Research Article

Impact of income, healthcare facility and female literacy on infant mortality rate – A comparative analysis of South Asian and Central Asian Countries

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Abstract
The present research paper on Spatiotemporal variation in infant mortality rate – a comparative analysis of central Asian and South Asian regions, reveals a significant variation in infant mortality rate because of various socio-economic and political reasons. Five countries of central Asia Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan were selected; similarly six countries of South Asia i.e. India, Pakistan, Nepal, Bhutan, Bangladesh, and Sri Lanka were selected. The paper is based on a secondary source of data. Time series analysis of the last six decades (1950-2010) was used to analyze the trend of IMR. Data for the last three years i.e., 2016, 2017, and 2018 was used to analyze the annual pattern of IMR pattern. The analysis shows that Central Asian countries have a low IMR rate (25/1000) in comparison to south Asian countries (30.6). Among The south Asian Countries, Pakistan has highest IMR rate (50 /1000 in 2018) followed by India (38/1000) Bangladesh(31/1000), Bhutan (30/1000), Nepal(27/1000) and Srilanka (8/1000) While as Turkmenistan from central Asia has highest IMR rate (33/1000 in 2018) followed by Tajikistan(31/1000), Kyrgyzstan (25/1000), Kazakhstan (19/1000) and Uzbekistan (17/1000). So there is a wide range of IMR within the countries as well as between these two regions. An attempt has been made to suggest a planning strategy for decreasing IMR in both the regions.

Keywords
IMR (infant mortality rate), Spatio-temporal, central Asia, South Asia

Introduction:
Infant mortality rate is defined as number of children who die before reaching their first birthday in a given year and it is expressed per 1000

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live births. Factors which effect infant mortality are mothers' health, birth weight of child and feeding practices. Diseases like pneumonia, diarrhea and malaria are leading cause of death in infants. Sustainable development goals are targeting to reduce infant mortality rate to 12 deaths per thousand live births by 2030. Asia -pacific region has shown tremendous decline in infant mortality rate that is up to 50 per cent (Haas et al., 2013). Infant mortality can be reduced by promoting best breast feeding practices by mothers, management and treatment of neonatal infections, pneumonia, diarrhea and other child birth diseases (UNICEF, 2013) Objectives of millennium development goal 4 cannot be attained without reducing infant mortality. On an average 130 million babies are born each year out of these 6.3 million prenatal deaths occur each year. 70 per cent of deaths take place in first month of birth.

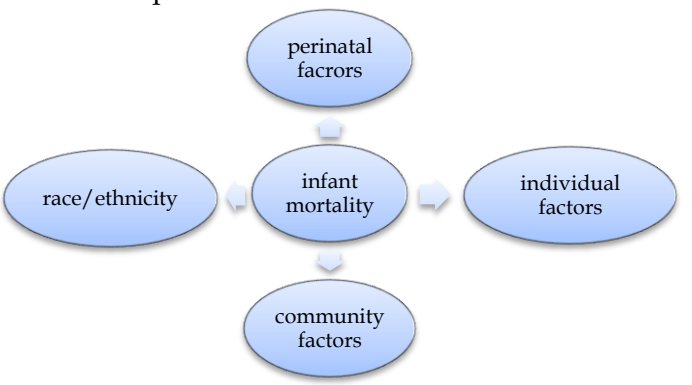

Figure 1:
Conceptual framework of factors influencing infant mortality rate

Low education attainment, less income, young maternal age and short inter pregnancy interval, low health consciousness behavior including use of drugs, cigarette smoking, alcohol consumption and inadequate prenatal care are factors responsible for preterm birth and low birth weight (LBW) in children in the Asian countries (Collins, 1990; kleinman, 1987). 60 per cent of neonatal deaths occur in Asia , it is because of low birth weight and lack of skilled health care delivery .It has been observed that 1/3 of neonatal deaths occur in three countries of south Asia , India , Pakistan and Bangladesh(Singh, 2006). Infant mortality can be reduced by promoting best breast feeding practices by mothers, management and treatment of neonatal infections, pneumonia, diarrhea and other child birth diseases (UNISCO, 2018). Infant mortality trends in central Asia are showing varied behavior in space and time. To understand the fertility trends and demographic transition we have to analyze demographic data for longer period of time to understand demographic transition in region (spoorenberg, 2000). A reflection on child and infant mortality in selected

