

## RESEARCH ARTICLE



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# Household health inequality in Pakistan: A comparative analysis

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## Abstract

**Background/Objectives:** Subsistence of health inequalities explains that basic human right is not available to every person in the country. As everyone knows that health of newborn child and maternal health are reflections of any good economy. The Infant Mortality (IM) and Maternal Mortality (MM) are caused by the health inequality, and hence this study is the first attempt to measure health inequality with respect to IM and MM for the most affected country like Pakistan. **Methodology:** On the basis of different income group across Punjab from the latest Human Development Index reports (HDI), data is extracted from primary household survey through Multi-stage technique for one year from 1 January 2018 to 31 December 2018. Concentration index is utilized to calculate Health inequality. CI has value from -1 to +1. The negative value of CI signifies the fact that the IM is higher in lower quintile of wealth for all regions in Punjab. **Findings:** The results revealed existence of significant inequalities with respect to IM in Punjab. The Highest inequality with respect to IM and MM is observed in the DG Khan and Chakwal where lowest was observed in Sialkot. However, the high inequality in DG Khan was accompanied by high IM, while Sialkot experiences lowest levels of inequality with low mortality rates. It is concluded that inequality in the wealth creates inequalities in the health status in Punjab. The regional health policies and reforms can also play catalytic role in controlling the mortality rate as well as inequalities in mortalities at macro level in Pakistan.

**Keywords:** Concentration curve; concentration Index; infant mortality; maternal mortality; health inequality; wealth inequality; Punjab-Pakistan

## 1 Introduction

Health is one of the most desirable aspects of Millennium Development Goals (MDGs) and the Sustainable Development Goals 2030 (SDGs). Health is a vital 'consumption good' that contributes directly to an individual's 'happiness' or 'satisfaction' with no other alternate. It is also a 'capital good' in terms of assets to the nation as well as an important component which render human beings worth. Moreover, factors like environment, culture and socioeconomic strata in which people live strongly influence their

chances to be healthy<sup>(1)</sup>. IM and MM has been considered as key elements of general population health<sup>(2)</sup>. It is the fourth goal of the MDGs to reduce IM and MM. Among the SDGs, there is a third goal to reduce IM and MM.

More than 60% of the world's (5.9 million) children belong to Asia and Africa who dies before their first birthday, where, Pakistan is at the top of the list among South Asian countries. According to the National Health Service (NHS), approximately 6.3 million children were born in Pakistan during 2016 of which 441,000 newborns died before celebrating the age of one year<sup>(3)</sup>.

Various women lost their life even before or shortly after birth of child<sup>(4)</sup> so another look out of health for any economy is maternal mortality. The average MM is the number of maternal deaths per 100,000 live births during the childbearing age of 15–49 years. Pakistan has the highest MM rate among South Asian countries<sup>(5)</sup>. So it is clear that IM and MM are the most important indicators of the health of any economy and Pakistan is among the worst affected country in this regard.

According to a survey of Multiple Indicators Survey (MICS) 2017–2018, IM is 60 over 1000 in Pakistan against SDGs which is 12 deaths over 1000. On other hands, MM is 234 which is more than SDGs targets in Pakistan. So there is need to inquire responsible factors for MM & IM for Pakistan scenario.

The above problems such as IM and MM are caused by the health inequality, so this study attempts to measure health inequality with respect to IM and MM for the most affected country like Pakistan where health equality is only measured at the macro level<sup>(5)</sup>. Therefore, this study tries to measure health inequality at microlevel regionally so as to give clearer picture for policymakers. Health inequality serves as a signal for health manger, health policy-makers and practitioner to originate strategies and action to diminish inequalities<sup>(6)</sup>. Moreover, this study uses CI that is more compatible to measure health inequality with respect to IM and MM on regional level<sup>(7)</sup>.

## 2 Methodology

To measure inequality with respect to IM and MM, current study uses CI. The CI is developed by Kakwani et al. 1997<sup>(8)</sup>. This index helps in quantifying the health inequality with respect to their respective socioeconomics factors related to health sector<sup>(9) (10) (11)</sup>.

