

# SOCIOECONOMIC DETERMINANTS OF INFANT AND UNDER-FIVE MORTALITY RATES IN PAKISTAN: A PROVINCIAL/AREA COMPARISON USING MULTIPLE INDICATOR CLUSTER SURVEY (MICS6) DATA

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DOI: <https://doi.org/10.5281/zenodo.22205950>

## Keywords

Infant mortality rate, under-five mortality rate, child survival, Pakistan, provincial disparities, socioeconomic inequality, maternal education, Multiple Indicator Cluster Survey (MICS)

## Article History

Received: 28 February 2026

Accepted: 15 March 2026

Published: 29 March 2026

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## Abstract

Some indicators that reflect the population's health are used for measuring infant mortality rate (IMR) and under-five mortality rate (UFMR), which incorporate the impact of maternal health, newborn care, nutrition, socioeconomic factors, and performance of health care systems. However, although there have been some improvements in child survival in Pakistan yet there are large regional and socioeconomic disparities. This study focuses on interprovincial and socioeconomic inequalities in infant and under-five mortality rates for the provinces/areas of Punjab, Sindh, Khyber Pakhtunkhwa (KP), Balochistan, Azad Jammu and Kashmir (AJ&K) and Gilgit-Baltistan (GB), with data from the most recent Multiple Indicator Cluster Surveys (MICS) available. Mortality differentials by geographical residence, level of maternal education and wealth status of the household were analyzed using a comparative descriptive methodology. The results show significant regional differences in early childhood mortality outcomes. The highest burden of mortality against 1000 live births is seen in Punjab (IMR 60 & UFMR 69), followed by AJ&K (IMR 51 & UFMR 59), Balochistan (IMR 48 & UFMR 53), GB (IMR 43 & UFMR 50), Sindh (IMR 39 & UFMR 46) and KP (IMR 35 & UFMR 39). Analysis shows high socioeconomic disparities: children from poorer households and children of mothers with low education levels are at higher risk of dying. Rural residents typically also have higher death rates, because they have less access to health care, face geographic challenges, and experience inequities in provision of maternal and child health services. The study finds that regional disadvantage, socioeconomic inequality, maternal education, and healthcare availability interact in complex ways to affect early childhood mortality in Pakistan. It suggests region-specific child survival interventions that target maternal education, equity in health outcomes related to poverty, health services for neonates and mothers, and expanding access to health services for rural and underserved populations.

## 1. INTRODUCTION

Child mortality continues to be a critical public health problem and an important measure of social and economic development. The infant mortality rate (IMR), which represents the number of deaths among infants before their first birthday, and the under-five mortality rate (UFMR), which refers to deaths among children under five years of age, offer valuable information about maternal health, newborn care, disease prevention, nutrition, and how well health care systems are functioning (World Health Organization [WHO], 2023). Preventable child and infant deaths have been a key target of the Sustainable Development Goals (SDGs) which are designed to achieve by 2030, including SDG 3.2, the target to end preventable deaths of newborns and children under five (United Nations [UN], 2023).

Despite the gradual improvements in child survival over the past decades, Pakistan's child mortality rates, though moderate, are still high compared to many other developing countries where socio economic constraints have a greater impact on IMR and UFMR (WHO/UN, 1979; Hashmi, 1979; Hobcraft et al., 1984; Mosley & Chen, 1984; Nag, 1985; Rutstein, 2005; Kazmi, 1995 & 2009; WHO, 2023; Kazmi et al., 2026e&f). Average statistics can hide significant regional and social disparities. There are significant disparities between provinces/administrative areas in terms of health facility infrastructure, maternal education, urban-rural gap, poverty rates, access to clean water and sanitation, and skilled birth attendants (Sathar 1984; Kazmi, 1995; UNICEF, 2023; Memon et al., 2023; Zaidi, 2024; Kazmi et al., 2024, 2025 and 2026a&c). Children in low-development areas have a higher risk of dying than children living in high-development areas, as a result. The provinces of Pakistan also have significant differences with respect to demographic and socioeconomic features (Memon, et al., 2023; Kazmi et al., 2024, 2025 and 2026a-e). The relatively superior healthcare infrastructure in the province of Punjab still faces many hurdles due to population pressure and rural-urban divide. Sindh has a major inter disparity between cities like Karachi and villages.

The province of Khyber Pakhtunkhwa (KP) has advanced with indicators of good health over the last few years but still has difficulties because it is mountainous and not easily accessible. Balochistan is one of the most vulnerable areas in the country owing to its scattered population, limited healthcare facilities, and socioeconomic difficulties (Knowles, 1979; Agha, 2000; Khan and Raza, 2014; WHO, 2023; Kazmi et al., 2024 & 2025a). In the same way, healthcare access is hindered by geographic barriers in remote areas of AJ&K and Gilgit-Baltistan (Pakistan Bureau of Statistics, 2020; Kazmi et al., 2023a&b and 2026a, d&e).

The Multiple Indicator Cluster Surveys (MICS) give insightful subnational information on child mortality and related socioeconomic factors (UNICEF, 2022). Comparative assessment of mortality patterns among the provinces and administrative regions of Pakistan can be made using the latest available MICS6 data from MICS Punjab (2017–18), MICS Sindh (2018), MICS KP (2022), MICS Balochistan (2022), MICS AJ&K (2020–21) and MICS GB (2024–25). The purpose of this study is to examine the provincial and socioeconomic differences in IMR and U5MR rates based on MICS data. Specifically, it examines: a) Differences in IMR and UFMR among provinces and administrative areas; b) Rural–urban variations in child mortality; c) The relationship between maternal education and child survival; d) The influence of household wealth status on mortality outcomes; and e) Policy implications for reducing inequalities in child health. Understanding these disparities is essential for designing evidence-based interventions that address the unequal distribution of child survival opportunities across Pakistan.

