

Influence Factors on Mortality Rates at Punjab District Level

MUHAMMAD KHALID¹, CHRISTIAN LORENZ², MADIHA AMJAD³

ABSTRACT

Even within the same country the quality of health services might differ significantly between regions, whether the area is more or less prosperous, urban or rural and capital area or in the province. Aiming at equity of health systems, governments are paying attention on the geographical distribution of sub national health expenditures. Accounting these expenditures on disaggregated levels allows decision makers to adjust tailor made health policies. Health expenditure data for Pakistan published in 2009 allow for further analysis on impacts of health expenditures on the health situation of the population at district level. This paper couples expenditures with outcome measures by measuring the impact of public health expenditures on people's health status, which is reflected by mortality rates. We aim in measuring the importance of public health expenditures compared to private health expenditures, availability of health facilities and other influence factors on mortality rates in district wise estimations. Our findings show in two models that public expenditure, private facilities in urban areas, private urban health expenditure and distance to the next health care facility are significantly related to both IMR and U5MR. Possible reasons for these results are that people have easy access to private facilities as their number is higher than that of public facilities, the quality of services is better and people have better purchasing power as socioeconomic status of urban population is relatively better compared to rural population.

Key words: Health financing, mortality rate, regional disparities, health equity

INTRODUCTION

Even within the same country the quality of health services might differ significantly between regions, whether the area is more or less prosperous, urban or rural, capital area or in the province. Aiming at equity of health systems, governments are paying attention on the geographical distribution of subnational health expenditures. Accounting these expenditures on disaggregated levels allows decision makers to adjust tailor made health policies.

National Health Accounts (NHA) data for Pakistan published in 2009 allow for further analysis on impacts of health expenditures on the health situation of the population at district level. This paper couples expenditures with outcome measures by measuring the impact of public health expenditures on people's health status, which is reflected by mortality rates. We aim in measuring the importance of public health expenditures compared to private health expenditures, availability of health facilities and other influence factors on mortality rates in district wise estimations. Mortality rates are commonly used for the assessment of the health level in a country¹. Pakistan is categorized by World Bank as lower middle income country². For 2008 in this group infant mortality rates (IMR) are lowest in Vietnam (12 per 1000 live births)

compared to Angola which has the highest infant mortality rate (130/1000); In Pakistan 72 children died per 1000 live births. For under five mortality (U5MR), Thailand and Vietnam have 14 per 1000 live births and Angola again has highest with 220. Pakistan's under five mortality rate is 89.

Figure 1 shows infant (square) and under five (circle) mortality rates for 1990, 2000 and 2008 for selected South Asian countries. Except Afghanistan all South Asian countries have lower mortality rates in 2008 as compared to Pakistan and also show a decreasing trend through 1990 to 2008 in mortality rates. It is important to mention that Bangladesh, Bhutan and Nepal started in 1990 with similar levels as Pakistan, but all three managed to decrease mortality much better than Pakistan. Bhutan managed to decrease its mortality rates on average by 43%, Bangladesh and Nepal even by 61% on average compared to only 30% in Pakistan. This leads to the question whether only the amount of inputs into the health systems is responsible for this development or also the allocation of resources on different influence factors for mortality.

Section 2 describes the data for mortality rates and their influence factors in Punjab and their sources. Section 3 explains the applied methodology and describes the models applied to measure the degree of influence as well as additional influence factors and gives the results of the empirical analyses. Section 4 concludes and describes demand for future research.