south Asian countries, the study tried to understand relationship between infant mortality rates in relation to literacy rates, cultural factors. And facilities like electricity, safe drinking water. Results of study showed there was need of better cesarean section delivery and empowerment of women(Personal & Archive, 2018). South Asia has shown minimal progress in development of child and maternal health, When we compare with other regions of world. In south Asia India's progress was very low in reduction of infant mortality rate. Bangladesh and Nepal despite of their problems and low socioeconomic status have performed well (Gangbar & Gayathri, 2014). Social determinants of health risk factors for infant mortality among African American demonstrated association between determinant of health and infant mortality. Findings of study showed most policies focus on individual and public policy levels and fail to understand the complexity of issue. so additional research is required(Reno & Hyder, 2018). In a study of racial disparity in infant mortality, to understand African –American women's birth outcome disadvantages. the study found factors such as crime, segregation , built environment , structured institutional racism , are factors responsible for poor outcome of African –American women(Europe et al., 2010). In a study related to factors shaping mother-child interaction in post-soviet countries of Eastern Europe and central Asia. It was observed mother-child interaction was highest in Georgia and lowest in Kyrgyzstan. Interaction was lower for younger children, older mothers and poorer households. parental child programs are required to improve the quality of maternal time (Zainiddinov & Habibov, 2019). A study on public health insurance and child health in United States showed that subsidized health insurance opportunities for low-income people has improved child healthcare scenario in country. Maternal health condition has improved because of timely prenatal visits and in turn pregnancy behaviors and outcomes (Palmer, 2018). There is a negative relationship between income and mortality, if the GDP per capita PPP increases by 10 per cent in a country where the infant mortality is 50/1000 live births, the infant mortality would be expected to decrease by 10 per cent to 45/1000 live births(Bernadette et al 2013). The infant mortality rate of the countries decreased as countries became rich and powerful and new levels of strategic thinking, which will find innovative solutions, have an important role in decreasing infant mortality rate and growing economic power of the countries. It reveals that there is a significant and negative relationship between infant mortality rate and real per capita GDP (Erdegon et al 2013).Economic shocks in the developing world generally lead to more infant deaths, especially of girls, and especially when these shocks are severe. Of course, there is variation across countries (Sarah

Baird et al 2009). The infant mortality rate is not only seen as a measure of the risk of infant death but it is used more broadly as a crude indicator of Community health status, Poverty and socioeconomic status levels in a community, Availability and quality of health services and medical technology. The health and well-being of children and families across the globe are measured by infant mortality rates.(Association of Maternal and Child Health Washington, 2013). Infant mortality rate is one of the most sensitive indicators of the socioeconomic and health status of a community. This is because more than any other age group of **a** population, infant's survival depends on the socio economic conditions of their environment (Masise et. al., 2003). South Asian countries are developing faster but south Asian countries are facing lots of internal problems. Out of them infant mortality plays a vital role and it is one of the most important items in the Millennium Development Goals (UNICEF, 2005; Mustafa and Odimegwu, 2008). The causes of infant mortality are strongly related to those structural factors like economic development, general living conditions, social well-being, and the quality of the environment, that affect the health of entire populations. (Reidpath, Allotey 2003)

Study Area:

Central Asia has a total area of 4003451 $km^{2.}$ The total population of central Asia as per 2019 data is 72,960,000 persons. Population density is 17.43/$km^{2.}$ It includes five countries i.e., Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan. Central Asia has historically been closely tied to Silk Road; Silk Road connects south Asia and East Asia. Central Asia is an extremely large region of varied geography; it includes mountains like tian shan, vast deserts Kyzyl Kum, Taklamakan, and grassy steppes. Major rivers of the region include the Amu Darya, Syr Darya, Irtysh, hari, and Murghab River. Major water bodies include the Aral Sea and Lake Balkhash. The climate of central Asia is dry and continental with hot summers and cool to cold winters, with occasional snowfall. Central Asia also contains the montane grasslands and shrublands, deserts and xeric shrublands. Central Asia has long been a strategic location merely because of its proximity to several great powers on the Eurasian landmass. South Asia is the southern region of the Asian continent. The total area of south Asia is 5,134,641 km^2. Total population of region is 1,814,014,121 persons in 2018. Population density is 362.3/km^2. South Asia includes seven countries i.e., Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka. South Asia alone accounts for 98.47 per cent population of Hindus, 90.5 per cent global Sikh population, and 31 per cent of the global Muslim population. The