Concentration curve (CC) is used to drive CI. The CI is built up on the basis of CC which explains the “twice the area between the CC and equality line (45-degree angle line). CI has three possible values: (1) Zero value means that there is no health inequality (2) negative value means that curve line is above the equality line. This shows that it moves toward poor income group. (3) Positive value means that curve line is below the equality line and converges toward rich income group people. CI have been verified to be an important instrument for calculating health inequalities for IM in many literature cited but for MM, it is being used for first time.

Following formula is used to calculate CI for data in different income group level<sup>(12) (13)</sup> :

$$CI = (p_1L_2 - p_2L_1) + (p_2L_3 - p_3L_2) + \dots + (p_{T-1}L_T - p_TL_{T-1}) \quad (1)$$

Where as;

**P** shows the cumulative percentage of sample ranked by economic status (starts from the lowest to the highest)

**L (p)** Shows the corresponding CC ordinate.

**T** Shows the number of socioeconomic groups in health

Standard error has been utilized to measure<sup>(10,14)</sup>:

$$R_t = \sum_{k=1}^{t-1} f_k + \frac{1}{2}f_t \quad (2)$$

Where **f<sub>t</sub>** shows the proportion of sample by different socioeconomics groups (from the lowest to the highest income group).

According to the theory, production of a healthy child needs a mother's time for Anti natal care (ANC) proper care and complete visit, visit at competent health provider, preparation of food, washing of clothes, breastfeeding, bathing the infant child, cleaning of household and care for disease<sup>(15)</sup>. CI can be calculated as the covariance between variable in the health sector and the relative rank in the distribution of living standard<sup>(10,16–18)</sup>. CI narrated the correlation between household health variable and the indicator of the living standard status of households. The study has used the primary data from household survey from the three different districts Dera Ghazi Khan (DG Khan) of the Punjab. Whereas DG Khan District nominated as lower income area district, Chakwal nominated as Middle income area district and Sialkot selected as higher income district<sup>(8)</sup>. All above district selected on the basis of latest HDI reports. The data is collected from 801 households from different economics zones on the basis of different income group from 1 January 2018 to 31 December 2018. Data provides the information on household Health related variables as well as on other relevant variables which are used in the analysis. Data is collected from the support

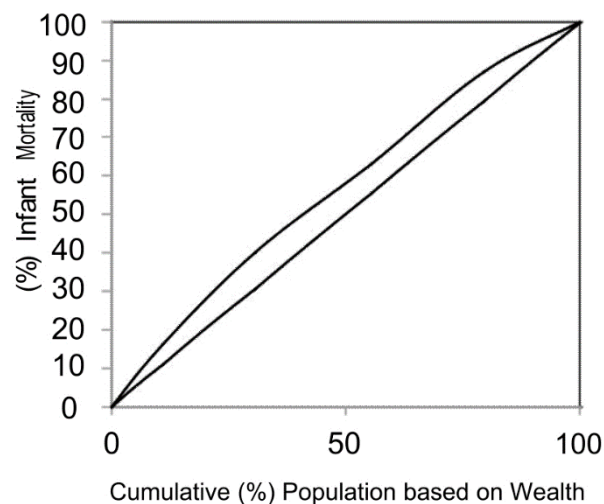
of District Chief Executive Officer health (CEO), integrated Reproductive Maternal and Child Health (IRMNCH) and Tehsil municipal corporation (TMA) of respective district.

### 3 Results and Discussion

**Table 1.** CI with respect to IM for DG Khan District

Wealth Group	No .of Births	Rel % Births	No. of Births	Cumul % Births	R	Total dead	UIMR	F_mu	Cum_f_mu	Q	CI
Poorest	44	22.0%		22.0%	11.0%	28	0.0595	0.0131	0.0131	0.2300	-0.0675
2 <sup>nd</sup>	42	21.0%		43.0%	32.5%	21	0.0341	0.0072	0.0203	0.3700	-0.0741
Middle	40	20.0%		63.0%	53.0%	19	0.0405	0.0081	0.0284	0.5800	-0.0365
4 <sup>th</sup>	34	17.0%		80.0%	71.5%	17	0.0281	0.0048	0.0331	0.7700	-0.0032
Richest	40	20.0%		100.0%	90.0%	15	0.0218	0.0044	0.0375	1.0000	-0.0031
Total	200	1		3	3	100	0.0375	0.0375	0.1323	2.9500	-0.1844

Table 1 shows the CI value for DG Khan District with respect to IM which is -0.1844. Its sign shows that the CC is above equality line. In the above table, population is divided into five income group from the poorest to the richest. In the last column of table, CI has been calculated. The negative value of CI signifies the fact that the inequality with respect to infant mortality is higher in lower quintile of wealth. Likewise, many researchers also reported a negative sign of CI which showed a greater health inequality<sup>(19,20)</sup>.