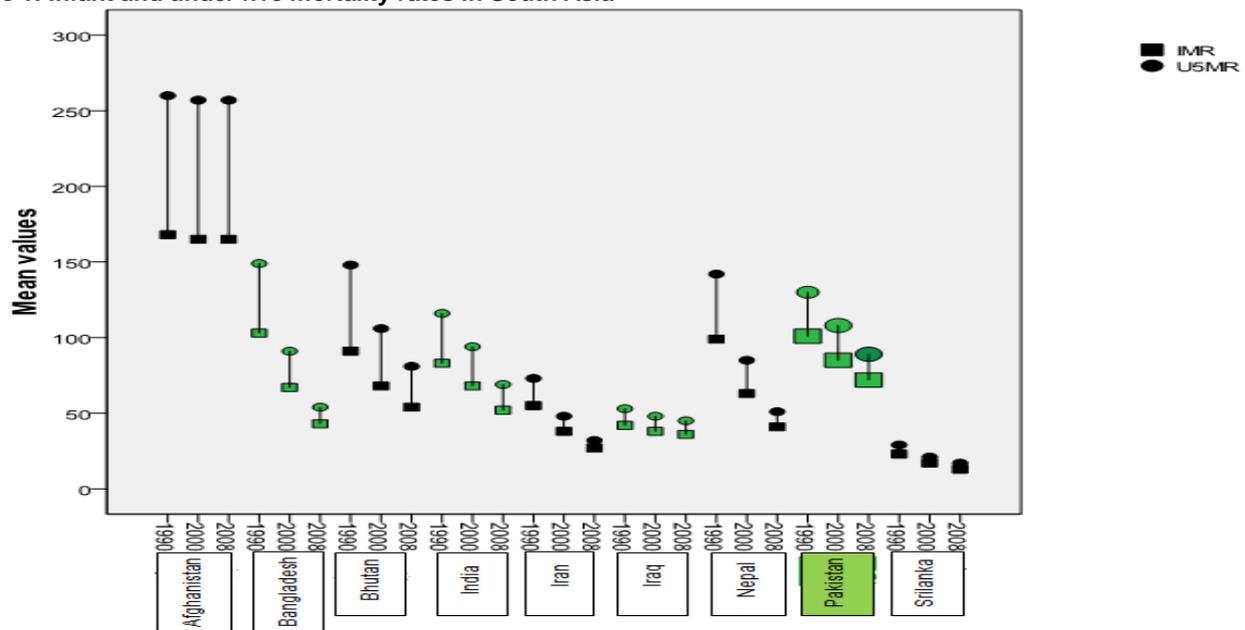
Centre for Applied Economic Research (CAWM), Muenster University, Germany.

Federal Bureau of Statistics, Statistics Division, Govt. Pakistan.

Correspondence to Dr. Muhammad Khalid, Program Senior Technical Expert Public Health, Pakistan

Email: dr_khalid_m@hotmail.com

Figure 1: Infant and under five mortality rates in South Asia



Source: Author's calculations based on data from WHO³.

Data description and variables

The data used in this paper come from a variety of sources. We are measuring the impacts of several factors on population's health which is represented by mortality rates. Since mortality rates only change in the long run and due to data availability gaps, we use sources from different years in the model.

Mortality rates, female literacy, antenatal care, skilled attendance and distance to the health facility

Mortality rates are commonly applied as indicator for the health assessment of population parts. Typical mortality rates are measured for neonates, infants, under five year old, and adults. Neonatal Mortality rate is the number of deaths during the first 28 completed days of life per 1000 live births in a given year or period; it is generally a good indicator of both maternal and newborn health and care. Infant Mortality Rate (IMR) is the probability of dying between birth and one year of age expressed per 1000 live births. The under-five mortality rate has also been used as an indicator of the health status of the population and the overall development of the countries and is also one of the MDG indicators⁴. The under-five mortality rate is the probability of dying between birth and exactly five years of age per 1000 live births. Adult mortality rate is defined as the probability that a 15 year old person will die before reaching his/her 60th birthday⁵. Maternal Mortality Ratio is the ratio of the number of maternal deaths per 100000 live births⁶. Different mortality rates are used in the literature however,

infant mortality rate has been used as a measure of population health and there is evidence reflecting the intuition that structural factors affecting the health of entire populations have an impact on the mortality rate of infants⁷.

So this paper would primarily be using the infant mortality rate (IMR) and the under-five mortality rate (U5MR) as proxy indicators of the health of the entire population and trying to see which factors influence these indicators to what extent at district level. IMR and U5MR at district level for Punjab have been obtained from the Multiple Indicator Cluster Survey (MICS) Punjab.

Female literacy is one of the socioeconomic variables which have been studied to assess its impact on IMR⁸. The variable antenatal care includes the percentage of women aged 15-49 years who gave birth in the preceding two years accessed antenatal care from any skilled personnel. The variable skilled attendant includes the percentage of women aged 15-49 years who gave birth in the preceding two years and whose delivery was attended by any skilled personnel. The variable distance from health facility includes distance from the nearest facility in terms of time required to reach these facilities. The data was recorded in percentage of people with health facilities under 30 minutes access. The variables female literacy, antenatal care, skilled attendant, distance from health facility by districts was obtained from MICS Punjab⁹.

