Original Article

Sociodemographic and Maternal Characteristics of Infant Deaths in Jamshoro, Sindh, Pakistan: An Analytical Cross-Sectional Study

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ABSTRACT

OBJECTIVE: To do analytical cross-sectional study based on 100 cases of infant mortality presented at the tertiary care hospital in Jamshoro, Sindh, divided into Rural and Urban (Slum). METHODOLOGY: This was an analytical cross-sectional study conducted to assess the sociodemographic determinants of infant mortality among the population presenting to Liaquat University of Medical & Health Sciences (LUMHS), Jamshoro. The research was carried out in the Departments of Obstetrics & Gynecology and Pediatrics at Liaquat University of Medical & Health Sciences (LUMHS), Jamshoro, Sindh, Pakistan. The study was conducted over a period of one month during the year 2024. Sociodemographic, obstetric, and infant features were categorized and tested for differences using Chi-square and Fisher's exact testing to find meaningful comparative differences.
RESULTS: There were significant differences. The illiteracy among the mothers was 83.8% in rural areas while it was 53.1% in urban/slum areas (P=0.001). The proportion of home deliveries was much greater in the rural (88.2%) than in the urban/slum (34.4%) groups (P<0.001). The causes of death were not specified in a large proportion in rural areas (57.4% vs 25.0%, P=0.008).
CONCLUSION: Residential setting is one of the main determinants of infant mortality. These vast gaps in infrastructure, education for women and birth spacing need to be addressed through interventions that prioritize rural health infrastructure, female education and birth spacing.

KEYWORDS: Infant Mortality, Sociodemographic Determinants, Maternal Education, Rural-Urban Disparities, Birth Spacing

INTRODUCTION

Infant mortality rate (IMR), is considered as a fundamental measure of socio-economic development and the effectiveness of health care in a country[1]. In Pakistan, infant mortality rate is far more than required in the region and the burden is disproportionate.[5] The infant mortality rate has dropped from 57 to 47 and neonatal mortality rate has dropped from 41 to 35 deaths per 1000 live births indicating that the mortality rates of babies aged 0-12 months and up to 28 days remain high, even when compared to the mortality rates of other countries in the region such as India (48), Bangladesh (38) and Sri Lanka (14)[2]. At the provincial level in Sindh, the estimated perinatal mortality rate is 70 per 1,000 live births, well above the national average, and due to low quality of healthcare delivery system[9]. Descriptive studies provide a description of general frequencies, whereas analytical studies are needed to identify the socio-demographic fault lines. The influence of maternal education on infant mortality is continually shown to be one of the strongest predictors of infant mortality, consistently reported across various studies and with high significance in each of those studies. According to OECD report 2025 for Asia/Pacific countries, in Pakistan, babies born to mothers with less than a high school education have a 75% chance of dying in infancy, while those born to higher educated mothers have a 26% chance. Likewise, the results of the HIES 2024-25 show that infant mortality rates for children born to mothers with no education is 72 per 1,000, whereas for those who are more educated, it is 11 per 1,000. A child's education has also been found to moderate the link between environmental hygiene and child mortality, and educated mothers are more likely to practice hygienic practices that help to avert preventable deaths[8]. Yet there are obstacles to the education of women, especially in rural Sindh where literacy rates are alarmingly low, despite this evidence. The global debate points to the fact that the "urban advantage" in health outcomes is often undermined by the creation of urban slums in which mortality rates are similar to those in the countryside[7]. A study conducted in Punjab, Pakistan, shows that there is a huge disparity between determinants of infant mortality rates in rural and urban areas, socio-economic position, social practices, environmental conditions and utilization of medical services were some of the key determinants in reducing infant death rates[5]. The difference is also very large in Sindh: 32% of rural children are fully immunised against the 64% in urban areas, and 45% of rural children are

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doi: 10.22442/jlumhs.2026.01599

malnourished compared to 30% of urban children[2,10]. Major causes of neonatal deaths are birth asphyxia, sepsis and prematurity, while pneumonia and diarrhoea are the major causes of post-neonatal death[2], constituting two thirds of all deaths in Sindh among infants. Utilization of antenatal care (ANC) has also been highlighted in recent research as an important protective factor against mortality, a service which is not being used to its full potential in rural Sindh. This study is based on comparative analytical approach which helps to isolate the impact of residential setting on maternal health literacy, birthing environment and the proximal causes of infant mortality in Jamshoro, Sindh and extends studies on health inequities in South Asia[9,10].