## 2. Literature Review

### 2.1 Global Trends in Infant and Under-Five Mortality

Globally Infant Mortality Rate (IMR) and Under-fives Mortality Rate (UFMR) are among the most commonly used indicators for measuring the general health status of populations, socioeconomic development and the quality of health

services at national level (Kazmi, 1995; Kazmi et al., 2026d&e). IMR denotes risk of death within the first year of life and is highly responsive to maternal health status, birth care, neonatal care and early childhood conditions. By contrast, UFMR includes the risk of death across the first five years of life and encompasses a wider spectrum of factors such as infectious diseases, malnutrition, immunisation coverage, environmental conditions and access to healthcare services (WHO, 2023). Overall, significant achievements have been made in the reduction of IMR and UFMR as a result of strengthening immunization programs, maternal, neonatal and child health services, nutrition interventions and prevention of childhood infections. But improvements are not even and the risk of death is higher for low-income countries and for socially disadvantaged groups (UNICEF, 2023&2024). Neonatal complications are still a significant cause of infant deaths and pneumonia, diarrhea, malnutrition and vaccine preventable diseases still contribute to under-five mortality in developing countries (UN, 1986; Kazmi, 2009; Black et al., 2017). The above mentioned patterns show that child deaths are not only a medical problem but also a reflection of wider social-economic inequalities in health care access, household resources, maternal education, and living conditions, in general (UN, 1979 & 1986; Hashmi, 1979; Mosley and Chen, 1984; Nag, 1985; Flege, 1985; Jinabhai et al; 1986; Agha, 2000; Rutstein, 2005; Khan and Raza, 2014; Black et al., 2017; Memon et al., 2023; WHO, 2023; Kazmi et al., 2024, 2025 and 2026a,b-f)

## 2.2 Infant and Under-Five Mortality Situation in Pakistan:

Sub-section 2.2 explains the situation of infant and under-five mortality in Pakistan. Pakistan still has a long way to go to meet infant/under-five mortality rates with other South Asian nations (Rusicka & Hansliwks, 1982; Jinabhai et al., 1986; Kuly, 1993; Kazmi 2009). While significant strides have been made in decreasing death rates due to better immunization rates, maternal health services and child nutrition, these gains have not been as rapid as anticipated (UNICEF, 2023).

Neonatal conditions, such as low birth weight, birth complications, poor newborn care, and lack of skilled health care, have a significant impact on infant mortality in Pakistan (Khan and Raza, 2014). The first month of life is a very critical time and the need of the hour is to strengthen the quality of antenatal care, institutional deliveries and quality neonatal services. Kazmi (1995) finds mother education and GDP per capita as the vital determinant of IMR Pakistan wherein female education emerged to be the strongest decisive factor among these. In addition, infectious diseases, malnutrition, unsafe water, poor sanitation, and delay in seeking care for illness contribute to under-five mortality in Pakistan. It has also been shown from studies that preventable childhood diseases continue to be a major cause of under-five mortality especially among poor and rural population groups (Kuly, 1993; Agha, 2000; Memon et al., 2023; Kazmi et al., 2026a&b). It was also observed that immunization coverage was sub-optimal and other socio-cultural and economic reasons were responsible for the low level of immunization. Kazmi (1995) found immunization programs with negligible impact on lessening the infant mortality rates in Pakistan as these programs remained significantly below the minimum effective level.

Long-standing IMR and UFMR indicate the interplay of childhood vulnerabilities and greater socio-economic disadvantage. Maternal factors are one of the most influential in the survival of children. Factors such as maternal education, age at marriage, birth spacing and access to antenatal care and delivery care have significant association with infant/child mortality risk factors. Increased likelihood of mothers seeking timely health services, adopting appropriate feeding practices, completing immunization schedules, recognizing early signs of child illness, seeking timely health care, and taking appropriate curative measures are also vital inputs for avoiding risk of child loss (Knowles, 1979; Caldwell, 1980; Young, et al., 1983; Cleland and Sathar, 1984; Sathar, 1984 & 1987; Kazmi, 1995; Cleland & Jejeebhoy, 1996; Khan & Raza, 2014; Memon et al., 2023; Zaidi, 2024; Kazmi et al., 2026d&e). In Pakistan Agha

(2000) and Kazmi (1995&2009) found that the level of maternal education and the utilization of health services are significant factors in reducing risks of child death.

### **2.3 Regional Inequalities in Infant and Under-Five Mortality in Pakistan**

Regional inequality in infant and under five mortality in Pakistan is still high and increasing. Variations in healthcare facilities, socioeconomic development, geographical location and service accessibility are the reason of the difference in the level of IMR and UFR across the provinces and administrative regions of Pakistan. The literature suggests that these inequalities in child mortality rates are linked to socioeconomic inequalities in access to healthcare services, poverty, female education, and segregation between urban and rural areas in terms of healthcare services and facilities (Kazmi, 1995&2005 and 2010; Agha, 2000; Khan & Raza, 2014; Memon et al., 2023; Kazmi et al., 2026d&e). Due to the vast geographical area, scattered population, scarce health care facilities and fewer skilled health care providers, Balochistan has always had high mortality rates. The situation is the same with rural areas of Sindh that are suffering from poverty, malnutrition, poor sanitation and lack of maternal and newborn health services. Besides, distance to health care facilities, topography and transportation challenges are extra barriers in mountainous areas like AJ&K, KP and Gilgit Baltistan (Knowles, 1979; Agha, 2000; Khan and Raza, 2014; Memon et al., 2023 Kazmi et al., 2026d&e). The differences between regions are indicative that national mortality rates can mask significant internal variations. Thus, it is important to analyse IMR and UFR at the provincial level to identify the vulnerable population and to design interventions for child survival.