Table 1: MICS Variables Punjab 2007-08

District	Female literacy	Antenatal care	Skilled attend- dant	Distance from health facility	IMR	U5MR
Attock	43.9	57.9	46.7	60.5	110	170
Bahawalnager	33.9	38.4	28.8	50.9	84	123
Bahawalpur	30.4	43.3	27.3	63.5	98	148
Bhakker	30.2	38.6	33.7	63.3	78	113
Chakwal	54.3	62.9	57.9	81.7	72	103
Dera Ghazi Khan	26.1	43.5	21.9	59.3	86	128
Faisalabad	53.1	61.4	56.4	90.2	110	170
Gujaranwala	61.7	69.2	59.1	95.9	75	108
Gujrat	63.5	85	67.7	93.6	88	130
Hafizabad	43	55.9	41.5	91.5	64	90
Jhang	30.5	39.6	34.7	67.2	67	95
Jhelum	63.2	75.5	62	87.4	70	100
Kasur	31.8	36.4	28.9	70.4	67	94
Khanewal	36.2	44.3	36.1	70.4	78	113
Khushab	34.7	49.9	42.1	79.2	82	120
Lahore	66.8	73.4	66.1	92	52	70
Layyah	34	37.6	25.6	57.8	53	72
Lodhran	24	45.7	30.5	50.5	77	112
Mandi Bahauddin	50.7	59.3	34.8	77	81	117
Mianwali	32.5	43.6	31.2	58.7	79	116
Multan	37.8	43.6	38.8	72	54	73
Muzaffargarh	25.4	44.4	19.9	57	92	138
Narowal	51.3	64.3	44.8	90.3	82	119
Okara	33.4	34.2	34.6	70.1	89	132
Pakpattan	29.4	36.1	27.4	41.1	109	167
Rahim Yar Khan	17.5	37.1	11.7	47	83	121
RajanPur	68.3	74.6	67.5	82.3	40	52
Rawalpindi	28.3	40.4	28.1	54.8	45	60
Sahiwal	40.1	52.5	49.8	88.7	60	82
Sargodha	43	54	44.8	88.7	51	69
Shiekupura	48.2	63.5	53.4	78	71	101
Sialkot	64.5	67.9	58.7	83.4	82	119
Toba Tek Singh	49.8	56.9	44.4	69.1	75	108
Vehari	32.4	39.9	32.9	81.3	78	113

Source: Planning and Development Department, Multiple Indicator Cluster Survey Punjab, 2007-08.

Table 2: Public health care facilities in Punjab districts (2008 per 100,000 persons)

District	BHU	RHC	Hospit- als	Oth- ers	To- tal	District	BHU	RHC	Hospit- als	Oth- ers	To- tal
Attock	3.67	0.32	0.39	0.64	5.02	Lodhran	3.21	0.27	0.20	0.54	4.22
Bahawalnager	3.95	0.39	0.20	1.68	6.23	M.B Din	3.65	0.58	0.15	1.39	5.76
Bahawalpur	2.22	0.31	0.13	0.41	3.07	Mianwali	3.07	0.69	0.23	2.23	6.22
Bhakker	2.99	0.30	0.22	1.20	4.71	Multan	1.91	1.91	0.05	0.96	4.83
Chakwal	5.02	0.70	0.23	0.23	6.18	Muzaffargarh	2.00	0.37	0.08	0.82	3.26
D.G Khan	2.41	0.00	0.09	1.91	4.40	Narowal	3.72	0.46	0.13	0.46	4.78
Faisalabad	2.48	0.18	0.07	0.62	3.34	Okara	3.50	0.36	0.11	0.43	4.41
Gujaranwala	2.01	0.23	0.09	1.03	3.36	Pakpattan	3.30	0.25	0.19	0.68	4.41
Gujrat	3.57	0.36	0.08	1.52	5.53	R.Y Khan	2.50	0.46	0.10	0.24	3.29
Hafizabad	3.04	0.39	0.20	2.06	5.68	RajanPur	2.17	0.41	0.20	1.15	3.93
Jhang	1.75	0.35	0.09	1.11	3.29	Rawalpindi	2.28	0.23	0.12	1.19	3.82
Jhelum	3.90	0.44	0.27	0.89	5.49	Sahiwal	3.36	0.45	0.13	1.16	5.10
Kasur	2.70	0.40	0.07	0.30	3.47	Sargodha	3.68	0.44	0.16	1.51	5.79
Khanewal	3.19	0.16	0.16	0.31	3.81	Shiekupura	1.54	0.17	0.05	0.73	2.49
Khushab	3.50	0.46	0.37	1.56	5.89	Sialkot	2.66	0.24	0.12	0.94	3.95
Lahore	0.43	0.07	0.03	0.93	1.47	T.T. Singh	3.37	0.31	0.15	1.23	5.05

 Source: Own calculations based on Punjab Health Sector Reform Program¹⁰ and Punjab Development Statistics 2008¹¹.

Health care facilities: The public health care facilities data have been obtained at provincial and district level. In order to have harmonization between provinces and districts the public health care facilities have been categorised as 1) BHU, 2) RHC, 3) Hospitals and 4) others.

For public health care facilities in Punjab, data has been obtained at district level from the Punjab Health Sector Reform Programme (PHSRP) which mainly includes BHUs, RHCs, and hospitals. However, this source does not cover health facilities like dispensaries, sub-health centres, TB clinics, Maternal and Child Health Centres, leprosy clinic which are covered from the Punjab Development Statistics

2008. Facilities reported in table 2 are per facility for per 100,000 persons.

Data on the number of private health facilities at a district level have been extracted from the economic census (2003) database. Due to limitation of availability of data, the number of private health facilities at district level cannot be disaggregated into various types of health care providers. Facilities reported in table 3 are for facility per 100,000 persons.