region is home to a variety of geographical features, such as glaciers, rainforests, valleys, deserts, and grasslands. It is surrounded by three water bodies, Bay of Bengal, the Indian Ocean, and the Arabian Sea. Most of this region is resting on the Indian Plate, the northerly portion of the indo-Australian plate, separated from the rest of the Eurasian plate. The climate of this vast region varies considerably from area to area from tropical monsoon in the south to temperate in the north. As Himalayas block, the north- Asian bitter cold winds, the temperatures are considerably moderate.

Objectives of Study:

- To analyze infant mortality rate and its Spatio-temporal variation between south Asia and central Asia.
- To analyze the relationship between infant mortality rate (IMR), health expenditure per capita in U.S dollars

Data Base and Methodology:

Sources of data: Central intelligence agency (CIA) 2000 for infant mortality rate and WHO (2000) for health expenditure per capita in U.S dollars.

Methodology: In present study three indicators of infant mortality has been used

1. Per capita income in US dollars
2. Female literacy rate
3. Infant mortality rate.

Time series analysis of the last six decades (1950-2010) was used to analyze the trend of IMR in last six decades. Data for the last three years i.e., 2016, 2017, and 2018 was used to analyze the annual pattern of IMR pattern.

Results and Discussions:

Infant mortality rate and scenario of south Asian countries:-

Table 1: Infant mortality data in south Asia from (1950-2015) number/1000

COUNTRY	1950-1960	1960-1970	1970-1980	1980-1990	1990-2000	2000-2010	2010-2015	AVERAGE
INDIA	178.33	152.16	256.3	99.37	76.47	55.02	41.36	122.71
BHUTAN	254.4	200,38	144.96	101	68.69	45.72	30.49	12O.8
NEPAL	226.31	200	159.5	120.03	78.04	47.08	32.36	123.33
BANGLADESH	204.8	159.13	161.4	117.33	81.43	49.66	33.1	115.26
SRI LANKA	81.39	56.75	40.11	26.73	18.1	11.56	8.23	34.69
PAKISTAN	230.95	160.01	129.8	114.46	97.18	80.64	69.84	126.12

Source: Central Intelligence Agency (CIA), 2000

From the above data it was analyzed that in all south Asian countries infant mortality has declined from 1950 to 2015. Countries like Bhutan, Bangladesh, and Nepal have shown a significant decline from 226.31 in 1950 to 30.49 in 2015 in Bhutan .in Nepal it has declined from 226.31 in 1950 to 32.36 in 2015. In comparison to this country like India and Pakistan there is not so much significant decline, in India IMR in 1950 was 178.33 in 1950, and in 2015 it was 41.36, and in Pakistan IMR was 230.95 in 1950 and this has declined to 69.84 in 2015. The above analysis clearly shows that India and Pakistan have not improved so much in comparison to small neighboring countries like Bhutan, Nepal, and Bangladesh. Pakistan from this region has still the highest IMR in 2015 that is 69.84. Only county in this which had the lowest IMR rate in 1950 is Srilanka. In Sri Lanka IMR in 1950 was 81.39 and it has declined to 8.23 in 2105. In 2015 Sri Lanka had the lowest infant mortality rate in the South Asian region.

