs of the populations or inequities in the distribution of public resources. As provincial governments are reassessing their primary health services and essential healthcare packages,\(^{19}\) it is imperative to take stock of division-level coverage of services.

Irrespective of public spending level in a division, coverage of financial protection indicators was found to be above 90% in all three terciles. When these indicators are viewed in parallel with health service coverage indicators, it is not difficult to decipher that this high level of financial protection may be due to non-utilization of health services and/or unmet health needs of populations, as coverage of most of health service indicators was less than 70%. Moreover, both financial protection and service coverage are likely the products of demand-side and supply-side factors. For example, the health system could be efficient in producing the necessary workforce and ensuring the medicines and vaccines are available, but there may be community-level factors, such as low education and social norms, that act as barriers to the appropriate use of health services. This suggests that local decision makers responsible for monitoring the recently launched health financing reforms should ensure that monitoring plans include not only health service coverage and financial protection indicators, but also indicators of supply-side and demand-side factors that influence these indicators.

As of now, no division-level indicators for health system organization and governance are available to

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**Table 3. Sensitivity analyses: estimation of additional models with different combinations of inputs.**

| Division     | Model 1 | Model 2.1 | Model 2.2 | Model 2.3 | Model 3 |
|--------------|---------|-----------|-----------|-----------|---------|
| Bahawalpur   | 83.7%   | 83.7%     | 83.7%     | 83.7%     | 78.7%   |
| Bannu        | 92.6%   | 92.6%     | 92.6%     | 92.6%     | 91.1%   |
| DG Khan      | 98.2%   | 98.2%     | 98.2%     | 98.2%     | 92.2%   |
| DI Khan      | 87.8%   | 87.8%     | 87.8%     | 87.9%     | 80.1%   |
| Faisalabad   | 89.4%   | 89.4%     | 89.4%     | 89.4%     | 91.2%   |
| Gujranwala   | 98.6%   | 100.0%    | 100.0%    | 100.0%    | 86.3%   |
| Hazara       | 85.0%   | 85.0%     | 85.0%     | 85.0%     | 79.6%   |
| Hyderabad    | 94.0%   | 94.0%     | 94.0%     | 94.0%     | 97.6%   |
| Islamabad   | 100.0%  | 100.0%    | 100.0%    | 100.0%    | 100.0%  |
| Kalat        | 82.3%   | 82.3%     | 82.3%     | 82.3%     | 90.5%   |
| Karachi      | 100.0%  | 100.0%    | 100.0%    | 100.0%    | 100.0%  |
| Kohat        | 91.8%   | 91.8%     | 91.8%     | 91.8%     | 92.2%   |
| Lahore       | 88.2%   | 88.2%     | 88.2%     | 88.2%     | 88.3%   |
| Larkana      | 95.2%   | 95.2%     | 95.2%     | 95.2%     | 93.4%   |
| Makran       | 78.0%   | 78.0%     | 78.0%     | 78.0%     | 94.0%   |
| Malakand     | 92.5%   | 92.5%     | 92.5%     | 92.5%     | 84.4%   |
| Mardan       | 100.0%  | 100.0%    | 100.0%    | 100.0%    | 99.1%   |
| Mirpur Khas  | 100.0%  | 100.0%    | 100.0%    | 100.0%    | 92.3%   |
| Multan       | 90.5%   | 90.5%     | 90.5%     | 90.5%     | 90.1%   |
| Nasirabad    | 79.7%   | 79.7%     | 79.7%     | 79.7%     | 84.1%   |
| Peshawar     | 87.7%   | 87.7%     | 87.7%     | 87.7%     | 88.9%   |
| Quetta       | 73.3%   | 73.3%     | 73.3%     | 73.3%     | 75.9%   |
| Rawalpindi   | 100.0%  | 100.0%    | 100.0%    | 100.0%    | 95.0%   |
| Sahiwal      | 96.8%   | 96.8%     | 96.8%     | 96.8%     | 100.0%  |
| Sargodha     | 96.7%   | 96.7%     | 96.7%     | 96.7%     | 92.8%   |
| Sibi         | 71.4%   | 71.4%     | 71.4%     | 71.4%     | 80.9%   |
| Sukkar       | 91.4%   | 91.4%     | 91.4%     | 91.4%     | 91.6%   |
| Zhob         | 75.4%   | 75.4%     | 75.4%     | 75.4%     | 100.0%  |
synthesize plausible reasons for variation in performance within and between provinces. However, some points of further inquiry can be deduced regarding service delivery characteristics from the results of the correlation analysis. Proximity and less time required to reach health facilities were associated with higher efficiency scores, possibly because physical access to health services have been found to be a key factor influencing the use of health services, as shown by related studies. Based on the correlations with the availability of health providers, lady health visitor (community health worker) and private dispensary/hospital had positive while government dispensary/hospital and informal-untrained providers had negative associates with the efficiency scores. Home visits by community health workers and the presence of private dispensaries in rural/far-flung areas could have led to better coverage of services, and poor quality of services by the informal-untrained providers and long distance and travel time required to reach government facilities could have affected the service coverage. Correlations for service readiness in health facilities hint towards community preferences and experiences, like the absence of a doctor and lady (female) staff and long waiting time, were negatively correlated, while also being satisfied with a health facility was positively correlated. These findings are similar to results of studies performed by previous researchers, which also found that the availability of a doctor, shorter waiting times, and higher perceived quality were all important determinants of the utilization of health facilities.