Private Expenditure

For the private expenditures, the Household Integrated Economic Survey (HIES) 2007-08 has been used. Two questions cover health related expenditure in HIES: medicine purchased¹⁵ and doctor's fee¹⁶.

Table 3: Private health care facilities Punjab districts (2003 per 100,000 persons)

District	Private Health Facilities			District	Private Health Facilities		
	Urban	Rural	Total		Urban	Rural	Total
Attock	21.87	22.77	44.63	Lodhran	45.50	20.61	66.11
Bahawalnager	20.99	19.54	40.52	M.B Din	41.28	25.16	66.44
Bahawalpur	34.38	42.92	77.29	Mianwali	25.80	21.19	46.99
Bhakker	41.46	21.07	62.52	Multan	43.88	47.79	91.67
Chakwal	23.80	20.94	44.74	Muzaffargarh	40.56	15.61	56.17
Dera Ghazi Khan	27.51	18.16	45.67	Narowal	40.75	19.98	60.73
Faisalabad	47.34	67.18	114.52	Okara	64.86	41.56	106.42
Gujaranwala	28.15	65.94	94.09	Pakpattan	60.19	24.81	85.00
Gujrat	37.23	37.31	74.53	Rahim Yar Khan	29.52	22.03	51.55
Hafizabad	26.27	38.81	65.08	RajanPur	23.47	16.14	39.61
Jhang	53.38	39.21	92.59	Rawalpindi	14.11	49.67	63.78
Jhelum	32.78	37.83	70.61	Sahiwal	61.50	28.33	89.84
Kasur	31.89	25.06	56.94	Sargodha	47.42	35.56	82.99
Khanewal	51.48	29.24	80.72	Shiekupura	24.73	29.99	54.73
Khushab	35.50	34.58	70.09	Sialkot	55.20	35.29	90.49
Lahore	11.48	71.90	83.37	Toba Tek Singh	52.54	33.85	86.39

Source: Author's calculation based on Federal Bureau of Statistics, Economic Census database, 2003.

Table 4: Private Health Expenditures (Per Capita) Punjab Districts (2007-08)

District	Urban per cap	Rural per capita	Tot per capita	District	Urban per capita	Rural per capita	Tot per capita
Attock	1,483.8975	626.5205	1,055.2090	Lodhran	1,156.1188	713.8272	934.9730
Bahawalnager	384.3124	972.5057	678.4090	M B. Din	1,660.0159	1,121.4351	1,390.7255
Bahawalpur	1,517.7356	747.6103	1,132.6730	Mianwali	1,258.3259	697.6048	977.9653
Bhakker	1,172.3852	644.8402	908.6127	Multan	1,349.7422	575.6348	962.6885
Chakwal	549.0413	1,013.1268	781.0841	Muzaffargarh	753.6106	644.8441	699.2274
Dera Ghazi Khan	1,296.6718	537.9932	917.3325	Narowal	2,064.6462	923.1293	1,493.8877
Faisalabad	900.5314	539.9957	720.2636	Okara	644.1950	758.7276	701.4613
Gujaranwala	1,428.2107	1,119.3928	1,273.8018	Pakpattan	153.1029	888.4367	520.7698
Gujrat	1,206.6517	1,330.0261	1,268.3389	R.Y Khan	1,004.9867	874.3017	939.6442
Hafizabad	1,674.4796	1,196.6204	1,435.5500	RajanPur	1,095.9401	465.8537	780.8969
Jhang	67.5997	944.8122	506.2060	Rawalpindi	785.9020	1,004.3896	895.1458
Jhelum	1,364.9053	716.3934	1,040.6494	Sahiwal	232.8788	1,156.6016	461.8614
Kasur	1,270.3017	409.9440	840.1229	Sargodha	1,148.2427	707.2979	927.7703
Khanewal	1,081.5770	771.9388	926.7579	Shiekupura	712.3632	736.2317	724.2974
Khushab	364.8124	955.1724	659.9924	Sialkot	1,194.1139	1,329.5637	1,261.8388
Lahore	487.2662	1,035.8839	761.5751	T T. Singh	1,198.1224	571.8383	884.9803

Source: Author's calculation based on Federal Bureau of Statistics, HIES data, 2007-08.