**Fig 1.** CC with respect to IM for DG Khan District

Figure 1 shows CC which was made on the basis of above CI results with respect to IM in DG Khan where IM is on the Y-axis and cumulative population is on the X-axis. Here 45 degree line represents the line of equality and line above 45 degree line shows the inequality line for different income groups. Inequality line is above the equality line, which shows that there is problem of more health inequality in DG Khan due to lower economic status of this district.

**Table 2.** CI with respect to IM for Chakwal district

Wealth Group	No. of Births	Rel % of births	No. of Births	Cumul Births	% R	Total dead	UIMR	F_mu	Cum_f_muQ	CI	
Poorest	50	25.0%		25.0%	12.0%	23	0.4600	0.1150	0.1150	0.2400	-0.0431
2nd	42	21.0%		46.0%	35.5%	14	0.3333	0.0700	0.1850	0.3900	-0.0241
Middle	31	15.0%		61.0%	53.0%	21	0.6774	0.1050	0.2900	0.5600	-0.021
4th	37	18.0%		80.0%	70.5%	19	0.5135	0.0950	0.3850	0.7600	-0.0221
Richest	40	20.0%		100.0%	90.0%	23	0.5750	0.1150	0.5000	1.0000	-0.001
Total	200	1		3	3	100	0.5000	0.5000	1.4750	2.9500	-0.1113

Table 2 shows the CI value for Chakwal District with respect to IM which is -0.1113. Its sign shows that the CC is above equality line. In the above table, population is divided into five income group from the poorest to the richest. In the last column of table, CI has been calculated. The negative value of CI signifies the fact that the inequality with respect to IM is higher in lower quintile of wealth. Likewise many researchers also reported a negative sign of CI and the poorest people showed a greater health inequality<sup>(19)</sup>. The inequalities in Chakwal District correlates with the incidence of moderate rate of under-one-years mortality.

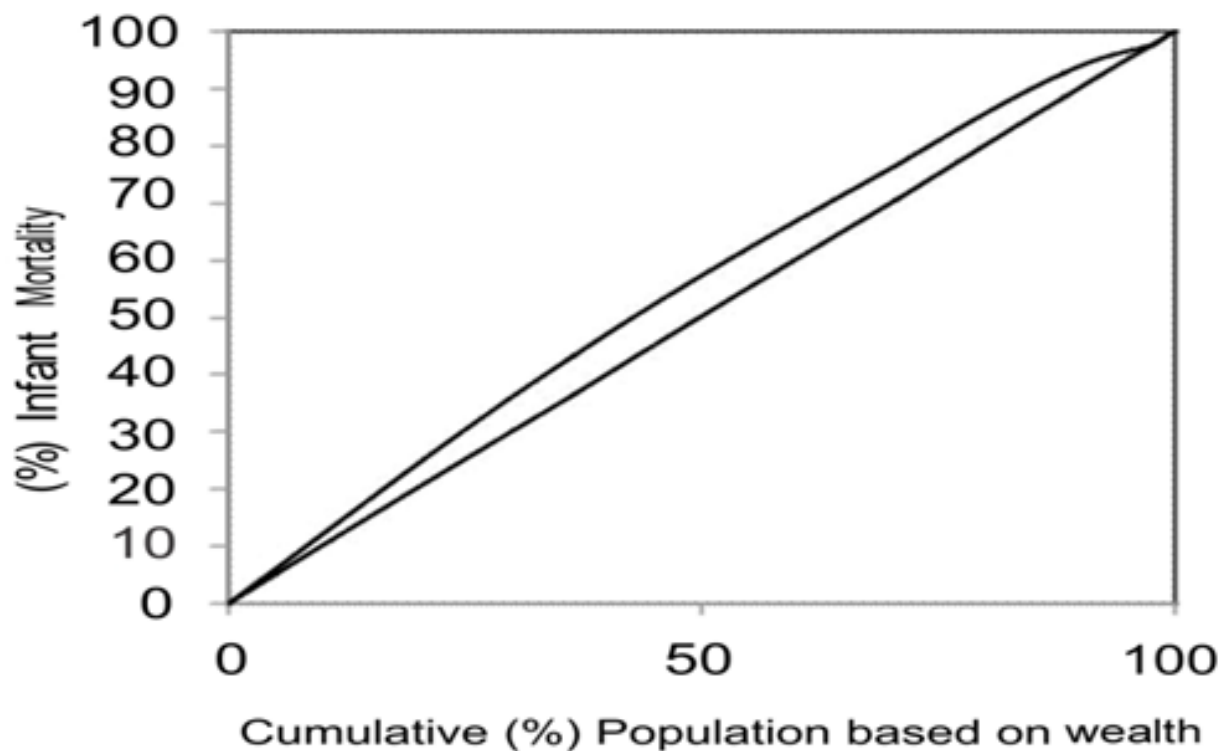
**Fig 2.** CC with respect to IM for Chakwal District

