

Original Research



Community-based assessment for infant, under-5 child and maternal mortality in tribal population of Himachal Pradesh, India

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Abstract

Introduction: Infant and child mortality rates are sensitive indicators of health services of any community. Tribal populations remain a disadvantaged group among other communities and the indicator of their accessibility and availability of health services is the infant and maternal mortality rates.

Objectives: To assess reliable estimates and causes for the child (less than five year of age) mortality rate and maternal mortality ratio (MMR) of tribal population of Himachal Pradesh, and the maternal and child health services and facilities available in their health institutions

Methods: A community-based surveillance study was conducted in 2019-20 on the deaths of all children (less than five year of age) and maternal deaths in the entire population of two tribal districts i.e., Kinnaur and Lahaul & Spiti, and of two tribal blocks of Chamba District in the state of Himachal Pradesh. Sub-centres (SC) remained under the study for a period of one year. Verbal autopsies were conducted to ascertain the cause of death by community workers under the supervision of project staff. In addition, a cross-sectional facility survey was conducted, Health institution data were gathered using a pre-tested structured schedule adapted from the National Health Mission Facility Assessment Tool.

Results: Majority (85%) of the SCs were functioning in Kinnaur District and 66% at Lahaul & Spiti District. In the latter district, the labour room was functional at primary health center (PHC). Civil and district hospitals were preferred for delivery while SC and PHC were preferred for preventive services. The infant mortality rate (IMR) of all districts was 24 per 1000 live births (LB). Most of the deaths were in post neonatal period (62%). Birth asphyxia and pneumonia were major causes. The 1-5-year mortality rate was 1 per 1000 LB, which was only reported from the district of Chamba. There were zero maternal mortalities during the survey period.

Conclusions & Recommendations: The IMR in tribal districts was higher than the state average. Most deaths were due to birth asphyxia, hence indicates the importance of labour room preparedness at PHCs in these hard-to-reach areas.

Keywords: sample registration survey, cause of infant death, neonatal mortality

Introduction

In India, 40.6% tribals in 2011 were below the poverty line, while the proportion among the rest was 20.5% (1). The key mortality indicators among tribes also remain very poor. According to the National Family Health Survey 4 (NFHS-4) (2015-2016), the under-5 mortality among the tribal population was 57.2 per 1000 live births (LB) compared to 38.5 among others, while the IMR was 44.4 per 1000 LB versus 32.1 in others (2-3). A child born to a tribal family in India has 19% higher risk of dying in the neonatal period and 45% in the post-neonatal period, compared with other social classes (4). Further, child malnutrition rates are substantially higher for tribal populations compared with other populations (5). In a cross-sectional study conducted in 2015, three-fourths (76.6%) of the 2926 under-5 children surveyed in the tribal district of Melghat in Maharashtra, India were found to be severely or moderately undernourished (6). According to the NFHS-4 data, 94.7% of children below five years of age and 83.2% of women aged 15-49 years in the tribal district of Lahaul & Spiti in Himachal Pradesh were suffering from anaemia (7).

The infant mortality indicator assesses the mortalities among LBs, and countries rely on routine birth and death registration systems for live birth data. In the absence of a strong Civil Registration System (CRS), countries carry out statewide surveys at regular intervals to collect information on infant and maternal deaths to derive mortality estimates. It also assists in assessing the impact of the health care delivery system. Special surveys like sample registration system (SRS) have been planned by the Registrar General of India to derive valid estimates for birth rate, death rate, IMR and MMR (8).

The tribal population of Himachal Pradesh, India as per Census 2011 is 392 126. It observed an IMR of 34 per 1000 LB and did not report MMR in the latest bulletin. The IMR assessment observed an improvement in child health services especially antenatal care, intranatal care and neonatal care.

Recent rapid assessment in the state (9) observed an IMR of about 20 per 1000 LB, which is significantly different from the SRS findings. The differential IMR was attributed to the type of study design in SRS and rapid cross-sectional survey. Therefore, it was proposed to carry out an IMR and MMR survey in the state using SRS methodology i.e., regular enumeration of population for one year and independent half yearly survey to unveil the IMR and MMR in Tribal areas of the state. This study was undertaken to determine reliable estimates for the child (less than five year of age) mortality rate and MMR among tribal population of Himachal Pradesh; to provide probable causes of death for infant (less than one year of age), under-5 child and pregnant mothers who had died during their pregnancy up to 42 days of termination of pregnancy; and to assess the maternal and child health services and facilities available in health institutions of the tribal area.