### **2.4 Role of Education and Wealth Inequality in Child Mortality**

Across all areas, maternal education is one of the best indicators of child survival. Women with higher education showed greater knowledge of

healthcare practices, were more likely to seek healthcare, and were more likely to engage in good nutrition and hygiene practices as well as better decision making regarding children's health (Sathar, 1984; Kazmi, 1995; Desai & Alva, 1998; Agha, 2000; Khan & Raza, 2014; Memon et al., 2023; (Knowles, 1979; Agha, 2000; Khan and Raza, 2014; Memon et al., 2023). There are specific reasons why maternal education-mortality association holds importance in developing countries such as Pakistan; where social and economic constraints on access to basic health care services are often quite high (UN, 1986; Kazmi S. 1995; Rutstein, 2005; Memon et al., 2023 Kazmi et al., 2026d&e).

Another important factor affecting IMR and UFR is household wealth. Food insecurity, lack of sanitation, insufficient space for living, lack of access to health care due to financial constraints are commonly found in poor households (Knowles, 1979; United Nations, 1979; Young et al., 1983; Kazmi, 2010; Khan & Raza, 2014; Memon et al., 2023; WHO, 2023). Through the Mosley and Chen (1984) perspective, socioeconomic factors impact on child survival via intermediate pathways such as maternal practices, environmental exposures, nutritional status, and health care availability. GDP Per capita also play an important role in child survival as it leads to reduction of IMR both in developed and developing countries (Preston, 1980; Mosley & Chen, 1984; UN, 1986; Rutstein, 2005; Kazmi, 1995 & 2009). In developing countries such as Pakistan, wealth-based inequalities are a substantial problem and children belonging to the poorest families consistently have a higher risk of dying than children belonging to wealthier families. Solving these inequalities needs to be done through integrated strategies that involve poverty reduction, maternal education, making healthcare services more accessible, nutrition interventions, and strengthening primary healthcare systems (Kazmi, 1995 and 2009; Agha, 2000; Khan & Raza, 2014; Memon et al.2023; WHO, 2023; Kazmi et al., 2026d&e).

### 3. Methodology

This study employs a comparative descriptive research design to examine interprovincial and socio-economic disparities in infant mortality rate (IMR) and under-five mortality rate (UFMR) across Pakistan. A descriptive comparative approach was selected because the objective of the study is to identify variations, patterns, and inequalities in child survival outcomes among different provinces and socioeconomic groups rather than to establish direct causal relationships. Comparative analysis of population-based survey data is widely used in public health research to explore health inequalities and identify vulnerable populations requiring targeted interventions (Mosley & Chen, 1984; WHO, 2023). The study utilizes secondary data from the latest available Multiple Indicator Cluster Surveys (MICS) conducted in six administrative regions of Pakistan, including Punjab, Sindh, Khyber Pakhtunkhwa, Balochistan, Azad Jammu and Kashmir, and Gilgit-Baltistan. The MICS program, supported by UNICEF, provides internationally standardized and comparable household-level information on maternal and child health, nutrition, education, sanitation, and socioeconomic characteristics (UNICEF, 2022, 2023 & 2024). The use of MICS data is justified because these surveys follow standardized definitions, sampling procedures, and data collection protocols, allowing reliable comparison of child mortality indicators across different geographical and socioeconomic settings. Furthermore, MICS datasets are specifically designed to monitor progress in child survival and Sustainable Development Goal (SDG) indicators, making them appropriate for assessing early childhood mortality inequalities.

The analysis is based on the information presented in Table 4.1: Provincial/Areas' Infant and Under-Five) Mortality Rates by Socioeconomic Characteristics. The study incorporates data from Punjab MICS 2017-18 (BoS Punjab & UNICEF, 2017-18), Sindh MICS 2018 (BoS Sindh & UNICEF, 2018), Khyber Pakhtunkhwa MICS 2022 (BoS Khyber Pakhtunkhwa & UNICEF, 2022); Balochistan MICS 2022 (BoS Balochistan

& UNICEF, 2022), Azad Jammu and Kashmir MICS 2020-21 (BoS AJ&K & UNICEF, 2020-21), and Gilgit-Baltistan MICS 2024-25 (P&DD Gilgit Baltistan & UNICEF, 2024-25). These datasets provide estimates of mortality patterns and allow examination of inequalities according to residence, maternal education, and household economic status. The primary outcome variables examined are infant mortality rate (IMR) and under-five mortality rate (UFMR), internationally recognized measures of population health reflecting the combined influence of maternal health, newborn care, nutrition, disease prevention, and healthcare system performance (WHO, 2023).