METHODOLOGY

This was an analytical cross-sectional study conducted to assess the sociodemographic determinants of infant mortality among the population presenting to Liaquat University of Medical & Health Sciences (LUMHS), Jamshoro. The research was carried out in the Departments of Obstetrics & Gynecology and Pediatrics at Liaquat University of Medical & Health Sciences (LUMHS), Jamshoro, Sindh, Pakistan. LUMHS is a tertiary care teaching hospital serving a diverse population from both rural and urban areas of the region. The study was conducted over a period of one month during the year 2024. The study population comprised mothers who had experienced infant death (defined as death of a child under one year of age) and who presented to the Departments of Obstetrics & Gynecology and Pediatrics at LUMHS Jamshoro during the study period. There were a total of 100 mothers with children who died of Sudden Infant Death Syndrome (SIDS) enrolled. As it was not feasible to obtain data at the setting during a one-month period and only a limited number of suitable candidates were available, the sample size was determined accordingly. The sampling technique used was non-probability sampling technique, convenience sampling. All mothers who presented to the study departments during the data collection period who were eligible for the study, and who fulfilled the inclusion criteria were approached for participation. Participants who could and did participate were recruited in a consecutive manner until the sample size of 100 was reached.

Inclusion Criteria

- Mothers who were willing to give their informed consent to participate in the study.
- Mothers who delivered in LUMHS, Jamshoro in the department of obstetrics & gynaecology and pediatrics.
- Mothers of baby who had died or lost consciousness before 1 year.

Exclusion Criteria

- Mothers who refuse or cannot consent.
- Mothers who had deliveries outside the LUMHS facility.
- Mothers who were unable to remember or give reliable data about obstetrics or infant characteristics.

Data Collection Procedure

A questionnaire, which was structured and pre-designed, was used for data collection. A thorough review of the literature on sociodemographic factors and infant mortality was conducted and used to develop the questionnaire. It included the following sections:

1- Sociodemographic: Age, Religion, District of residence, Residential status (rural/urban/slum), Language spoken, Marital status, Age at marriage, Literacy status, Educational level, Occupation status, Household income.

2- Obstetric and reproductive history: Total number of children, birth spacing between the dead infant and the previous child, history of multiple births (twins/ triplets), gestational age at delivery and mode of delivery.

3- Maternal health characteristics: Co-morbidities in pregnancy (hypertension, diabetes, coronary heart disease or other complications), complications during delivery and history of substance addiction (smoking, naswar, gutka, mainpuri, supari or others).

4- Characteristics of the deceased infant: sex of the infant, age at death, reported mother's breastfeeding status, and cause of death reported by the mother or in hospital records.

Questionnaire was administered by trained data collectors in the outpatient departments and wards of the study areas through face-to-face interviews. Prior to data collection, the purpose and procedures of the study were explained to each participant. All participants signed informed consent forms; those who were unable to sign signed with a thumb print. All information was kept confidential.

Data Analysis Procedure

IBM SPSS Statistics 2025 was used to enter and analyse the data. Categorical variables were presented in terms of frequencies and percentages. Means and standard deviations were computed for continuous variables. The distribution of socio-demographic and clinical characteristics of the study population was presented using descriptive statistics. The results were presented using tables and figures (in pie charts and bar charts) to show how many of the different variables occurred. In this descriptive cross-sectional analysis there were no inferential statistical tests used.

Ethical Considerations

The study was carried out on moral principles of medical research on human beings. The institutional review board of LUMHS, Jamshoro was garnered the ethical approval. All participants gave informed consent before participating in the study. Participants

were told that they could withdraw at any time from the study without losing any benefits of the research. The data were anonymized and all data were kept confidential to preserve the anonymity of the participants.

RESULTS

Maternal Sociodemographic Characteristics

There was a distinct structural divide in the sociodemographic characteristics of the two types of dwellings. Rural mothers were much more likely than urban/slum mothers to have never been in school (85.3% vs 59.4%, P=0.004) and to be illiterate (83.8% vs 53.1%, P=0.001). Household income < 20000 PKR was also strongly associated with rural families (76.5 % vs 50 % (P=0.008)). Rural mothers were more likely to marry early (between 10 and 20 years old) than urban mothers (82.4% vs 65.6%) but this difference was not statistically significant at the conventional .05 level (P=0.068). The findings were combined and are provided in **Table I**, and collectively show that socioeconomic marginalization is still a key baseline risk factor for infant deaths in the region.