Methods

The study was conducted in two tribal districts i.e., Kinnaur and Lahaul & Spiti, and two tribal blocks of the district of Chamba in the state of Himachal Pradesh, India. Kinnaur District is in the Eastern part of Himachal Pradesh adjoining the border with Tibet, with 100% rural population of 84 121 and a sex-ratio of 819 per 1000 males. Lahaul & Spiti District falls in the Northern Mountain zone constituting part of the Himalayan macro region in Himachal Pradesh. It is the smallest district with three sub-divisions, namely Udaipur, Lahaul & Spiti. It has a sex ratio of 903 females per 1000 males and the total population is 31 564. Chamba District is part of the Northern Himachal Pradesh. Pangi and Bharmour areas are tribal areas of this district. Pangi has a population of 18 868 in 54 inhabited villages with around 50% of males. Bharmour has a population of 39 108 living in 238 villages with almost equal distribution of males and females (10-12).

This was a community-based surveillance study conducted on children's deaths (less than five years

of age) and maternal deaths, for which the tribal population residing in all health administrative units were considered for the study. The units remained under study over 14 months between January 2019 and March 2020. Due to the COVID-19 pandemic and the closure of snow-bound areas during winter, the study was delayed. The sub-centre (SC) was the identified health administrative unit for the study and all the villages were recruited for the study for one year.

The eligible respondents for infant and under five deaths were mothers or any family member present at the time of death. For maternal death, it was any family member present at the time of death along with recording of information from the available hospital records. In the case of home delivery, the personnel who attended the delivery were interviewed independently.

Baseline data on socio-demographic profile: Baseline district-wise socio-demographic profile was collected from all villages using a pre-tested structured interview schedule. The operational definition of infant death was any death of less than one year of age after the birth of child in the selected settings. Under-5 child death was any death of less than five year of age after the birth of child in the selected settings. A maternal death was any woman dying during the period of pregnancy, delivery or up to 42 days of termination of pregnancy.

Birth, death and morbidity surveillance: All child and mother deaths reported by accredited social health activist (ASHA) were investigated by the medical officer (MO) of concerned PHC administering the Verbal Autopsy (VA) tool. ASHA is the frontline worker at village level of the public health system in India. All the information was collected during the house-to-house survey every calendar month. In a case of death (infant, under-5 child and maternal), ASHA worker informed medical officers in the Department of Community Medicine, Dr. RKGMC, Hamirpur and local MO.

Data forms collected by the ASHA and project staff were handed over to the data entry operator (DEO). The DEO maintained a log of received and entered forms, which was routinely verified by the faculty in-charge. Supervisor along with the MO supervised around 20% of the interviews conducted through independent and random surveys in a district by the ASHA. The data were entered in the EPI-Info software and analysed using the same software. In the software, a standardized database structure was prepared with the appropriate range and consistency checks.

For the facility survey, a cross-sectional study was conducted. Information about the health institutions was gathered using a pretested structured schedule adapted from the NHM Facility Assessment Tool (13). Information was corroborated by physical verification of one regional hospital, one randomly selected civil hospital and five randomly selected community health centres/primary health centres providing maternal and child health services in every tribal district.

Results

The socio-demographic profile of the respondents is given in Table 1. Their health seeking behaviour is given in Table 2. For delivery services, most of the families preferred the district hospital. For routine immunization services, they showed faith in government institutions only, while it was the PHC/CHC or district hospital for major childhood illnesses.

According to the facility survey, there were 34 SCs, 24 PHCs, four CHCs, one civil hospital and one district hospital for a population of around 84 000 in Kinnaur District. Other results of the survey are given in Table 3.

Availability of health infrastructure, staff and services

At district Kinnaur, no PHC had functional labour

rooms and therefore no deliveries. None of the CHCs had 24*7 newborn and normal delivery services. First referral units were those CHCs which have blood storage facilities, major surgical procedures

available and operation theatres available round the clock; hence serve as first referral centre for village level SC or PHC.