The explanatory variables include three major socioeconomic characteristics. The first is place of residence, categorized as rural and urban, to assess geographical inequalities in child survival (Memon et al, 2023). The second is maternal education, classified as pre-primary or no education, primary, middle, secondary, and higher education. Maternal education is included because previous research has demonstrated its significant influence on healthcare-seeking behavior, child nutrition, preventive practices, and survival outcomes (Khan, 1979; Flege, 1982; Sathar, 1984; Kazmi, 1995&2009; Desai & Alva, 1998; Agha, 2000; Khan & Raza, 2014; Kazmi et al., 2026d&e). The third variable is household wealth status, measured through wealth index quintiles ranging from poorest to richest. Household wealth is an important determinant of child survival because it affects access to healthcare services, nutrition, sanitation, and living conditions (Mosley & Chen, 1984; Kazmi, S. 1995; Agha, 2000; Kazmi, 1995 & 2009; Memon et al., 2023; Kazmi et al., 2026d&e). The analysis involves comparative assessment of mortality patterns across provinces and socioeconomic groups. Provincial comparisons are conducted to identify regional disparities, while rural-urban analysis evaluates geographical inequalities. Further comparisons examine differences associated with maternal education and household wealth categories. Since the study relies on secondary cross-sectional survey data, the findings are interpreted as associations and

population-level patterns rather than causal effects. Nevertheless, the methodology provides a robust framework for identifying disparities in early childhood mortality (IMR & UFMR) and generating evidence-based recommendations for improving child survival policies in Pakistan. However, this study is not free from limitations. First, the analysis is primarily based on secondary data obtained from Provincial MICS6 datasets and reference years across provinces may affect direct comparability of findings. Second, the use of cross-sectional data limits the ability to establish causal relationships between IMR-UFMR and socio-economic factors. Third, some regional indicators and disaggregated statistics, particularly for remote and rural areas, were either unavailable or incomplete, restricting deeper comparative analysis. Despite these limitations, the study relies on international recognized institutional datasets, and widely accepted socioeconomic determinant s of IMR and UFMR, which enhances the reliability

and policy relevance of the findings across Pakistan.

#### 4. Results Analysis and Discussion

The analysis consists of a comparison study of the provinces mortality patterns with its socioeconomic determinants. Regional inequalities are assessed through provincial comparisons while geographical inequalities are assessed by rural and urban comparisons. Other comparisons focus on differences by categories of maternal education and household wealth. The results in Table 4.1 are based on secondary cross-sectional survey data and are considered associations, population-level patterns, and not necessarily causal effects. However the methodology offers a strong platform to look at the disparities in early childhood mortality (IMR & UFMR) and to derive evidence-based recommendations to enhance child survival policies in Pakistan.

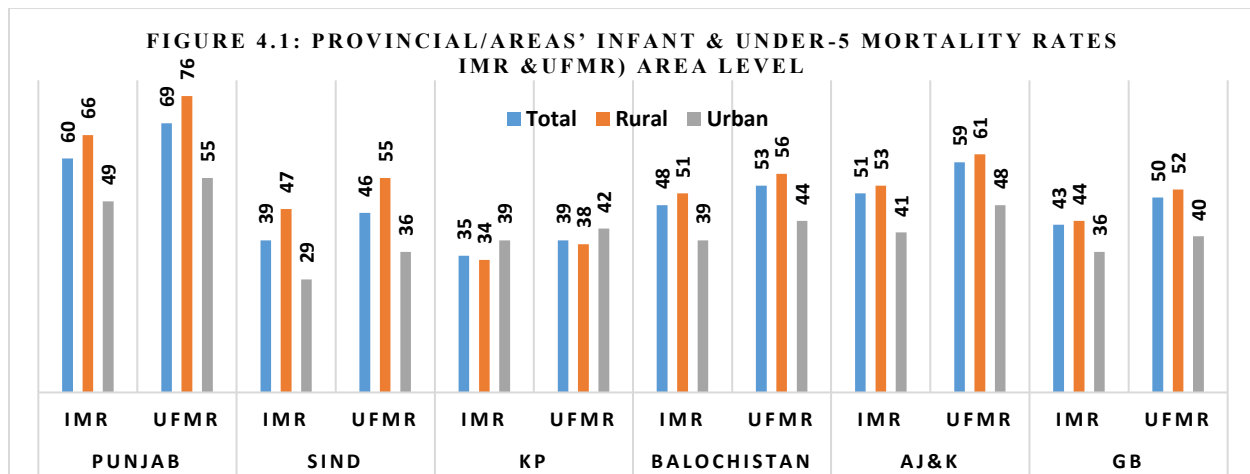
| Table 4.1: Provincial/Areas' Infant & Under-5 Mortality Rates For the 5 Years by Socioeconomic Characteristics       |        |      |      |      |     |      |             |      |      |      |     |      |
|----------------------------------------------------------------------------------------------------------------------|--------|------|------|------|-----|------|-------------|------|------|------|-----|------|
| Areas                                                                                                                | Punjab |      | Sind |      | KP  |      | Balochistan |      | AJ&K |      | GB  |      |
| IMR/UFMR                                                                                                             | IMR    | UFMR | IMR  | UFMR | IMR | UFMR | IMR         | UFMR | IMR  | UFMR | IMR | UFMR |
| Total                                                                                                                | 60     | 69   | 39   | 46   | 35  | 39   | 48          | 53   | 51   | 59   | 43  | 50   |
| Rural                                                                                                                | 66     | 76   | 47   | 55   | 34  | 38   | 51          | 56   | 53   | 61   | 44  | 52   |
| Urban                                                                                                                | 49     | 55   | 29   | 36   | 39  | 42   | 39          | 44   | 41   | 48   | 36  | 40   |
| Education                                                                                                            |        |      |      |      |     |      |             |      |      |      |     |      |
| Pre-primary or none                                                                                                  | 75     | 87   | 44   | 54   | 35  | 39   | 50          | 56   | 70   | 79   | 55  | 65   |
| Primary                                                                                                              | 65     | 72   | 32   | 40   | 39  | 42   | 44          | 47   | 47   | 54   | 40  | 49   |
| Middle                                                                                                               | 50     | 58   | 31   | 37   | 43  | 47   | 37          | 45   | 56   | 63   | 43  | 45   |
| Secondary                                                                                                            | 45     | 52   | 33   | 37   | 29  | 33   | 34          | 35   | 43   | 52   | 27  | 31   |
| Higher                                                                                                               | 26     | 30   | 16   | 16   | 27  | 29   | 39          | 40   | 37   | 49   | 28  | 30   |
| Wealth index quintile                                                                                                |        |      |      |      |     |      |             |      |      |      |     |      |
| Poorest                                                                                                              | 83     | 95   | 46   | 54   | 37  | 41   | 66          | 74   | 65   | 75   | 51  | 64   |
| Second                                                                                                               | 74     | 84   | 54   | 65   | 35  | 41   | 58          | 65   | 62   | 70   | 48  | 47   |
| Middle                                                                                                               | 60     | 68   | 37   | 44   | 36  | 41   | 38          | 44   | 46   | 53   | 45  | 48   |
| Fourth                                                                                                               | 49     | 55   | 16   | 29   | 33  | 35   | 39          | 42   | 36   | 47   | 33  | 38   |
| Richest                                                                                                              | 27     | 30   | 16   | 27   | 32  | 36   | 35          | 40   | 38   | 44   | 36  | 40   |
| Sources: Provincial/Areas' MICS6 (Punjab 2017-18; Sindh 2018 ; KP 2022.; Baluchistan 2022; AJ&K 2020-21; GB 2024-25) |        |      |      |      |     |      |             |      |      |      |     |      |