Table 5: Total consumption per capita per month Punjab districts (2007-08)

District	Consumption		District	Consumption	
	Urban	Rural		Urban	Rural
Attock	3338.67	2138.41	Lodhran	2705.8	1447.46
Bahawalnager	2438	1500.39	Mandi Bahauddin	3031.42	2169.7
Bahawalpur	2438	1577.04	Mianwali	2714.4	1878.42
Bhakker	2737	1345.44	Multan	2705.8	1554.66
Chakwal	3338.67	2106.69	Muzaffargarh	1082.14	1431.4
Dera Ghazi Khan	1082.14	1238.07	Narowal	3031.42	2240.29
Faisalabad	2714.4	2090.23	Okara	3113.41	1836.63
Gujaranwala	3031.42	2266.65	Pakpattan	2705.8	1644.92
Gujrat	3031.42	2408.53	Rahim Yar Khan	2438	1297.62
Hafizabad	3031.42	1904.01	RajanPur	1082.14	1254.62
Jhang	2714.4	1891.35	Rawalpindi	3338.67	2481.27
Jhelum	3338.67	2136.74	Sahiwal	2705.8	1783.98
Kasur	3113.41	1614.09	Sargodha	2737	1747.64
Khanewal	2705.8	1417.86	Shiekupura	3113.41	1902.24
Khushab	2737	1750.74	Sialkot	3031.42	2140.9
Lahore	3113.41	2671.75	Toba Tek Singh	2714.4	1915.02
Layyah	1082.14	1158.91	Vehari	2705.8	1610.15

Source: Author's calculation based on Federal Bureau of Statistics, HIES data, 2007-08.

Total Consumption:

For the total consumption on all household items of the province Punjab, the Household Integrated Economic Survey (HIES) 2007-08 has been used. The variable includes household's expenditure on all household items including food and non food items; also basic food items are included.

Population:

For the purpose of analysis and comparison between districts the variables public facilities, private facilities (per 100,000 persons), and private health expenditures were converted to per capita. For this purpose the population by district is required, which has been calculated using the following methodology. Since the exact size of Pakistan's population is unknown and the latest population census has been carried out in 1998, the absolute population figure on district level has to be estimated on the basis of 1998 results. Three methods have been considered to extrapolate the population and get the total estimate of the population on district level.

1) HIES weight factor approach

The weights for each district are available in the HIES (Household Integrated Expenditure Survey), 2007-08 dataset. By applying these weighting factors to each household multiplied with the average household size per primary sampling unit, the total population is about 130 million only, which is very low as compared to the actual population of a 2007 estimation of about 173 million from National Institute of Population Studies¹⁴.

2) 1998 population share approach

The population share is calculated from the 1998 total population figure and then applied to all districts. This approach distributes the growths between the

total population in 1998 and 2007 equally between all districts. As the growth rate is very heterogeneous between districts the following projection approach is applied.

3) Projection approach

The projection approach applies the average growth rates from 1981-1998 on the base year population from 1998¹⁵ using the following formula for projection:

$$P_c = P_0 (1+r)^n \text{ with}$$

P_c = projected population (2007)

P_0 = base year population (1998)

r = average growth rate 1981-1998

n = projected year 2007 – base year 1998.

The total population estimate is about 169 million with this estimate, which is much closer to the recent year total population figure of NIPS 2010 of 173 million.

METHODOLOGY AND RESULTS

The econometric approach is based on regressions in equations for under-five mortality and infant mortality rates. The specification allows for identification of the channels through which government expenditure and other influence factors affect these health outcomes over time. Due to data availability and in order to demonstrate impacts on district level, we apply several models including additional factors and dealing on district level. For Punjab we ran a pure district model, i.e. all relevant influence factors were available on district level. Influence factors private facilities (per 100,000 patients), public facilities (per 100,000 patients) and private expenditure are converted into per capita using the projected population approach to each district for the conversion. We use the following regression model in order to analyse the

relationship between the regressors and the influence factors.

$$IMR = \alpha + \beta_1 Pubfac + \beta_2 Prifac_{urb} + \beta_3 Prifac_{rur} + \beta_4 pubexp + \beta_5 Priexp_{urb} + \beta_6 Priexp_{rur} + \beta_7 femlit_{urb} + \beta_8 femlit_{rur} + \beta_9 cons_{urb} + \beta_{10} cons_{rur} + \beta_{11} AC + \beta_{12} SA + \beta_{13} D \quad (1)$$

$$U5MR = \alpha + \beta_1 Pubfac + \beta_2 Prifac_{urb} + \beta_3 Prifac_{rur} + \beta_4 pubexp + \beta_5 Priexp_{urb} + \beta_6 Priexp_{rur} + \beta_7 femlit_{urb} + \beta_8 femlit_{rur} + \beta_9 cons_{urb} + \beta_{10} cons_{rur} + \beta_{11} AC + \beta_{12} SA + \beta_{13} D \quad (2) \text{ with}$$