Figure 2 shows CC which made basis on the above CI results that IM in Chakwal district where IM is on the Y-axis and cumulative population is on the X-axis. Here 45 degree line represents the line of equality and line above 45 degree line shows the inequality line for different income groups. Inequality line is slightly above the equality line, which shows moderate health inequality in Chakwal.

Table 3 shows the CI value for with[ds1] respect to IM which is -0.00220. Its sign shows that the CC is above equality line. In the above table, population is divided into five income group from the poorest to the richest. In the last column of table,

**Table 3.** CI with respect to IM for Sialkot district

Wealth Group	No. of Births	Rel % No.of births	Cumul % Births	R	Total dead	UIMR	F_mu	Cum_f_mu	Q	CI
Poorest	45	22.0%	22.5%	11.0%	43	0.9556	0.2150	0.2150	0.4300	-0.0503
2 <sup>nd</sup>	37	18.0%	41.0%	31.8%	13	0.3514	0.0650	0.2800	0.5600	-0.0246
Middle	41	20.0%	61.0%	51.3%	22	0.5366	0.1100	0.3900	0.7800	-0.0321
4 <sup>th</sup>	38	19.0%	80.0%	71.0%	10	0.2632	0.0500	0.4400	0.8800	-0.0750
Richest	39	19.0%	100.0%	90.3%	12	0.3077	0.0600	0.5000	1.0000	-0.0542
Total	200	1	3	3	100	0.5000	0.5000	1.8250	3.6500	-
										0.00220

CI has been calculated. The negative value of CI signifies the fact that the inequality with respect to infant mortality is higher in lower quintile of wealth. Here again a negative sign of CI and the poorest people showed a greater health inequality<sup>(19)</sup>. In case of inequalities in under-one year mortality, it should be noted that, for Sialkot District, the incidence of under-one-years mortality is the lowest among all district. The results show that health inequality is more in lower quintile of income group.

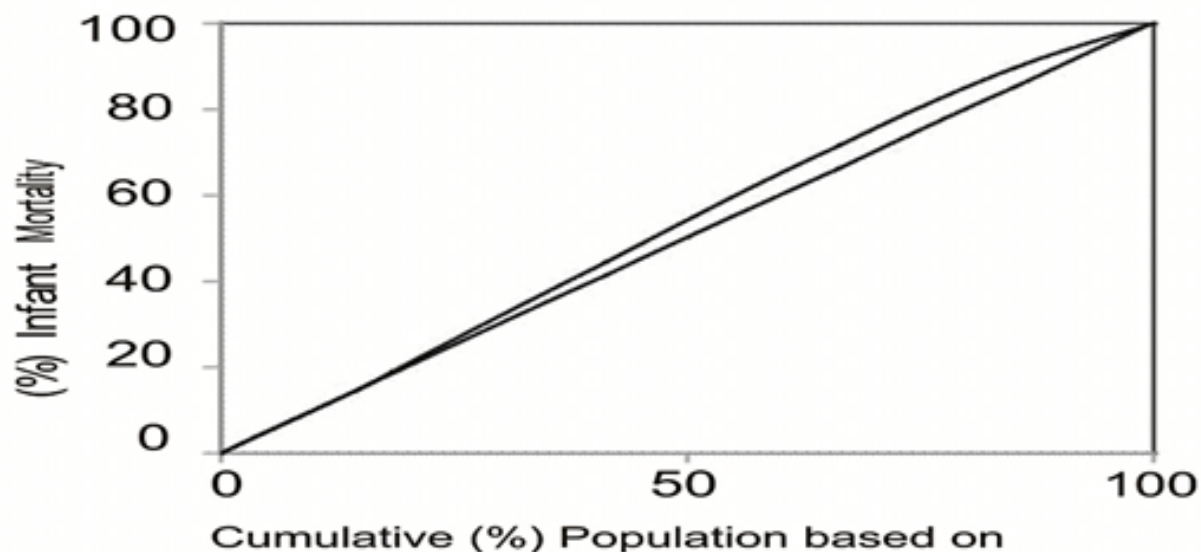
**Fig 3.** CC with respect to IM for Sialkot District