Table 4.1 and Figure 4.1 shows that the overall burden of early childhood mortality is highest in Punjab as IMR and UFMR are 60 and 69, respectively per 1,000 live births compared to the other surveyed regions. Punjab has better health care infrastructure, higher economic activities and more medical facilities in comparison to other provinces but the province is still facing many issues of child deaths. This could be explained by its high population density, strain on health

services, rural-urban disparities and district inequities in health services use (Kazmi et al., 2024, 2025, 2026a-e). Death rates are significantly high in rural areas of Punjab as compared to the urban areas with the IMR and UFMR of 66 and 76 respectively as compared to the IMR and UFMR of 49 and 55 respectively in the urban areas. This pattern indicates that mere availability of health care facilities is not enough unless the facilities are accessible, affordable and used

effectively by the disadvantaged community. Other past studies have also pointed out the role of socioeconomic inequalities in relatively developed areas on maternal and child health outcomes (Kazmi, 1995; Desai & Alva, 1998; Agha, 2000; Rutstein, 2005; Khan and Raza, 2014; Memon et al., 2023; Kazmi et al., 2026d&e). The IMR of 51 and UFM of 59 in Azad Jammu and Kashmir (AJ&K) make it the second worst region of

mortality. The data that the region faces considerable child survival challenges. Although social indicators are relatively favorable in this region as compared to other parts of Pakistan, overall development indicators do not necessarily ensure child health outcomes, as evidenced by the high rate of mortality (Kazmi, 2009; Agha, 2000; Memon et al. 2023; UNICEF; 2024; Kazmi et al., 2024, 2025 and 2026a-e).



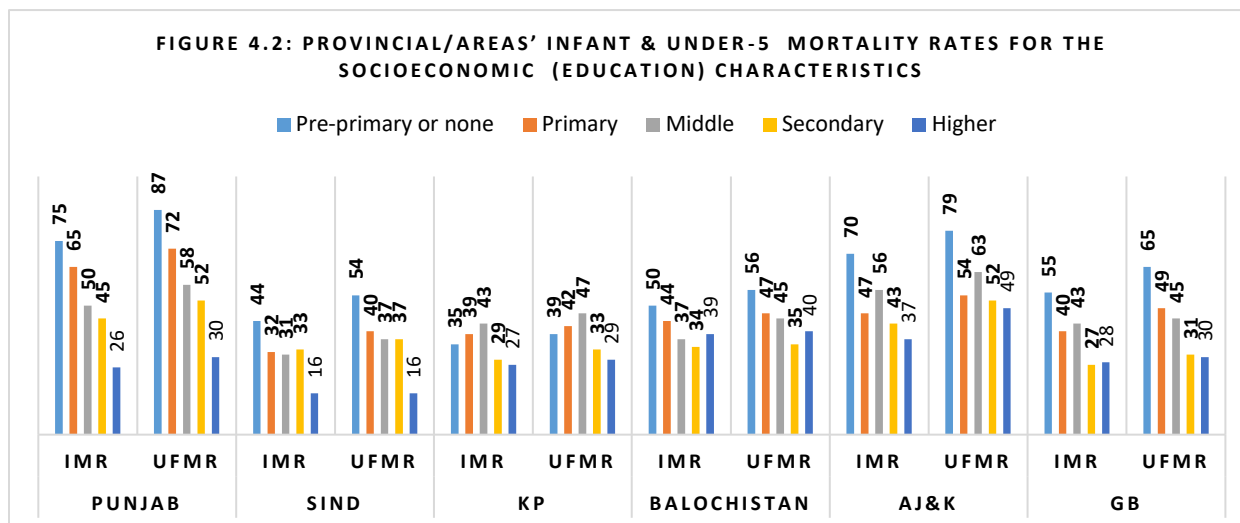
The geographical features of AJ&K such as mountainous topography, scattered population, poor transport connectivity and lack of access to specialized maternal and newborn health services can affect the utilization of health services and risk of mortality. There are urban rural disparities evident in different areas in AJ&K (Kazmi et al. 2023a&b; 2024, 2025 and 2026a&c-e). In this study rural population is experiencing higher mortality rates than urban population, with rural IMR and UFM of 53 and 61 against urban IMR and UFM of 41 and 48, respectively. The discovery underscores the need for better health promotion and referral to emergency services in hard to reach areas. Balochistan is still another very vulnerable area with total IMR of 48 and UFM of 53. The province is still grappling with structural problems such as low population density, limited healthcare infrastructure, a large geographical area, a shortage of skilled health personnel and problems accessing emergency health services. The recent available figures indicate that IMR and UFM in rural Balochistan

