Original Research Article

Association of maternal and child health related variables with decline in infant mortality rate in Punjab, India

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ABSTRACT

Background: Infant mortality rate (IMR) is a sensitive indicator for monitoring child health and survival. Punjab state in North India is performing better than most of the other states in various health indicators. Punjab's IMR has shown a rapid decline from 38/1000 live births in 2008 (Sample registration system (SRS) 2008) to 24/1000 live births in 2014 (SRS 2014). This study was planned to assess which of the maternal and child health services is associated with rapid decline in infant mortality rate.

Methods: Association between various components of prenatal care, intranatal care and postnatal care, and child healthcare and socio demographic variables (taken from secondary data of District Level Household Surveys) and Infant Mortality Rate (taken from SRS) of Punjab was studied. Spearman correlation coefficient was calculated to measure the association between the variables.

Results: Total fertility rate (TFR), women who had institutional deliveries, safe deliveries and mean children ever born are statistically significantly associated with decline in infant mortality rate.

Conclusions: In Punjab, maternal and child health indicators are directly or indirectly associated with decline in infant mortality rate. Findings of the study demonstrate that the recent rapid decline in IMR of Punjab is strongly associated with increase in institutional deliveries and decline in TFR and the mean number of children ever born.

Keywords: Infant mortality rate, Maternal health, Child health, Health services

INTRODUCTION

Infant mortality rate (IMR) is a sensitive indicator in monitoring child health and survival. It is influenced by many factors that are in turn likely to be influenced by health status of the mother and child such as socioeconomic conditions, antenatal and post natal care, sickness, and the environment in which they are living.¹

The International Conference on Primary Health Care held in Alma Ata in 1978 was the first global forum to consider that systematic development could help in reducing child mortality.² At the International Conference

on Population and Development (ICPD) held in Cairo in 1994, United Nations adopted the plan of action to reduce mortality in children.² The level of IMR was static in India during 1968-70 at 130 deaths per 1000 live-births.² After the Alma Ata declaration of 1978, a national goal was conceived by the Government of India for reaching an IMR of 60 by the year 2000.² Though IMR declined steadily, the goal could not be achieved. Currently, India has highest IMR than amongst all the countries in South East Asia Region.³ In recent years however, a rapid decline has been observed in Infant Mortality Rate (IMR) of India. Over last five years, there has been a drop in IMR by an average rate of 4.56% per year.

In North India, Punjab state is performing better than most of the other states in India in different health indicators. Punjab's IMR is at 24 (SRS 2014) and has decreased from 38 in 2008 (SRS 2008) as resources of National Rural Health Mission (NRHM) and initiatives such as Universal Immunization Programme (UIP), Navjat Shishu Suraksha Karyakram (NSSK), Integrated management of neonatal and childhood illness (IMNCI), Facility Based Newborn Care (FBNC), emergency obstetric care, and referral transport services were effectively utilized by Government of Punjab.⁴

Over the years, changes in delivery of health services, health indicators and other socioeconomic changes have been captured by a series of surveys, the National Family Health Surveys (NFHS) carried out in 1992-93, 1998-99, 2005-06 and 2015-16 and the District Level Household and Facility Surveys (DLHS) carried out in 1998-99, 2002-04, 2007-08 and 2012-13.

This study assesses which of the variables reflecting health status, delivery of health services and other socioeconomic conditions (captured through the DLHS) are associated with the decline in IMR in Punjab.

METHODS

This retrospective study used secondary data to evaluate the association between various components of prenatal care, intranatal care and postnatal care, and child healthcare and socio-demographic variables (taken from the four rounds (between 1998-2014) of DLHS for Punjab) and infant mortality rate (IMR), taken from sample registration system (SRS) of Punjab.

Study variables

Variables related to antenatal care (women who had full antenatal care, and women who had any pregnancy related complications), intranatal care (percentage of

women having institutional deliveries, safe deliveries (delivery by a skilled birth attendant) and women who had any delivery related complication), post natal care (women who had any post-delivery complication, children age 0-5 months exclusively breastfed, women's knowledge of diarrhea management, children sought advice/treatment for diarrhea, percentage of children given oral rehydration therapy, women aware of danger signs of acute respiratory illness (ARI), children sought advice/treatment for ARI) and other indicators (percentage of children received full vaccination, percentage of currently married women who are illiterate, total fertility rate). In India, three antenatal care visits, two tetanus toxoid injections and 90 doses of iron and folic acid (IFA) tablets are considered as 'full antenatal care'.⁵ Intranatal care includes the necessary care provided for the proper management of labour and emotional support, to assure a successful result for both mother and the baby.⁶ The first six weeks (42 days) after delivery are counted as the post-partum period.