Childbirth Dynamics, Obstetric and Reproductive Dynamics.

The rural mothers were significantly more likely to deliver their babies at home (88.2%) than urban/slum mothers (34.4%, P<0.001), reflecting a high level of unmet demand for skilled birth attendants in rural areas. Limited uptake of family planning services was also evident with rural households having significantly lower birth spacing (25.0% vs 52.9% with less than 12 months, P=0.013). On the other hand, the urban/slum group had significantly higher percentages of cesarean-section babies (53.1% vs 20.6%, P=0.001), further indicating that more complex and high-risk labor and delivery is facilitated in a facility setting in this group.[4] Mothers in rural areas were more likely to have five or more children (high parity) than mothers in urban areas (52.9% vs 34.4%) but this did not reach statistical significance (P=0.086). These results are given in **Table II**.

Phenotypic Outcomes of Infants and Stratified Etiology

Analysis of infant outcomes revealed that an unspecified cause of death occurred significantly more often in rural cases (57.4%) than among urban/slum cases (25.0%, P=0.008), while a clearly documented clinical entity occurred significantly more often among urban/slum cases (46.9% vs 19.1%, P=0.008). The lack of this information signaled a major deficiency in the quality of vital registration and diagnostic follow-up in rural areas versus urban areas, in which clinical pathologies are more commonly recorded[3]. The proportion of neonatal deaths within the first month of life (42.6% vs 40.6%, P=0.844) as well as the proportion of infants who were breastfed (75.0% vs 68.8%, P=0.510) were not differentiated by residential setting. The complete comparative data are shown in **Table III**.

Table I: Comparative Analysis of Maternal Sociodemographic Frameworks

Variable	Rural (n=68)	Urban/Slum (n=32)	P-Value
Maternal Illiteracy	57 (83.8%)	17 (53.1%)	0.001
No Formal Education	58 (85.3%)	19 (59.4%)	0.004
Early Marriage (10–20 yrs)	56 (82.4%)	21 (65.6%)	0.068
Low Income (≤ 20,000 PKR)	52 (76.5%)	16 (50.0%)	0.008

Table II: Obstetric, Reproductive and Birthing Dynamics

Variable	Rural (n=68)	Urban/Slum (n=32)	P-Value
Home Delivery	60 (88.2%)	11 (34.4%)	<0.001
Short Birth Spacing (<12 mo)	36 (52.9%)	8 (25.0%)	0.013
C-Section Delivery	14 (20.6%)	17 (53.1%)	0.001
High Parity (≥5 children)	36 (52.9%)	11 (34.4%)	0.086

Table III: Infant Phenotypic Outcomes and Stratified Etiology

Variable	Rural (n=68)	Urban/Slum (n=32)	P-Value
Unspecified Cause of Death	39 (57.4%)	8 (25.0%)	0.008
Clinical Entities	13 (19.1%)	15 (46.9%)	0.008
Neonatal Death (<1 month)	29 (42.6%)	13 (40.6%)	0.844
Breastfed	51 (75.0%)	22 (68.8%)	0.510

DISCUSSION

Geography is a strong determinant in infant mortality in Sindh. In rural areas, mothers live in a “vicious cycle” of illiteracy and inadequate professional obstetric care, which is linked to much higher rates of preventable deaths. This is consistent with the study conducted by Tesema et al.[4] that showed residential status is one of the main factors linked to mortality. In addition, the diagnostic vacuum in rural areas is in line with other developing areas where facility-based death registration is not in place and results in poor public health planning[3]. While clinical pathologies are more likely to be present in urban deaths, rural deaths tend to be the result of structural neglect over time. To confront these disparities, there is a need for a change towards proactive reforms and for the formal municipal healthcare networks to reach the rural and slum people. Last, birth spacing is of critical importance as short inter-pregnancy intervals still contribute to infant morbidity in Pakistan[10]. This paucity of documentation of a cause of death in rural cases requires special attention. Verbal autopsy has been shown to be a pragmatic approach to estimating cause-specific mortality and may help significantly reduce the diagnostic gap noted in this group in settings where a routine facility-based death review