was higher 51 and 56 than in urban area having 39 and 44 respectively. This rural disadvantage is due to the inequitable distribution of health resources and the difficulty of delivering maternal and child health services in remote areas. The same pattern has been observed in the developing countries' remote areas where an increased mortality rate was reported due to limited access to essential health services (Kuly, 1993; Kazmi, 1995; Rutstein, 2005; Kazmi, 2009; UNICEF, 2023; Memon, et al., 2023; Kazmi et al., 2026d&e). The IMR for Gilgit-Baltistan (GB) with IMR 43 and the UFM 50 is a region with significant challenges in child mortality. The topography of GB presents a number of specific challenges to accessing healthcare services, such as a high proportion of seasonal isolation, lack of access to specialist health facilities and long distances to travel to obtain health services. Rural populations have higher levels of mortality as rural UFM is 52 against 40 in urban areas. The results highlight the need to enhance the healthcare system at the community level, promote better

transport connectivity and the scale up of maternal and newborn health services in remote areas. Among the four provinces Sindh with IMR 39 and UFMR 46 has lower mortality than the other three regions, namely Punjab, AJ&K and Balochistan. However, the results show stark disparities between rural and urban areas. The mortality rate (IMR) is high in rural Sindh (47) than in urban (29) and the under-5 mortality rate (UFMR) is also greater in rural areas (55) than in urban dwellings (36). This pattern suggests that the advantages of an urban healthcare infrastructure might not be balanced by urban and rural populations equally. Poverty, malnutrition, poor sanitation, less availability of healthcare facilities and less utilization of maternal healthcare services still remain issues in rural areas of Sindh like other areas or developing countries (Frenzen and Hogan, 1982; Irfan, 1986; Kazmi, 2009; Agha, 2000; Khan and Raza, 2014; Memon et al., 2023; Kazmi et al., 2026d&e). These findings further support the notion that there can be significant internal variation within provincial average scores. In comparison Khyber Pakhtunkhwa (KP) has the lowest mortality rates of all the regions surveyed, with an IMR of 35 and an UFMR of 39. The relatively high performance of KP could be due to better community-based healthcare programs, maternal health programs and prevention healthcare services. There is, however, a difference in mortality between rural and urban residents with IMR of 34, UFMR of 38 in rural areas, and IMR of 39, UFMR of 42 in urban areas. To sustain the improvement and to ensure that the

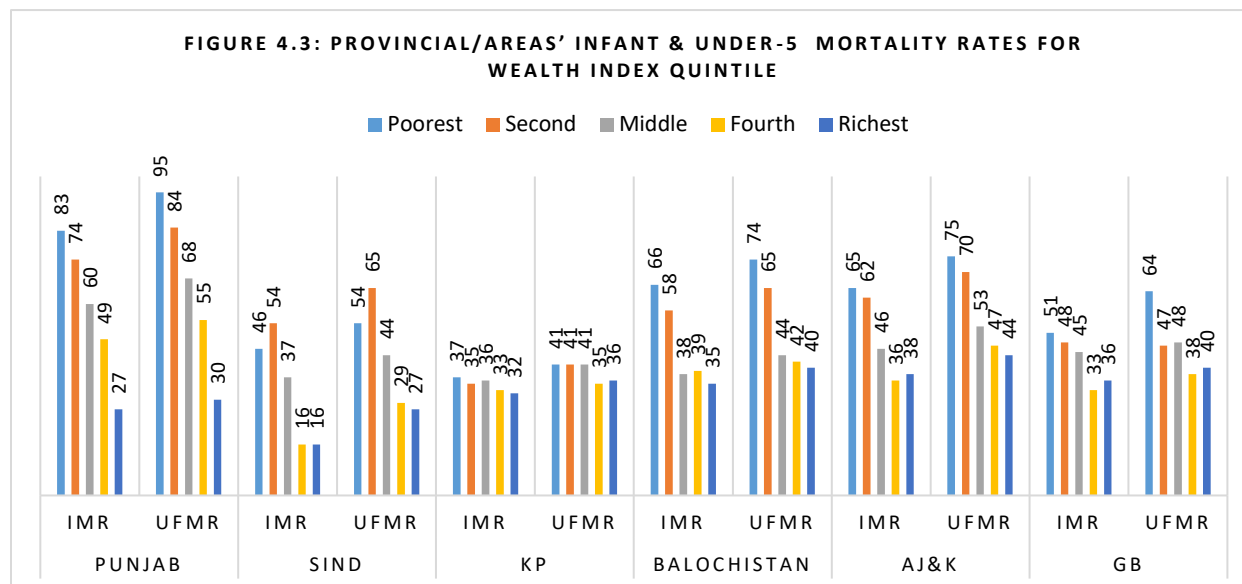
vulnerable groups do not lose out on health benefits, further investment is needed (Kazmi, 1995 & 2009).