Figure 3 shows CC which made basis on the above CI results with respect to IM in Sialkot District, whereas IM is on the Y-axis and cumulative population is on the X-axis. Inequality line is slightly above the equality line, which shows less health inequality with respect to IM among three districts.

Table 4 shows the CI value of -0.09876 for DG Khan District with respect to MM. The negative sign means that there is health inequality. CI is more toward poorest group. The negative value of CI signifies the fact that the inequality in MM is higher in lower quintile of wealth as reported elsewhere<sup>(21)</sup>.

Figure 4 shows CC with respect to MM for DG Khan District. Here 45 line show the equality and above line shows the inequality level in the poor income group, which is far away from equality line. This shows more health inequality with respect to maternal mortality in DG Khan District as compared to other two districts. The shape of curve shows that health inequality is more in poor quintile as compared to high income quintile.

**Table 4.** CI with respect to MM for DG Khan District

Wealth Group	No.of Maternal Women	Rel % Maternal Women	Cumul % Maternal Women	R	Total death	MM	F_mu	Cum_f_muQ	
Poorest	41	48.8%	48.8%	24.4%	13	0.9556	0.4664	0.4664	0.7076 - 0.0001
2 <sup>nd</sup>	14	16.7%	65.5%	57.1%	10	0.3514	0.0586	0.5250	0.7965 - 0.0003
Middle	12	14.3%	79.8%	72.6%	7	0.5366	0.0767	0.6016	0.9128 - 0.0001
4 <sup>th</sup>	9	10.7%	90.5%	85.1%	6	0.2632	0.0282	0.6298	0.9555 - 0.0001
Richest	8	9.5%	100.0%	95.2%	6	0.3077	0.0293	0.6591	1.0000 - 0.0002
Total	84	1	3	3	42	0.6591	0.6591	2.8819	4.3724 - 0.09876