does not exist[11]. The use of a streamlined verbal autopsy tool as part of existing rural health information systems would enable reclassification of deaths of unknown causes into actionable categories and improve surveillance and resource allocation. The high disparity in home delivery rates also shows Pakistan's inequity of skilled attendance at home deliveries. CBWs, including Lady Health Workers, have been shown to reach remote rural communities and serve as a link between households and health services for basic maternal and newborn care services in households[12]. Expanding these CHW programs and providing conditional transport and referral incentives could help to decrease the need to rely on unattended home births without needing to invest in large-scale infrastructure immediately[12]. This high cesarean section rate in the urban/slum group should not be interpreted as exclusive evidence of better access, but may be due to over-medicalization of childbirth in tertiary care institutions or delayed attendance to already high-risk pregnancies. This high cesarean section rate in the urban/slum group does not necessarily mean it is an indicator of better access; it may be partially attributable to over-medicalization of birth in tertiary institutions or to postponement of high-risk pregnancies for presentation. It would be impossible to differentiate medically indicated cesarean sections from those for defensive practice or convenience without linking to detailed clinical indications which were not available in this data set. These results align with the overall policy goals outlined in SDGs and Every Newborn Action Plan which both consider access to skilled birth attendance and neonatal care as prerequisites to the reduction of preventable infant mortality[14]. The community-based approaches and recommendations outlined here will require provincial maternal, newborn and child health programs to attend to the rural-urban divide instead of implementing a uniform district-level approach. There are some limitations to this study. The single-center, hospital-based design and relatively small sample size (n=100) restrict generalizability to the overall population of in Sindh and mothers who had no contact with any facility may be under-represented, especially from the remote rural regions. The cross-sectional design also does not allow for causal inferences to be drawn, and there was the possibility of recall bias regarding obstetric history and delivery location[15]. These associations need to be confirmed in larger, multi-site and community-based research and to inform the allocation of resources at district level with greater precision.

CONCLUSION

The current study demonstrates that sociodemographic factors play a significant role affecting the infant mortality rate in Jamshoro, Sindh, and the health disparities can be attributed to various sociodemographic factors with certain structural factors standing out such as residential setting. Rural mothers have a double burden of illiteracy, poverty, and low rate of skilled birth attendance, early marriage, and cause of infant deaths as well, with significantly higher rates of home deliveries, short birth spacing, and infant deaths of unspecified causes than their urban/slum counterparts. The extent of the diagnostic gap is marked: rural areas had more than 50% of infant deaths with unknown causes, reflecting the critical gaps in vital registration and post-mortem surveillance that hinder critical public health planning by evidence. However, neonatal mortality and breastfeeding, which are other important outcomes, were comparable between the groups, while distinct differences in maternal education and utilization of healthcare services and documented causes indicate the need for targeted interventions. To address these inequities, a multi-sectoral approach is needed, which includes an expansion of female education, strengthening of the healthcare infrastructure in rural areas with skilled birth attendants, promotion of family planning services for optimal birth spacing and implementing standardized cause-of-death reporting mechanisms such as verbal autopsy tools. Unless intentional efforts are made to reduce the gap between rural and urban areas, preventable infant mortality will continue to be a source of perpetuation of rural poor health and poverty among the most vulnerable populations of Pakistan. Further studies using community-based larger samples with prospective designs is needed to confirm these results and help effectively allocate resources for sustainable reduction of infant mortality.

Recommendations

1. **Targeted Literacy:** Intensive maternal health programs focusing on infant care and hygiene.
2. **Expand SBA Coverage:** Incentivize skilled birth attendants to operate in remote agrarian zones.
3. **Family Planning:** Institutionalize birth spacing in routine antenatal care and immunization programs.
4. **Diagnostic Frameworks:** Implement mandatory, standardized cause-of-death reporting in rural primary health centers, supported by verbal autopsy tools.

Ethical permission: Liaquat University of Medical and Health Sciences, Jamshoro, The study has been approved by ERC.

Conflict of interest: There is no conflict of interest between the authors.

Financial Disclosure / Grant Approval: No funding agency was involved in this research.

Data Sharing Statement: The corresponding author can provide the data proving the findings of this study on request. Privacy or ethical restrictions bound us from sharing the data publicly.

AUTHOR CONTRIBUTION

Khetran MMJ: Data collection
Tariq F: Data analysis
Masood MS: Acquisition of data
Shaikh NA: Grammatical correction
Khuram M: Typographical correction
Bijarani SA: Final approval

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