The analysis has a number of limitations that should be considered when interpreting the results. First, limited data were available on health service coverage indicators at the division level and only six MDG-related indicators, focused more on preventive care than on treatment, could be selected. Because these types of services are predominantly provided by public health facilities and as such, more reliant on public than private health financing in Pakistan, our results may be upward biased, compared to a situation in which we had the ability to capture the full set of indicators suggested by WHO for tracking progress towards UHC.

Second, the estimate of per capita public expenditure was under-reported, as development expenditures and some categories of current expenditures could not be disaggregated at the division level. Further, there were no data available for pooled private spending at the division level. However, since the budget heads used for each division was consistent throughout our analysis, it is unlikely that the underreporting has biased our input estimates.

Third, DEA is ideally used for DMUs operating under similar conditions, such as factories and hospitals. Though 28 divisions of the same country were assessed in this analysis, Pakistan is a large country and there are significant contextual differences between divisions. For this reason, the focus of this analysis was more on investigating relative differences between divisions rather than on how divisions are performing relative to the frontier. Moreover, DEA does not compare the efficiency of DMUs relative to the “true” production frontier; it is sensitive to the chosen outputs, and is unable to yield estimates of allocative efficiency. Because of not having data on health system organization and governance variables, the determinants of efficiency could not be investigated through a robust model.

Fourth, we did not have division-level data on environmental variables regarding health systems organization and governance. This prevented us from exploring the association between the efficiency scores in order to provide insights for the future reforms.

Lastly, we recognize that OOP dominates total health expenditures in Pakistan and we did not deliberate further on Model 3, when private OOP and pooled public spending were combined and taken as an input into the model. Our approach was informed by the evidence on UHC suggesting that private OOP is not a preferred source of health financing in any country context and for countries to make progress towards UHC, there needs to be a predominant reliance on public revenue sources. Voluntary or private revenue sources contribute little in helping countries move towards UHC. However, we believe that further analysis, which is outside the scope of this study, is needed to investigate how private revenue sources are influencing prevention health outputs.

**Conclusions**

With the current fiscal constraints on public health expenditure in Pakistan, it is necessary to explore alternative strategies for enhancing the efficiency of the health system. This research presents a snapshot of the variation in UHC performance at the sub-national level and the results provide support for the premise that progress towards UHC is possible even at lower levels of public spending. The outputs selected for this analysis are very relevant for the ongoing discussions regarding the delivery of an essential healthcare package and financial protection for the poorest segment of the population. Keeping in view that health is now a provincial responsibility, future research in this area should examine the reasons for the variation in performance at the sub-provincial level in depth. For this, provincial health accounts, Pakistan medical and dental
council, and provincial ministries of health need to compile and make available the data on health system organization and health expenditures at the district level. The local health authorities can use the findings of this study as a starting point for gauging performance for UHC and should consider determinants of efficiency while planning future reforms.

Notes

a. Response categories: Private Dispensary/Hospital, Government Dispensary/Hospital, Basic Health Unit/Rural Health Center, Lady Health Visitor/Lady Health Worker, Hakeem, Homepath, Chemist, One who performs ‘Dum’ (spiritualism), Other.

b. Response categories: Satisfied, Doctor not present, Staff non-cooperative, Lady staff not present, Lack of cleanliness, Long wait, Costly treatment, Staff untrained, Medicines not available, Unsuccessful treatment, Other.

c. Response categories: 0-14 minutes, 15-29 minutes, 30-44 minutes, 45-59 minutes, 60+ minutes.

d. Response categories: Far away, Very costly, Does not suit, Lack of tools/staff, No enough facility, Other.

e. Either terciles or quartiles could be used because the top group of observations would always have a wide variation; the majority of the values are concentrated below 5 dollars per capita and only three observations out of 28 are above 10 dollars per capita.

Disclosure of Potential Conflicts of Interest

No potential conflict of interest was reported by the author.