The association between exposure variables and outcome variable was measured by Spearman correlation coefficient. Multivariate analysis could not be carried out as data on many indicators on maternal and child health were not available for all the DLHS surveys.

RESULTS

The maternal and child health indicators, healthcare delivery and other socio-demographic indicators have shown considerable improvement over the past two decades. While illiteracy amongst currently married women has declined, institutional deliveries and safe deliveries have shown dramatic increase. Rates of complications of pregnancy, delivery and post-delivery have also shown declines. Exclusive breastfeeding, knowledge of mothers regarding diarrhea and acute respiratory infections have shown an increasing trend.

Table 1: Trends of maternal and child health, health delivery and socio-demographic indicators.

	DLHS 1 (1998-99)	DLHS 2 (2002-04)	DLHS 3 (2007-08)	DLHS 4 (2012-13)	α^2 for linear trend (p value)
1. Percentage of currently married women who are illiterate	41.5	36.1	28.3	29.2	4.656 (0.030)
2. Total Fertility Rate	2.92	2.21	2.0	1.6	
3. Pregnant women who had full antenatal care	25.4	16.7	14.3	20.6	1.016 (0.315)
4. Women who had institutional delivery	40.5	48.9	63.3	82.7	40.366 (<0.001)
5. Percentage of Safe Delivery	54.7	64.3	76.9	97.0	41.974 (<0.001)
6. Women who had any pregnancy Complications	59.3	25.5	46.4	32.6	13.918 (<0.001)
7. Women who had any delivery complications	20.0	20.4	54.4	13.9	0.544 (0.460)
8. Women who had any post delivery complications	29.5	18.7	21.2	8.3	12.288 (<0.001)
9. Children received full vaccination	72.9	72.9	79.9	68.4	0.144 (0.704)
10. Children age exclusively breastfed	36.3	23.1	32.4	56.4	10.063 (0.001)

11.	Women's knowledge of diarrhea Management	57.6	63.8	99.8	76.9	22.672 (<0.001)
12.	Children sought advice/treatment for Diarrhea	91.7	83.5	88.0	73.8	9.472 (0.002)
13.	Percentage of children with diarrhea who received ORS	2.4	26.2	52.0	47.8	59.314 (<0.001)
14.	Women aware of danger signs of ARI	49.0	40.0	99.3	68.2	22.818 (<0.001)
15.	Percentage of Children who sought advice/treatment for ARI	7.4	87.4	92.7	92.2	145.014 (0)
16.	Mean children ever born	3.96	3.4	3.1	2.8	
		1998	2004	2008	2013	
1.	Infant Mortality Rate	53	45	41	26	9.348 (0.002)

Table 2: Co-relation between variables under study and infant mortality rate.

	Variables	Co-relation co-efficient	P value
1.	Percentage of currently married women who are illiterate	0.800	0.200
2.	Total Fertility Rate	1.000	<0.01
3.	Pregnant women who had full antenatal care	0.400	0.600
4.	Women who had institutional delivery	-1.000	<0.01
5.	Percentage of Safe Delivery	-1.000	<0.01
6.	Women who had any pregnancy complications	0.400	0.600
7.	Women who had any delivery complications	0.200	0.800
8.	Women who had any post delivery complications	0.800	0.200
9.	Children received full vaccination	0.316	0.684
10.	Children age exclusively breastfed	-0.400	0.600
11.	Women's knowledge of diarrhea management	-0.800	0.200
12.	Children sought advice/treatment for diarrhea	0.800	0.200
13.	Percentage of children with diarrhea received ORS	-0.800	0.200
14.	Women aware of danger signs of ARI	-0.600	0.400
15.	Children sought advice/treatment for ARI	-0.800	0.200
16.	Mean children ever born	1.000	<0.01

Out of all variables, total fertility rate (TFR), women who had institutional deliveries, safe deliveries and mean children ever born are significantly associated with decline in infant mortality rate (Table 2).

DISCUSSION

The purpose of the study was to explore maternal and child health related factors which are strongly associated with decline in IMR in Punjab. The findings show that there is significant statistical association between total fertility rate, percentage of women having institutional delivery, percentage of safe deliveries (either home delivery or institutional delivery assisted by ANM/LHV/Nurse/doctor) and mean number of children ever born and IMR. A decline in TFR and mean children ever born were statistically significantly associated with decline in IMR whereas increase in institutional deliveries and safe deliveries were statistically significantly associated with decline in IMR.