The pattern of maternal education shows a consistent association between education and child survival (Kazmi, 1995; Desai & Alva, 1998; Agha, 2000; Khan and Raza, 2014; Memon et al., 2023; Kazmi et al., 2026d&e). In Table 4.1 and Figure 4.2, children whose mothers have more than a high school diploma tend to have lower rates of mortality across provinces than children whose mothers have limited or no education. For instance, in Punjab, IMR and UFMR drops from 75 and 87 to 26 and 30 respectively among mothers with higher education, respectively. Likewise, AJ&K reveals that the level of IMR and UFMR among mothers with no education is 70 and 79 and among mother with higher educated is 37 and 49 respectively. Maternal education has a number of pathways through which it affects child survival: through raising awareness of health issues; through better health seeking behavior; through better nutritional practices; through better say/weight in family; and through an increased capacity to identify early signs of child illness (Khan and Sirajeldin, 1979; Caldwell, 1980; Flege, 1982; Frenzen and Hogan, 1984; Sathar, 1984; Kazmi 1995 & 2009; Cleland & Jejeebhoy, 1996; Desai & Alva, 1998; Agha, 2000; Memon et al., 2023; Kazmi et al., 2026d&e). The results of this analysis reinforce the case for investing in female education as a long-term investment to promote child health (Kazmi, 1995; 2009 and 2010).



The third variable is household wealth status as represented by wealth index quintiles (poorest to richest). Household wealth has an impact on survival rates of children because it influences access to health care services, nutrition and sanitation, and living conditions (Frenzen and Hogan, 1982; Flege, 1982; Mosley & Chen, 1984; Kazmi, S. 1995; Agha, 2000; Kazmi, 1995 & 2009; Memon et al., 2023; Kazmi et al., 2026d&e). This wealth based analysis also shows that socioeconomic inequality has a strong effect on child mortality. In both areas, poorer children have higher mortality rates than wealthier. The figure 4.3 clearly portrayed regional wealth

inequality, the highest in Punjab with IMR and UFM falling from 83 and 95 for the poorest households to 27 and 30 for the richest households respectively. Likewise, the poor and rich households have IMR of 65 and 38, and UFM of 75 and 44, respectively, according to AJ&K. The situation is worse for Balochistan, where IMR and UFM drops from 66 and 74 in the poorest to 35 and 40 in the richest. In Sindh the poor and rich households have IMR 46 and 16 and UFM of 54 and 27, respectively. The IMR & UFM change in KP is quite low, dropping IMR 37 and UMR 41 in the poorest to 32 and 36 in the richest.



These variations suggest that poverty may impact child survival rates through several pathways, such as low levels of nutrition, poor sanitation conditions, delayed health care access, and the inability to access health care (Present, 1980; Mosley & Chen, 1984; Kazmi, 1995; Kazmi et al., 2024 and 2025, 2026d&e). Overall, the findings demonstrate that geographical disadvantage and socioeconomic inequality are still strong factors in the association of early childhood mortality in Pakistan. The results show that interventions should be more than just the expansion of healthcare and more specific in targeted interventions to each region's vulnerabilities. Improving maternal education, reducing poverty, strengthening rural healthcare systems, expanding neonatal care services, and ensuring equitable access to quality healthcare are essential strategies for reducing mortality inequalities and achieving Sustainable Development Goal targets related to child survival (Kazmi 1995 & 2009; Kazmi et al., 2026d&e).

## 6. Key Findings

Comparative analysis of early childhood mortality indicators across the provinces and administrative regions of Pakistan show large variations and inequalities in the survival outcomes of infants and under-fives. The results show that there are

significant differences in the mortality patterns across the provinces, and that geographical access, maternal education, and the economic situation of the household are significant factors affecting the patterns. The findings corroborate the overall evidence based on the interactions of social and economic and health-system factors affecting child mortality in developing countries (United Nations, 1979; Hashmi, 1979; Mosley & Chen, 1984; Nag, 1985; Flege, 1985; UN, 1986; Kazmi, 1995 & 2009 Agha, 2000; Rustein, 2005; Black et al., 2017; Memon, 2023; WHO, 2023; Kazmi et al., 2026d&e). The study finds that the infant mortality rate (IMR) and the under-five mortality rate (UFMR) were highest in Punjab at 60 and 69 per 1,000 live births respectively. Despite the relatively strong health care facilities, Punjab has huge child survival issues, especially in the rural population. The high mortality rates highlight the need to tackle inequalities in access to health services, quality of health services provided to mothers, and the use of existing health facilities. Azad Jammu and Kashmir (AJ&K) becomes the second highest mortality area with IMR of 51 and UFMR of 59. The results show that AJ&K has a significant problem with child survival which was not previously considered on basis of overall socioeconomic indicators. The findings indicate that geographical barriers, access to specialized