Funding

Authors are thankful to DfID UK for for paying the “Open Access” charges under the Making Country Health Systems Stronger grant.

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## Appendix

### Appendix Table 1. Division Level Input and Output Indicators

| Public financing for health facilities (per capita US$) | % of households with no Catastrophic Expenditures | % of households with no Impoverishing health Expenditures | Percentage of children aged 12-23 months that have been fully immunized* | Percentage of pregnant women visiting health facility for pre-natal consultation within 6 weeks after delivery | Percentage of women who received a post-natal consultation within 5 years where a practitioner was consulted | Percentage delivered by a skilled provider | Percentage of diarhea cases for children less than 5 years where Oral Rehydration Salt (ORS) was given to the child |
|--------------------------------------------------------|-----------------------------------------------|----------------------------------------------------------|--------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| Punjab                                                 |                                              |                                                          |                                                                                |                                                                                                                     |                                                                                                           |                                                                                  |                                                                                  |
| Rawalpindi                                             | 5.17                                         | 96.77                                                    | 99.85                                                                         | 93.80                                                                | 83.35                                                             | 34.04                                                              | 75.18                                                             | 96.77                                                               | 81.04 |
| Gujranwala                                             | 2.75                                         | 97.93                                                    | 99.90                                                                         | 92.61                                                                | 75.90                                                             | 25.53                                                              | 64.06                                                             | 88.04                                                               | 59.90 |
| DG Khan                                                 | 2.45                                         | 93.96                                                    | 97.51                                                                         | 86.35                                                                | 66.35                                                             | 27.36                                                              | 36.53                                                             | 97.28                                                               | 86.16 |
| Sahiwal                                                 | 2.90                                         | 95.22                                                    | 99.35                                                                         | 90.77                                                                | 71.49                                                             | 31.26                                                              | 48.36                                                             | 97.31                                                               | 62.10 |
| Sargodha                                                | 3.46                                         | 96.85                                                    | 98.68                                                                         | 88.43                                                                | 62.93                                                             | 29.89                                                              | 60.53                                                             | 91.78                                                               | 76.50 |
| Multan                                                  | 5.12                                         | 93.87                                                    | 98.16                                                                         | 92.71                                                                | 70.80                                                             | 27.83                                                              | 51.36                                                             | 95.09                                                               | 67.65 |
| Faisalabad                                              | 4.76                                         | 98.46                                                    | 99.66                                                                         | 85.22                                                                | 69.95                                                             | 26.12                                                              | 73.46                                                             | 94.29                                                               | 52.53 |
| Lahore                                                  | 9.99                                         | 98.61                                                    | 99.71                                                                         | 88.23                                                                | 84.66                                                             | 28.61                                                              | 72.43                                                             | 91.38                                                               | 51.90 |
| Bahawalpur                                              | 5.70                                         | 92.82                                                    | 98.14                                                                         | 80.81                                                                | 66.00                                                             | 28.46                                                              | 44.95                                                             | 92.46                                                               | 48.53 |
| Sindt                                                   |                                              |                                                          |                                                                                |                                                                      |                                                                                                           |                                                                                  |                                                                                  |
| Karachi                                                 | 6.75                                         | 99.67                                                    | 99.90                                                                         | 89.00                                                                | 91.00                                                             | 32.00                                                              | 89.88                                                             | 94.00                                                               | 95.00 |
| Mepur Rhas                                              | 1.37                                         | 94.51                                                    | 96.87                                                                         | 58.55                                                                | 41.67                                                             | 40.46                                                              | 36.84                                                             | 96.77                                                               | 87.27 |
| Larkana                                                 | 3.12                                         | 97.03                                                    | 99.06                                                                         | 72.65                                                                | 56.51                                                             | 36.38                                                              | 30.66                                                             | 98.13                                                               | 95.36 |
| Hyderabad                                               | 4.16                                         | 98.17                                                    | 99.03                                                                         | 75.24                                                                | 62.95                                                             | 40.83                                                              | 56.96                                                             | 88.52                                                               | 80.07 |
| Sukkur                                                  | 3.75                                         | 97.88                                                    | 99.18                                                                         | 72.09                                                                | 53.55                                                             | 24.92                                                              | 40.98                                                             | 95.83                                                               | 95.58 |
| KP                                                      |                                              |                                                          |                                                                                |                                                                      |                                                                                                           |                                                                                  |                                                                                  |
| Mardan                                                  | 2.60                                         | 98.47                                                    | 98.47                                                                         | 88.87                                                                | 72.40                                                             | 27.35                                                              | 46.36                                                             | 89.06                                                               | 88.25 |
| Banu                                                    | 3.38                                         | 92.20                                                    | 97.49                                                                         | 55.73                                                                | 65.29                                                             | 14.94                                                              | 64.61                                                             | 94.97                                                               | 93.43 |
| Malakand                                                | 3.65                                         | 95.26                                                    | 99.13                                                                         | 77.55                                                                | 63.25                                                             | 25.94                                                              | 47.64                                                             | 92.47                                                               | 81.86 |
| Kohat                                                   | 3.83                                         | 94.88                                                    | 99.40                                                                         | 73.83                                                                | 67.85                                                             | 17.87                                                              | 57.71                                                             | 91.00                                                               | 85.04 |
| DI Khan                                                 | 4.01                                         | 96.82                                                    | 99.28                                                                         | 70.46                                                                | 44.86                                                             | 31.61                                                              | 33.49                                                             | 91.18                                                               | 92.29 |
| Peshawar                                                | 14.34                                        | 95.59                                                    | 99.10                                                                         | 90.11                                                                | 79.41                                                             | 23.55                                                              | 60.31                                                             | 87.08                                                               | 81.91 |
| Hazara                                                  | 5.22                                         | 97.73                                                    | 99.35                                                                         | 67.52                                                                | 59.36                                                             | 19.21                                                              | 47.87                                                             | 92.63                                                               | 78.44 |
| Balochistan                                             |                                              |                                                          |                                                                                |                                                                      |                                                                                                           |                                                                                  |                                                                                  |
| Kalat                                                   | 5.82                                         | 98.64                                                    | 99.87                                                                         | 65.09                                                                | 51.22                                                             | 20.16                                                              | 39.11                                                             | 90.51                                                               | 89.58 |
| Makran                                                  | 6.00                                         | 94.03                                                    | 99.28                                                                         | 54.34                                                                | 35.88                                                             | 26.71                                                              | 34.68                                                             | 87.49                                                               | 95.39 |
| Nasirabad                                               | 3.97                                         | 97.84                                                    | 99.76                                                                         | 46.92                                                                | 22.27                                                             | 28.84                                                              | 16.34                                                             | 95.89                                                               | 99.45 |
| Zhob                                                    | 5.58                                         | 99.77                                                    | 100.00                                                                        | 60.36                                                                | 23.88                                                             | 19.41                                                              | 20.66                                                             | 96.06                                                               | 85.02 |
| Quetta                                                  | 27.54                                        | 99.15                                                    | 99.76                                                                         | 53.43                                                                | 26.23                                                             | 20.40                                                              | 51.65                                                             | 89.03                                                               | 91.50 |
| Sibi                                                    | 8.60                                         | 98.59                                                    | 100.00                                                                        | 30.81                                                                | 30.13                                                             | 25.23                                                              | 32.10                                                             | 90.42                                                               | 87.94 |
| Islamabad                                               | 37.88                                        | 99.93                                                    | 100.00                                                                        | 90.00                                                                | 96.00                                                             | 76.00                                                              | 88.32                                                             | 100.00                                                              | 96.00 |