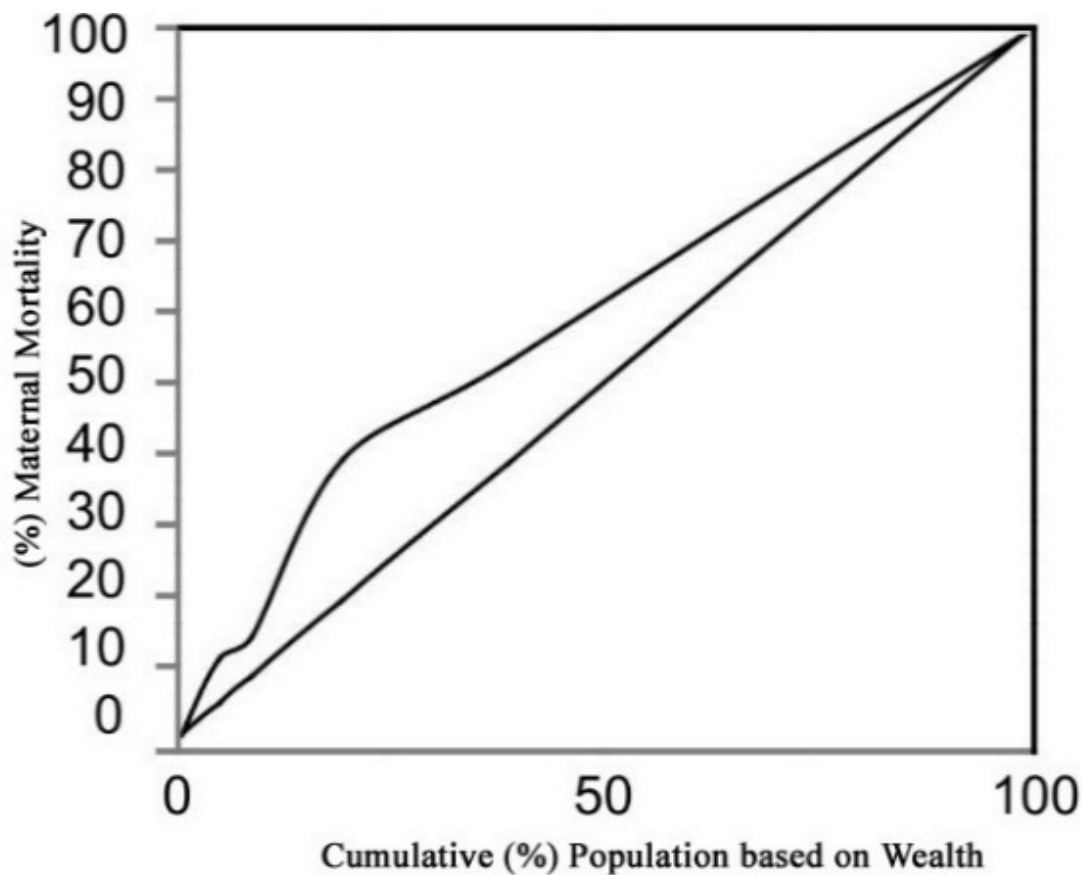
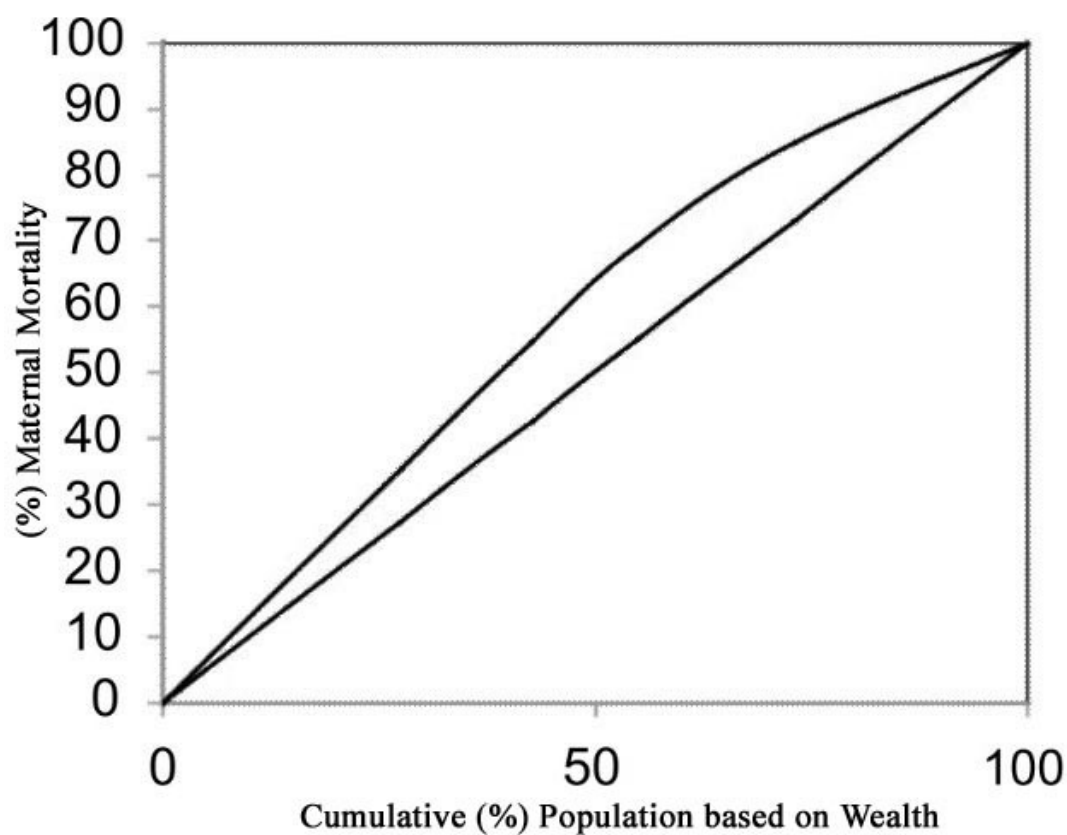
**Fig 4.** CC with respect to MM for DG Khan District

Table 5 shows the CI value for Chakwal District for MMR which is -0.0660. The negative value of CI signifies the fact that maternal mortality is higher in lower quintile of wealth. Many researchers also reported a negative sign of CI and poorest quintiles of wealth group showed a greater health inequality<sup>(21)</sup>.