To achieve the 4th millennium development goal (MDG-4), India was to reduce under- five mortality rate and IMR by two-third between 1990 and 2015 but this could

not be achieved. Among all countries of South East Asia Region, India has poor maternal and child health indicators.^{2,4} Even within India there are large variations in maternal and child health indicators. Some Indian states are performing better than others and Punjab is one of them. Infant mortality rate of Punjab declined from 38 in 2008 (SRS 2008) to 24 in 2014 (SRS 2014).

The findings in the study demonstrate that increase in institutional deliveries is significantly associated with decline in IMR ($p < 0.01$). In a meta-analysis and systematic review of the effect of delivery in health facility on neonatal mortality, it was found that in low and middle income countries, the risk of neonatal mortality reduces by 29% due to delivery in health facility.⁷ A study conducted in Southern and Central India in which 36 clusters were analyzed from population based surveillance system showed that significant increase in institutional deliveries were followed by reduction in perinatal mortality and stillbirths rate but not by neonatal mortality rate.⁸ A community based study of IMR in rural Aligarh, India, where cause of death was determined by using standard verbal autopsy procedure, found that most of the infant deaths are preventable by

promoting institutional deliveries, early recognition of danger signs, strengthening of referral system and periodic retraining of health workers.⁹ A study done in districts of Tanzania to assess facilitators and barriers to institutional deliveries showed that improving the quality of antenatal care, promoting discussion with the partner and empowering their socioeconomic status probably enhance institutional deliveries.¹⁰ A cross sectional study done in Tigray region, Ethiopia to determine antenatal and delivery care utilization suggest that antenatal care and institutional delivery are both associated with socio-demographic factors.¹¹ Antenatal advice can contribute to increase in institutional delivery.¹¹ A cross sectional study conducted in district Biharamulo, Tanzania, to study the predictors and magnitude of institutional deliveries showed that women should be encourage to make early antenatal care visits and build inter spousal relationship and plan for health facility delivery and reducing costs, improvement in the experience of women undergoing delivery in a healthcare facility.¹² These studies also suggest that increase in institutional deliveries leads to decline in infant mortality rate.

Our study also shows that decrease in TFR leads to decline in IMR. Similar study done in developed and developing countries to find the causal relationship between fertility and infant mortality, shows that decline in IMR that is due to an increase in per capita income triggers a subsequent decline in fertility.¹³ A study done to analyze the effect of IMR on TFR suggests that replacement rates of dead children rises as the total fertility rate falls, which reflect the increase ability of women to control their fertility.¹⁴ A study done from comprehensive survey on fertility patterns of ever married woman in Oman confirms that education is strong determinant and higher education of woman lower her fertility.¹⁵ A study to evaluate the possible confounders in connection between increased neonatal, infant, and child mortality and short birth intervals showed that neonatal, infant, and child mortality are significantly and are strongly related to leading birth interval, where after the previous birth, births within a short interval of time have increased mortality.¹⁶ Hence, there is positive correlation between total fertility rate and infant mortality rate. However, many other factors, maternal education, birth interval and breastfeeding play important role.

Our study shows that IMR declines when the number of safe delivery increases. A systematic literature search to find out the impact estimates in providing basic and comprehensive emergency obstetric care concluded that both emergency/ or essential obstetric care and skilled birth attendance have the capacity to cut down the count of stillbirths.¹⁷ Utilization of safe delivery is very valuable in decreasing infant mortality rate. Skilled birth attendants play an important role in providing Basic and essential obstetric care to the mothers which affect both the mother and child, hence reduces mortality.

The DLHS were conducted with large sample size with high response rate whereas sample registration system is known for its consistency. Besides these strengths, there were few data limitations. In order to maintain consistency in variables across four rounds of district level household surveys, data on important predictors like postnatal care, children with low birth weight and some socioeconomic indicators of maternal and child health were missing. These indicators may also effect infant mortality rate.

CONCLUSION

The study findings suggest that in Punjab, only some maternal and child health indicators are directly or indirectly associated with decline in infant mortality rate. Findings of the study demonstrate that the decline is mainly due to increase in institutional deliveries and safe deliveries. Decline in TFR and mean number of children ever born is also statistically associated with decline in IMR. However, the decline in TFR and mean children ever born has been happening over the years and is unlikely to account for the rapid decline in IMR as happened in the last few years.

Recommendations

Most of the maternal and child health indicators are improving from DLHS 1-4 but some of them are worsening with time. There are gaps in delivery of full antenatal care, postnatal care and childhood vaccination. Besides strengthening of institutional delivery mechanisms, postnatal care and child vaccination services need to be strengthened.

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