Table 1: Socio-demographic profile of the sample

Character	Kinnaur (n=600) No. (%)	Chamba (n=600) No. (%)	L&S (n=600) No. (%)
Gender			
Male	276 (46.0)	254 (42.3)	282 (47.0)
Female	324 (54.0)	346 (57.7)	318 (53.0)
Age, mean (SD)			
	43.8 (12.3)	49.5 (13.8)	50.5 (14.8)
Education status			
Literate	468 (78.0)	457 (76.2)	442 (73.7)
Illiterate	132 (22.0)	143 (23.8)	158 (26.3)
Education level			
Primary level	187 (40.0)	203 (44.4)	222 (50.2)
Matriculation	95 (20.3)	118 (25.8)	134 (30.3)
Senior secondary	125 (26.7)	102 (22.4)	76 (17.2)
Graduation & above	61 (13.0)	34 (7.4)	10 (2.3)
Occupational status			
Government job	92 (15.3)	32 (5.3)	41 (6.8)
Private Job	63 (10.5)	71 (11.8)	63 (10.6)
Agriculturist	247 (41.2)	211 (35.2)	251 (41.8)
Skilled worker	70 (11.7)	81 (13.5)	91 (15.2)
Unskilled worker	102 (17.0)	102 (17.0)	59 (9.8)
Homemaker	26 (4.3)	103 (17.2)	95 (15.8)
Socio-economic status			
Upper class	211 (35.2)	167 (27.8)	160 (26.7)
Upper middle class	182 (30.3)	117 (19.5)	125 (20.8)
Middle class	176 (29.4)	181 (30.2)	190 (31.7)
Lower middle class	17 (2.8)	103 (17.2)	115 (19.2)
Lower class	14 (2.3)	32 (5.3)	10 (1.6)
Religion			
Hindu	351 (58.5)	541 (90.2)	189 (31.5)
Buddhist	241 (40.1)	46 (7.8)	401 (66.8)
Others	8 (1.3)	12 (2.0)	10 (1.7)
Type of family			
Nuclear	260 (43.3)	229 (38.1)	367 (61.2)
Joint	253 (40.2)	310 (51.7)	223 (37.2)
Three generation family	87 (14.5)	61 (10.2)	10 (1.6)

In district Chamba, the labour room was not functional in any PHC. None had 24*7 delivery and

newborn care facilities. At Lahaul & Spiti all SCs had ANMs. Almost all PHCs had sanctioned staff.

The accessibility to services in the form of road connectivity to all the primary, secondary, and tertiary level centres was 100% in all three districts. National ambulance service was also available in all tribal areas of the three districts. Thirty percent of PHCs had female MOs in place. At primary level, 12.7% of PHCs were functioning round the clock and

6.4% imparted newborn care and delivery services in the three districts. Ninety-eight percent of PHCs, all CHC and CH were delivering immunization services. Half of the CHCs were functioning 24 hours a day and 7 days a week, while 72.5% were conducting deliveries (Table 3).

Table 2: Health seeking behaviour of the study population of District Kinnaur, Himachal Pradesh for MCH care

Health seeking behaviour	Kinnaur (n=600)	Chamba (n=600)	L&S (n=600)
	No. (%)	No. (%)	No. (%)
Preferred place for routine antenatal checkups			
Sub-centre	36 (6.0)	72 (12.0)	85 (14.2)
PHC/CHC	138 (23.0)	354 (59.0)	360 (60.0)
District hospital	368 (61.3)	161 (26.8)	155 (25.8)
Private hospital	58 (9.7)	13 (2.2)	0 (0.0)
Preferred place for delivery			
Sub-centre	0 (0.0)	0 (0.0)	0 (0.0)
PHC/CHC	0 (0.0)	51 (8.5)	360 (60.0)
District hospital	492 (82.0)	291 (48.5)	0 (0.0)
Tertiary care hospital	43 (7.2)	191 (31.8)	165 (27.5)
Private hospital	35 (5.8)	10 (1.7)	5 (0.8)
Home delivery	30 (5.0)	57 (9.5)	70 (11.7)
Preferred place for routine immunization			
Sub-centre	219 (36.5)	291 (48.5)	181 (30.2)
PHC/CHC	315 (52.5)	301 (50.2)	306 (51.0)
District hospital	66 (11.0)	8 (1.3)	113 (18.8)
Private hospital	0 (0.0)	0 (0.0)	0 (0.0)
Preferred place for minor/major childhood illnesses			
Sub-centre	15 (2.5)	103 (17.2)	90 (15.0)
PHC/CHC	308 (51.3)	355 (59.1)	375 (62.5)
District hospital	242 (40.4)	90 (15.0)	105 (17.5)
Private hospital	35 (5.8)	52 (8.7)	30 (5.0)