*A child is considered fully immunized if it has received the following vaccines: Bacille Calmette Guerin (BCG), 3 doses of Diphtheria Pertussis Tetanus (DPT), 3 doses of Polio, Measles, and 3 doses of Hepatitis.*
## Appendix Table 2. Efficiency Score for Each Decision Management Unit

| Decision Management Unit (Division) | UHC performance (DEA score) | Decision Management Unit (Division) | UHC performance (DEA score) |
|-------------------------------------|----------------------------|-------------------------------------|----------------------------|
| Punjab                              |                            | KP                                  |                            |
| Rawalpindi                          | 100.00%                    | Mardan                              | 100.00%                    |
| Gujranwala                          | 98.64%                     | Bannu                               | 92.60%                     |
| DG Khan                             | 98.16%                     | Malakand                            | 92.50%                     |
| Sahiwal                             | 96.84%                     | Kohat                               | 91.81%                     |
| Sargodha                            | 96.67%                     | DI Khan                             | 87.84%                     |
| Multan                              | 90.55%                     | Peshawar                            | 87.67%                     |
| Faisalabad                          | 89.40%                     | Hazara                              | 84.98%                     |
| Lahore                              | 88.20%                     | Balochistan                         |                            |
| Bahawalpur                          | 83.72%                     | Kalat                               | 82.33%                     |
| Sindh                               |                            |                                     |                            |
| Karachi                             | 100.00%                    | Nasirabad                           | 79.68%                     |
| Mirpur Khas                         | 100.00%                    | Zhob                                | 75.41%                     |
| Larkana                             | 95.17%                     | Quetta                              | 73.33%                     |
| Hyderabad                           | 93.95%                     | Sibi                                | 71.38%                     |
| Sukkar                              | 91.42%                     | Islamabad                           | 100%                       |