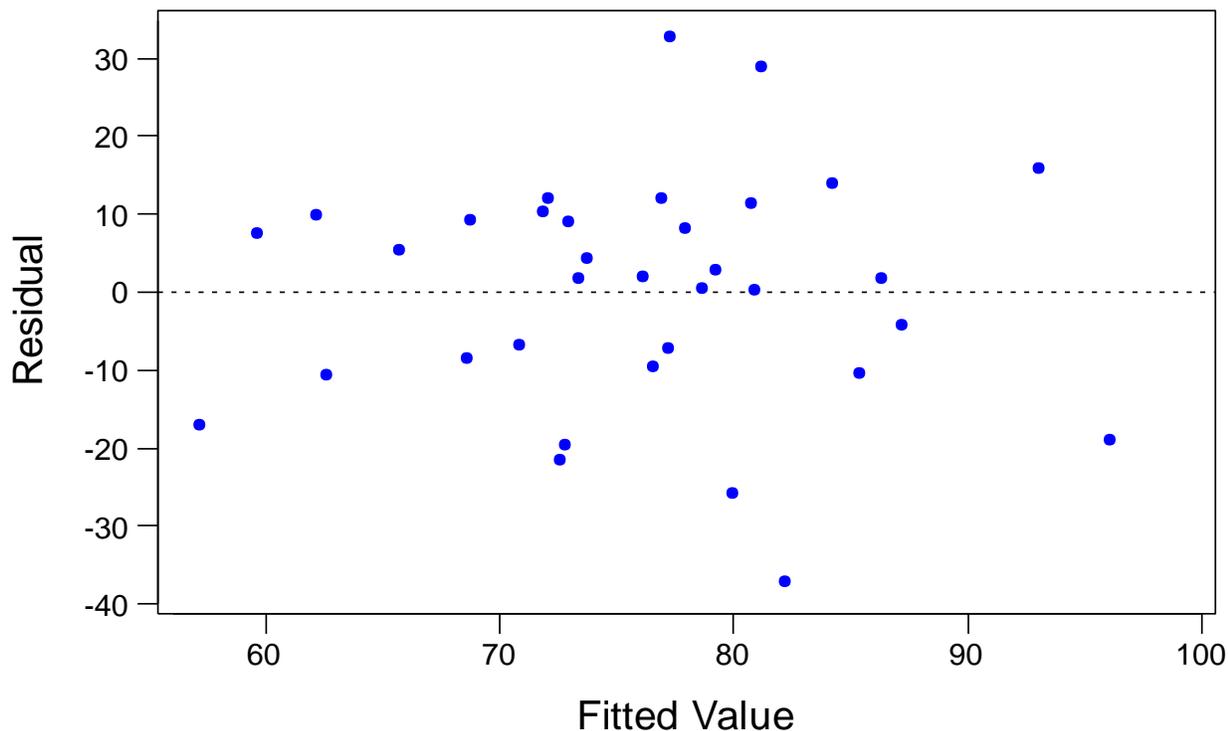
- IMR = infant Mortality Rate
- U5MR = under five mortality rate
- Pubfac=public facilities, that includes BHU, RHC, hospital and other public facilities
- Prifac_urb = private facilities in urban areas
- Prifac_rur= private facilities in rural areas
- Pubexp= public expenditure
- Priexp_urb= private Expenditure in urban areas
- Priexp_rur=private Expenditure in rural areas
- Femlit_urb=female literacy at age 15 year & above in urban areas.
- Femlit_rur=female literacy at age 15 year and above in rural areas.
- Cons_urb=consumption per capita per month of persons living in urban areas
- Cons_rur=consumption per capita per month of persons living in rural areas
- AC = percentage of women age 15-49 receive antenatal care
- SA = %age of women age 15-49 receive skilled attendant at the time of delivery
- D=distance from the nearest facility in terms of time required to reach the facility.

In the following we check the quality of the applied data from several sources in our database and analyse the outcomes of running the described regression models on them.

Figure 2 shows that our data points are evenly scattered and also fulfil the assumptions of normality of residuals. There is no heteroscedasticity in the data which was checked by applying White hetroscedasticity test. As the data was cross sectional it was not checked for autocorrelation. The main assumptions for applying the regression model are thus fulfilled.

Applying the described models (1) and (2) leads to the following results. Running the regressions for both models for both types of mortality rates shows that some variables are highly insignificant. Therefore in model 1 the variable Skilled Attendant at time of delivery has been excluded. Model 2 excludes the variables Antenatal care received by women as well as the variable Skilled Attendant.

Figure 2: Residuals vs. fitted values



Source: Author’s calculations based on MICS Punjab, HIES 2007-08, Punjab Development Statistics, Punjab Health Sector Reform Programme and NHA Pakistan.