Figure 5 shows that CC which made on the basis of CI, MM on the Y-axis and population group on the X-axis for Chakwal District. Here 45° line shows the equality line and the distance of other curve from equality line shows the inequality level. Here, the curve is slightly close to equality line. The shape of CC shows moderate inequality with respect to MM in Chakwal District.

**Table 5.** CI with respect to MM for Chakwal District

Wealth Group	No.of Maternal Women	Rel % Maternal Women	Cumul % Maternal Women	R	Total death	MM	F_mu	Cum_f_muQ	CI
Poorest	21	35.0%	17.5%	11.0%	10	0.4600	0.1610	0.1610	0.0629 - 0.0001
2 <sup>nd</sup>	12	20.0%	45.0%	32.5%	5	0.3333	0.2277	0.2277	0.0890 - 0.0003
Middle	12	20.0%	65.0%	53.0%	4	0.6774	0.3632	0.3632	0.1419 - 0.0001
4 <sup>th</sup>	9	15.0%	82.5%	71.5%	7	0.5135	0.4402	0.4402	0.1720 - 0.0001
Richest	6	10.0%	95.0%	90.0%	4	0.5750	0.4977	0.4977	0.1945 - 0.0002
Total	60	1	3	3	30	3	2	2	1 - 0.06601

**Fig 5.** CC with respect to MM for Chakwal District

**Table 6.** CI with respect to MM for Sialkot District

Wealth Group	No.of Maternal Women	Rel % Maternal Women	Cumul % Maternal Women	R	Total death	MM	F_mu	Cum_f_muQ	CI
Poorest	11	21.2%	21.2%	10.6%	7	0.0595	0.0126	0.0126	0.2300 - 0.0001
2 <sup>nd</sup>	12	23.1%	44.2%	32.7%	5	0.0341	0.0079	0.0205	0.3700 - 0.0001
Middle	12	23.1%	67.3%	55.8%	4	0.0405	0.0093	0.0298	0.5800 - 0.0001
4 <sup>th</sup>	8	15.4%	82.7%	75.0%	3	0.0281	0.0043	0.0341	0.7700 0.0002
Richest	9	17.3%	100.0%	91.3%	7	0.0218	0.0038	0.0379	1.0000 - 0.0001
Total	52	1	3	3	26			0.1323	3 - 0.04675

Table 6 shows the CI value for Sialkot District for MMR which is -0.04675. The negative value of CI signifies the fact that the inequality in maternal mortality, in both measures of maternal mortalities, is higher in lower quintile of wealth.

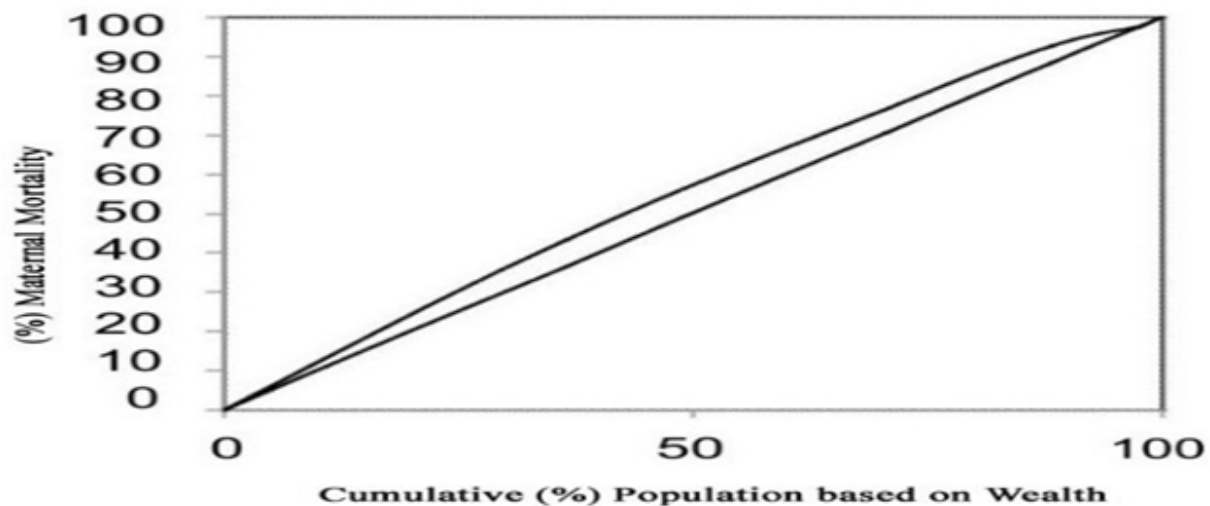
**Fig 6.** CC with respect to MM for Sialkot District