Healthcare expenditure and its impact on infant mortality rate in south Asian countries

Table 2: Relation between infant mortality rate and health expenditure

INFANT MORTALITY RATE IN NUMBER / 1000					HEALTH EXPENDITURE PER CAPITA IN U.S DOLLARS				
	2016	2017	2018	AVERAGE	2000	2005	2010	2015	AVERAGE
INDIA	40.5	39.1	38	39.2	19	28	45	63	38.75
PAKISTAN	53.9	52.1	50	52	16	21	27	38	25.5
NEPAL	28.9	27.9	27	27.93	9	15	30	44	24.5
BHUTAN	33.9	32.1	30	32	32	42	69	91	58.5
BANGLADESH	32.9	31.7	31	95.6	8	11	20	32	17.75
SRILANKA	8.6	8.4	8	8.33	36	47	83	118	71

Source: - Central Intelligence Agency (CIA), 2000 for infant mortality rate and WHO (2000) for health expenditure per capita in U.S dollars

From the above data it was analyzed that Srilanka has the highest expenditure on health (71 U.S dollars) and lowest infant mortality rate (8.33 /1000). So it directly shows that an increase in health expenditure decreases infant mortality rate of country or region. Pakistan has the lowest expenditure in health (25.5 U.S dollars) and the highest infant mortality rate in the region (52/1000). And it has been analyzed that there is a continuous decrease in infant mortality rate with increased expenditure on health. So these countries should increase their expenditure on health to reduce their infant mortality rates.

Factors influencing infant mortality in central Asian countries and its regional variation:

South Asia constitutes 20 per cent population of world and region has high population density. Due to high population density and low socio

economic conditions health sector could not develop in these countries when we compare with central Asian countries, where socioeconomic conditions are better and low population density. When we compare countries of south Asia among themselves there are regional variations in south Asia. These regional variations are due to various socioeconomic and political reasons. Mundle in (2011) found that low performance of India in reducing infant mortality rate was due to lack of adequate medical and health infrastructure, low transport infrastructure and less access to health care facility. Maternal and child health are also affected by gender factors. In countries like Afghanistan and Pakistan it was observed that females have less autonomy related to decisions of their health care especially more in rural areas in comparison to urban areas. Because of these factors limited health care access is available to women. (Babar, 2015; Mashal, 2007), The persisting high burdens of diarrheal disorders, acute respiratory infections, and hepatitis A and E in South Asia reflect the poor state of basic public health services, especially clean water and sanitation, and a general lack of hygiene awareness.

Infant mortality rate and scenario of central Asian countries:

Table 3: Infant mortality data in central Asia from (1950-2015) number/1000

COUNTRY	1950-1960	1960-1970	1970-1980	1980-1990	1990-2000	2000-2010	2010-2015	AVERAGE
KAZAKHSTAN	105.95	89.315	72.74	56.16	47.26	29.52	14.12	59.29
KYRGYZTAN	135.17	115.06	95	75.03	54.10	38.36	19.56	76.04
TAJIKISTAN	155.73	137.98	119.83	102.49	83.92	54.1	39.88	99.13
TURKMENISTAN	145.23	125.48	105.72	85.9	68.39	51.12	46.7	89.79
UZBEKISTAN	120.05	99.61	81.1	68.24	57.11	48.52	44.02	74.09

Source: Central Intelligence Agency (CIA), 2000

From the analysis of the above data, it was observed that all central Asian countries have shown a Continuous decline in IMR from 1950 to 2015. Countries like Tajikistan, Turkmenistan, Uzbekistan, Have shown a moderate decline, and the rate of decline is almost the same in these three countries. Tajikistan has shown a decline from 155.73 in 1950 to 39.88 in 2015. Turkmenistan has shown a decline from 145.23 in 1950 to 46.7 in 2015. Uzbekistan has shown a decline from 132.72 in 1950 to 44.02 in 2015. Two countries of central Asia that is Kyrgyzstan and Kazakhstan have shown a decline from 1950 to 2015. Kyrgyzstan has shown a decline from 135.17 in 1950 to 19.56 in 2015. Similarly Kazakhstan has shown a decline from 105.95 in 1950 to 14.12 in 2015.