Table 6: Regression results for model 1

	Dependent Variable: IMR					Dependent Variable: U5MR			
	B	Std. Error	t	Sig.		B	Std. Error	t	Sig.
(Constant)	12.867	43.913	0.293	0.772	(Constant)	2.11	73.804	0.029	0.977
pubfac	-572238.12	466403.27	-1.227	0.233	Pubfac	-994296.48	783882.54	-1.268	0.219
Prifac_urb	19582.563	11243.322	1.742	0.096**	Prifac_urb	32891.843	18896.617	1.741	0.096**
Prifac_rur	16069.472	19141.915	0.839	0.411	Prifac_rur	27183.704	32171.758	0.845	0.408
pubexp	0.213	0.122	1.742	0.096**	Pubexp	0.374	0.206	1.819	0.083**
priexp_urb	0.013	0.008	1.676	0.109	priexp_urb	0.022	0.013	1.687	0.106
priexp_rur	0.004	0.016	0.241	0.812	priexp_rur	0.004	0.027	0.149	0.883
cons_urb	0.011	0.008	1.282	0.214	cons_urb	0.018	0.014	1.256	0.223
cons_rur	0.02	0.018	1.069	0.297	cons_rur	0.037	0.031	1.18	0.251
femlit_urb	-0.05	0.549	-0.09	0.929	femlit_urb	-0.052	0.922	-0.057	0.955
femlit_rur	-0.618	0.579	-1.067	0.298	femlit_rur	-1.111	0.974	-1.141	0.267
D	-0.989	0.344	-2.874	0.009*	D	-1.695	0.578	-2.932	0.008*
AC	0.484	0.44	1.099	0.284	AC	0.825	0.739	1.116	0.277
R Square	0.409				R Square	0.416			
Adjusted R Square	0.071				Adjusted R Square	0.083			
Std. Error of Estimate	16.719				Std. Error of Estimate	28.099			

Source: Author's calculations based on MICS Punjab, HIES 2007-08, Punjab Development Statistics, Punjab Health Sector Reform Programme and NHA Pakistan. With * P-value < 0.05, ** P-value < 0.1.

Table 7: Regression results for model 2

(Constant)	Dependent Variable: IMR				(Constant)	Dependent Variable: U5MR			
	B	Std. Error	t	Sig.		B	Std. Error	t	Sig.
(Constant)	20.682	43.538	0.475	0.639	(Constant)	15.444	73.234	0.211	0.835
pubfac	-654376.44	462545.33	-1.415	0.171	Pubfac	-1134430.5	778041.45	-1.458	0.159
Prifac_urb	17109.37	11067.714	1.546	0.136	Prifac_urb	28672.393	18616.856	1.54	0.138
Prifac_rur	12658.812	18977.67	0.667	0.512	Prifac_rur	21364.866	31922.091	0.669	0.51
pubexp	0.236	0.121	1.944	0.065**	Pubexp	0.413	0.204	2.023	.055**
priexp_urb	0.014	0.008	1.883	0.073**	priexp_urb	0.024	0.013	1.895	.071**
priexp_rur	0.005	0.016	0.315	0.756	priexp_rur	0.006	0.027	0.224	0.825
cons_urb	0.007	0.008	0.915	0.37	cons_urb	0.012	0.013	0.879	0.389
cons_rur	0.024	0.018	1.342	0.193	cons_rur	0.044	0.03	1.458	0.159
femlit_urb	0.004	0.549	0.008	0.994	femlit_urb	0.04	0.924	0.043	0.966
femlit_rur	-0.5	0.572	-0.874	0.391	femlit_rur	-0.91	0.962	-0.946	0.354
D	-0.768	0.281	-2.736	0.012*	D	-1.319	0.472	-2.792	.011*
R Square	0.375				R Square	0.382			
Adjusted R Square	0.063				Adjusted R Square	0.073			
Std. Error of Estimate	16.797				Std. Error of Estimate	28.255			

Source: Author's calculations based on MICS Punjab, HIES 2007-08, Punjab Development Statistics, Punjab Health Sector Reform Programme and NHA Pakistan with * P-value < 0.05, ** P-value < 0.1.

The table 6 (model 1) shows that the independent variables private facility in urban areas, public expenditure and distance are significantly related to both IMR and U5MR. All other independent variables have a non-significant relationship with IMR and U5MR. Using univariate regression analysis and applying log to the variables does not affect the significance of the results much. The independent variables show low correlation with the dependent variables. Table 7 (model 2) shows that the independent variables public expenditure, private expenditure in urban areas and the distance from the next health facility are significantly related to both IMR and U5MR. The results clearly indicate that the amount of public spending on health and better access to health facilities significantly influences the mortality rates of children in the area.

People have easy access to private facilities in urban areas as the number of private health care fa-

ilities is relatively higher and they also have a better quality of services compared to public health facilities. In addition, socioeconomic conditions of people are relatively better compared to rural areas providing them the purchasing power to opt for the private sector.