health services and transportation challenges remain a problem, while access to maternal and newborn services is unevenly distributed and remains an influence on child survival. Balochistan remains another highly vulnerable region, with an IMR of 48 and UFM of 53. The province's high mortality burden reflects persistent structural challenges, including scattered population distribution, limited healthcare infrastructure, shortage of skilled health workers, and difficulties in accessing emergency maternal and child healthcare (Kazmi, 1995; Kazmi et al., 2024, 2025 & 2026a-e). Similarly, Gilgit-Baltistan records relatively high mortality levels, with an IMR of 43 and UFM of 50, indicating the influence of geographic isolation and healthcare accessibility barriers. In contrast, Khyber Pakhtunkhwa demonstrates the lowest mortality levels among the surveyed regions, with an IMR of 35 and UFM of 39. This comparatively better performance may reflect improvements in community-based healthcare programs, maternal health interventions, and preventive health services. However, continued attention is required to address remaining inequalities among remote and disadvantaged populations. The other passive units- Punjab, AJ&K, GB and Balochistan may seek insight from KP for getting better results in health sector, particularly regarding the Infant and child survival.

The analysis also shows that in most areas, rural people suffer from a higher death toll. In Pakistan, the disproportionate burden of rural poverty is felt in Punjab, Sindh, Balochistan, AJ&K, and GB where children in rural areas are at higher risk of dying than those in urban areas. The results highlight the need for geographical factors to be taken into consideration in child survival, as rural areas tend to have limited access to health-care facilities, transportation challenges and limited availability of skilled health-care providers (Memon et al., 2023). Maternal education becomes an important protective factor for child mortality. In each region, the higher the level of education of the mother, the lower the mortality rates of the children. This result corroborates the

earlier study by Caldwell (1980), which showed that the level of education of mothers affects their health knowledge, seeking health services, practices of nutrition and utilization of preventive care. Kazmi (1995) study infers that **Education** not only provides greater autonomy to female but also enables her to have better say in the family having implications for child survival. The study also validates the fact that poverty is one of the most powerful determinants of child death. Overall, children living in the poorest households have significantly higher mortality rates than children in richer households. There are several links between socio-economic disadvantage and child survival, such as malnutrition, poor sanitation, lacking education, residence, delayed use of health services, and lack of access to health care (Hashmi, 1979; Mosley & Chen, 1984; UN, 1986; Kazmi, 1995; Agha, 2000; Khan & Raza, 2014; Memon et al., 2023; Kazmi et al., 2026a, c-e). The results show that there can be significant differences within provinces which can only be addressed through targeted interventions and not through a uniform approach.

## 7. Conclusion and Policy Recommendations

This study concludes that there are still a lot of inequalities in early childhood mortality in Pakistan – at the provincial, geographical and socioeconomic levels (Khan and Sirajeldin, 1979; Irfan, 1986; Kazmi 1995&2009; Agha, 2000; Khan & Raza, 2014; Memon et al., 2023; Kazmi et al., 2026d&e). Improvements in child survival rates have been made but child mortality has not been uniformly reduced throughout the region. The results show that the situation in Punjab, AJ&K and Balochistan needs special focus as these have significantly higher mortality rates compared to KP, which offers evidence of relatively good child survival rates. The study points out that enhancing access to health services for children is not enough to improve child survival. Equitable access to quality maternal and newborn health services, improved female education, poverty reduction, improved nutrition and enhanced health systems are critical for effective reduction in infant and under-five mortality. The impact of

maternal education and household wealth on mortality outcomes is a reflection of the close link between child survival and other aspects of social development (Hashmi, 1979; Frenzen and Hogan, 1982; Flege, 1982; UN, 1986; Kazmi 1995 and 2010; Desai & Alva, 1998; WHO 2023; Memon et al; 2023 Kazmi et al., 2026a, d&e). It is therefore necessary to have a child survival strategy for the region and equitable that takes into account the interprovincial and inter-administrative differences in socio-economic vulnerability and healthcare requirements in Pakistan. The insight from the KP could help the poor performing provinces /areas to mitigate the high IMT and UFRM problem.

Based on the results, recommendations for policy interventions are given at the regional level. Punjab should focus on improving maternal and newborn health care in rural areas, through strengthening district level health facilities, enhancing the availability of skilled birth attendants and narrowing the gap between urban and rural areas. Enhancing the quality and utilization of health services should be a key priority in the province, especially as the province has a high mortality burden despite the good infrastructure. There is a need for providing health services to remote and mountainous communities in AJ&K. Enhancing emergency transport, improving referral systems, raising awareness on maternal health and encouraging mothers' education are all critical interventions to mitigate mortality risk. Significant investments are needed in the rural healthcare infrastructure to enhance the availability of skilled health workers, improve referral systems, increase maternal and newborn services and expand primary healthcare facilities in Balochistan. Sindh needs to work to reduce the inequalities in the health outcomes of the rural population by increasing access to health services, improving nutrition support, providing adequate sanitation, and encouraging use of maternal health services. Mobile and community oriented health care services need to be expanded in order to address geographic barriers in Gilgit-Baltistan. Accessibility during hard seasons and the capability of emergency healthcare are priorities.

There is a need that KP should sustain the success of child survival interventions with emphasis on the unresolved inequalities between the remote rural and urban vulnerable groups. A comprehensive approach to child survival is needed at the national level, involving maternal education, poverty alleviation, nutrition enhancement, extending rural health coverage, facilitating skilled birth attendance, supporting neonatal care, and health systems strengthening. An equity-based approach is crucial to meet Sustainable Development Goals targets on reducing preventable newborn and child mortality (United Nations, 2023).

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