Healthcare expenditure and its impact on infant mortality rate in central Asian countries

Table 4: Relation between infant mortality rate and health expenditure

INFANT MORTALITY RATE IN NO/1000					HEALTH EXPENDITURE PER CAPITA IN U.S DOLLARS				
	2016	2017	2018	AVERAGE	2000	2005	2010	2015	AVERAGE
KAZAKHSTAN	20.3	19.6	19	19.63	51	150	364	379	236
KYRGYZTAN	26.8	25.9	25	25.9	12	36	63	92	50.75
TAJIKISTAN	32.8	31.8	31	31.86	6	18	43	63	32.5
TURKMENISTAN	35.5	34.3	33	34.26	77	345	222	405	262
UZBEKISTAN	18.6	18	17	17.86	29	29	74	134	66.5

Source: Central Intelligence Agency (CIA) 2000 for infant mortality rate and WHO (2000) for health expenditure per capita in U.S dollars.

From the above data it was analyzed that Kazakhstan has the lowest infant mortality rate of 19.63 and the highest expenditure on health (236 U.S dollars per capita). Uzbekistan has an average infant mortality rate of 17.86 and health expenditure (66.5 U.S DOLLARS). So we can conclude that an increase in health expenditure decreases infant mortality rate in a country. In health expenditure Kazakhstan showed a significant improvement form 51 U.S dollars in 2000 to 379 U.S dollars in 2015, because of this health and medical facilities has improved tremendously in-country and because of this Kazakhstan has one of lowest infant mortality rate in the region. Turkmenistan despite height expenditure in health 262 U.S dollars but has still height infant mortality rate in the region. Turkmenistan should focus on health care expenditure on children and females to improve infant mortality rates in the region. .The infant mortality rate has continuously declined in all south Asian countries from 2016 to 2018. From the analysis of the above data we can see India and Bhutan have shown significant improvement in the last three years. The reason was the increased focus on health care spending and improvement in health and medical facilities. Pakistan also has shown a significant improvement from 53.9 in 2016 to 50 in 2018, but Pakistan still has the highest infant mortality rate in South Asian countries and it was 50 in 2018. Sri Lanka has the lowest infant mortality rate in the region and is lowest both from the central Asia region and south Asia region.

Impact of female literacy, health expenditure, and per capita on infant mortality between south and central Asia:

From the data in table 5, it was analyzed that both average infant mortality from 1950-2015 and 2016-2018 were highest in south Asian countries than in central Asian countries. Sri Lanka from South Asia has shown significant improvement.

Table 5: Relation between infant mortality, health expenditure and per capita income

Country	Average IMR 1950-2015	Average IMR 2016-2018	Average per capita health expenditure in U.S dollars	Female literacy rate – 2008	Country	Average IMR 1950-2015	Average IMR 2016-2018	Average per capita health expenditure in U.S dollars	Female Literacy rate 2008
India	122.71	39.2	38.75	66	Kazakhstan	59.29	19.63	236	100
Pakistan	120.8	52	25.56	46	Kyrgyzstan	76.04	25.9	50.75	99
Nepal	123.33	27.93	24.5	60	Tajikistan	99.13	31.86	32.5	100
Bhutan	120.8	32	58.5	63.9	TURKMENISTAN	89.79	17.86	26.2	100
Bangladesh	115.26	31.86	17.75	71	UZBEKISTAN	74.69	34.69	66.5	100
Sri lanka	126.12	8.33	71	91	-	-	-	-	-
Total	121.5	31.8	39.3	66.31		79.78	25.98	82.39	99.8

Source: Central Intelligence Agency (CIA), 2000

Conclusions and Recommendations

Inconsistent policies, weak infrastructure, governance issues, and financial constraints do greatly affect countries such as Bangladesh and Nepal, but instead of these challenges, both countries have managed to make great strides in terms of MDG achievement relative to India's performance. Specifically looking at the issue of funding, it is evident that increasing funding will not ensure progress in this field, but rather, success is contingent upon whether the resources are adequate, and how well they are allocated and used. This issue of resources is compounded by the fact that such programs have not been directly linked with improving malnutrition rates across these countries. A major reason for the lack of progress could be attributed to issues of poor governance – lack of political will, the divergence of effort, and the lack of a transparent dedicated health system that is pro-child and maternal health and nutrition. Further research is required to examine the state of child and maternal health and nutrition and to examine how resources are being allocated and utilized to address the issues that are the reason for the height infant mortality rate in these countries. In both regions there is need to extend institutional and professional capabilities in public health policy to remove inequities in access to health care. Technical healthcare also needs improvement.

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