The findings of this study have shown both public and private health spending to have significant impact on mortality rates, as opposed to previous studies which found no significant relationship between health care spending and changes in mortality rates^{16,17,18}. Zhang²⁰ et al (2007) identify a significant relationship between public and private spending on the individual health level. Their findings indicate that there is a difference in public health spending of urban and rural residents and give reason that urban residents with high income can benefit a lot from a relatively stable and quality health care system and insurance system in urban areas¹⁹.

CONCLUSION

Analysing the equity of the Pakistani health system, we have a closer look at the geographical distribution of subnational (i.e., district) health expenditures. We couple expenditures on health with outcome measures operationalized by mortality rates in several regression models. In the first model we found significant influence of the variables private urban health facilities, public health expenditure and distance to the next health facility, which have impacts on mortality (infant and under five) rates. In a second model, we find that public health expenditure, private urban health expenditure and distance to the next health facility have significant influence on the mortality rate.

Interestingly, private health expenditures as well as private health facilities only in urban areas do have an influence on mortality due to the better service quality of urban health facilities, which are in majority paid out of pocket. In contrast to that, the influence of public facilities stays insignificant due to poor service conditions and non availability of doctors; the health care quality matters.

Possible reasons that private facilities in urban areas are significantly related to IMR and U5MR but not to private health facilities in rural areas are a) people in urban areas have better socioeconomic conditions and therefore better purchasing power than rural areas b) the quality of services in private sector facilities in urban areas is much better than in private sector facilities in rural areas. Possible reasons that private health facilities in urban areas significantly influence IMR and U5MR but not private health facilities in rural areas are a) people in urban areas live in better socioeconomic conditions and their purchasing power is higher than in rural areas b) the quality of services in private sector facilities in urban areas is much better than in private sector facilities in rural areas. The distance to the next health facility is significant in both models, which shows the positive influence of the urbanisation level on mortality rates.

Overall, we found that the situation in the districts is very heterogeneous and therefore, health system research ideally should be done even on Tehsil level to be able to cover the real situation of subnational levels. This is only possible if data are made available also by provincial and Tehsil authorities and that data allow for a sufficient level of comparability.

REFERENCES

1. Program Manager at Save the Children International
2. Centre for Applied Economic Research (CAWM), Muenster University, Germany. Opinions and points of view expressed in this article are those of the authors only and do not necessarily reflect any official position or policy.
3. Federal Bureau of Statistics, Statistics Division, Government of Pakistan.
4. World Health Organization, World Health Statistics includes mortality rates for 53 lower middle income countries, <http://www.who.int/whosis/whostat/2008/en/index.html>.
5. Lower middle income group countries are according to World Bank defined as countries with a GNI per capita between 996-3,945 USD. <http://data.worldbank.org/about/country-classifications> The full list of LMIC can be found here http://econ.worldbank.org/external/datastatistics/0,contentMDK:20421402~menuPK:64133156~pagePK:64133150~piPK:64133175~theSitePK:239419,00.html#Lower_middle_income
6. WHO, World Health Statistic, 2010.
7. WHO, Health statistics and health information systems, Health Status Statistics: Mortality.
8. WHO, Statistical Information System (WHOSIS), Adult mortality.
9. World Health Organisation, Health statistics and health information systems, maternal mortality ratio.
10. Reidpath; Allotey, Infant mortality rate as an indicator of population health, 2003.
11. Terra de Souza et. al., Variations in infant mortality rates among municipalities, 1999.
12. Planning and Development Department, Multiple Indicator Cluster Survey Punjab, 2007-08.
13. Punjab Health Sector Reform Program (PHSRP), <http://www.phsrp.punjab.gov.pk/>.
14. Punjab Development Statistics, www.pndpunjab.gov.pk/user_files/File/PDS08.pdf.
15. Code 5601 includes medicines & vitamins, medical apparatus and other equipment/supplies etc.
16. Code 5602 includes medical fees paid to doctors, specialists, Hakeem (traditional healer) or midwives outside hospital, including medicine etc. Hospitalization charges, including fee etc. for doctors or Hakeem etc. and laboratory tests, x-Ray charges, dental care, teeth cleaning, extraction, charges, eye glasses and all others, not elsewhere classified.
17. NIPS, National Institute of Population Studies, <http://www.nips.org.pk/>.
18. OCHA, One Response, OCHA's population Management Toolbox Pakistan census population, 1998, <http://onerresponse.info/Countries/Pakistan/IM/publicdocuments/Population-1998-and-2009-By-district-All-provinces.xls>
19. Kim; Moody, More Resources, Better Health? A Cross-National Perspective, 1992.
20. Zhang et al., Using data envelopment analysis approach to estimate the health production efficiencies in China, 2007, 18.