Figure 6 CC which made basis on the above CI results shows that MM on the Y-axis and population group on the X-axis for Sialkot District. Here 45 line show the equality and above line shows the inequality level in the poor group, which is slightly close to equality line. The health inequality is less in Sialkot as compared to other two districts.

As one moves upwards in the different wealth groups, from poorest to richest, there is gradual decline in the incidence of IM. This finding is also supported by the existing literature<sup>(19,22)</sup>. This finding also reflects that the child survival amongst the disadvantaged groups is weak relative to their wealthy counterparts. Alternatively, the prospects of child survival could be improved with the up-gradation in the wealth status. It is concluded from this study that the inequality in the wealth has led to creation of inequalities in the health status in selected district of Punjab. The better-off groups enjoy better life chances relative to poorer ones. Further, the most prosperous region in Punjab i.e. Sialkot district exhibits lower health inequality in IM<sup>(19)</sup> Low mortality and low inequality in mortality in Sialkot and high inequality as well as high mortality in DG Khan concluded that citizens of Sialkot are healthier than people from any other selected district in Punjab<sup>(5)</sup>.

It is observed that inequality in the wealth has led to creation of inequalities in the health status in selected district in Punjab. Sialkot district exhibits lower inequality in MM, where Chakwal has emerged as a special case depicting the highest MM than DG Khan District<sup>(21)</sup>. These results are slightly similar with the IM result scenario, each district have same IM having same MM result. So, there is need of uniform policy regarding IM and MM though health inequality. It's proofed that districts having

poor maternal health cause poor infant health which moved toward high IM in respective countries<sup>(2)</sup>.

## 4 Conclusion

To measure health inequalities, CI is widely used in literature cited worldwide. IM and MM are employed to access the health outcomes in Punjab, Pakistan, because it reflects the true picture of any health economy in world. Wealth status in the different economics group and mortality index has been correlated. Households are divided into five different groups: richest, richer, middle, poor and poorest. The CCs for IM show that the CC is farthest from the equality line in the case of DG Khan District for which the highest inequality amongst district is reported. The CC for Chakwal shows the minimal difference of CC from the equality line for which the lowest inequality in IM is found. In case of Sialkot, it is observed that the CC lies significantly close to the equality line indicating smaller inequalities in the Sialkot city. From the above findings, it is concluded that there is negative association between level of wealth and inequality of mortality rates.

The results revealed existence of significant inequalities in IM and MM in Punjab, Pakistan and across its constituencies. Highest inequality is observed in the DG Khan and Chakwal and lowest is being observed in Sialkot. However, the high inequality in DG Khan was accompanied by high IM as well in MM, while Sialkot experiences the lowest levels of inequality with low mortality rates. Punjab, despite being relatively more developed than other provinces, experiences the highest mortality rates along with high inequality. While inequality in IM and MM exists across wealth groups, it shows irregular prevalence across the different regions in the country may be attributed to the existence of non-economic factors at the regional, as well as, household level. The existing literature has identified various factors which contribute towards inequalities in IM and MM. For instance, at household level, parents' characteristics such as education, occupation, per capita income, and household living conditions, geographical area of residence, access to various health facilities such as clean drinking water, utilization of health services, type of food<sup>(23–25)</sup>. In addition, the regional health policies and reforms can also play catalytic role in controlling the mortality rate as well as inequalities in mortalities<sup>(22)</sup>.

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