Infant, under-5 and maternal mortality

The overall IMR in tribal areas of Himachal Pradesh was 24 per 1000 LB. It was highest in Lahual & Spiti district (38 per 1000 LB) and lowest in Chamba (19 per 1000 LB). Post neonatal mortality rate was 15 per 1000 LB. Low birth weight/prematurity and pneumonia (23% each) were the main reasons for infant death followed by congenital anomalies and diarrhoea (15.4% each) (Table 4). Half of the deaths

were in neonatal periods in Chamba, due to birth asphyxia followed by pneumonia and diarrhoea. There was one 1-5-year child mortality in Chamba. One death in L&S was due to birth asphyxia in boy child and one death in girl child due to pneumonia. Overall, the under-5 mortality rate was 25 per 1000 LB, while 1-5-year child mortality rate was 1 per 1000 LB. No maternal mortality was reported in any of the districts during the study duration.

Table 3: Facilities of health institutions in Himachal Pradesh State

Health Facility	Kinnaur	Chamba	L&S
Health facility and population ratio			
Sub-centre level	1:2500	1:1700	1:1000
PHC level	1:3700	1:8500	1:1882
CHC level	1:21000	1:30000	1:10666
Health facilities, No. (%)	n=241	n=306	n=280
ASHA	106 (44.0)	72 (23.5)	46 (16.4)
Village health, nutrition and sanitation committee	241 (100.0)	290 (94.7)	250 (89.3)
Sub-centre within 3 km	234 (97.0)	281 (91.8)	160 (57.1)
PHC/CHC/CH within 10 km	62 (26.0)	189 (52.5)	193 (69.0)
Training during last year, No. (no set standard)			
IMNCI (Integrated Management of Neonatal and Childhood Illnesses) training	1	2	1
MTP (Medical Termination of Pregnancy) training	0	0	0
Management of obstetric complications (BEmOC- Basic Emergency Obstetric Care) training	0	0	0
Immunization training	2	2	1
Reproductive tract infection/ sexually transmitted infection (RTI/STI) training	0	0	0
Skilled birth attendant training	0	0	1
Availability of services, No. (%)			
PHC-	n=24	n=6	n=17
Labour room functional	0 (0.0)	0 (0.0)	3 (18.0)
PHCs functioning on 24*7 hours basis	3 (13.0)	0 (0.0)	3 (18.0)
PHCs having newborn care and delivery services on 24*7 hours basis	0 (0.0)	0 (0.0)	3 (18.0)
Immunization services	24 (100.0)	6 (100.0)	16 (95.0)
Basic lab investigation facility	0 (0.0)	0 (0.0)	0 (0.0)
Essential drugs available	24 (100.0)	6 (100.0)	17 (100.0)
CHC-	n=4	n=1	n=3
Labour room functional	1 (25.0)	1 (100.0)	3 (100.0)
CHCs having 24*7 hours normal delivery and newborn care services	0 (0.0)	1 (100.0)	3 (100.0)
Basic lab investigation facility	2 (50.0)	1 (100.0)	3 (100.0)
Immunization services	4 (100.0)	1 (100.0)	3 (100.0)
Essential drugs available	4 (100.0)	1 (100.0)	3 (100.0)
CH-	n=1	n=2	n=0
Labour room functional	0 (0.0)	2 (100.0)	-
CHs having 24*7 hours normal delivery and newborn care services	0 (0.0)	2 (100.0)	-
Basic lab investigation facility	1 (100.0)	2 (100.0)	-
Immunization services	1 (100.0)	2 (100.0)	-
Essential drugs available	1 (100.0)	2 (100.0)	-

Discussion

The tribals of Himachal Pradesh (HP) constitute 1.8% of total population of H P. States like Madhya Pradesh, Maharashtra, Odisha, Gujarat, Jharkhand, Chhattisgarh, Andhra Pradesh, West Bengal and Karnataka are home to around 80% of tribal population in India (14). All the tribal districts of HP are rural. Agriculture was the major occupation among all the tribal districts. The poverty rate is extremely high among the tribes residing in Jharkhand, Odisha, Madhya Pradesh and Chhattisgarh. The tribes of HP were better off in context of literacy and socio-economic status as compared to other states.

Health seeking behaviour

PHC/CHC was the most preferred health facility antenatal checkup by the tribal population of Himachal Pradesh (59-61%). The preferred place for childbirth varied in different districts. Sub centre, PHC and CHC were the preferred sites for routine immunization by majority. PHC/CHC were the preferred facility for both minor and major childhood illnesses (52-63%).

Health infrastructure and manpower

L&S has a large geographical area with a sparse population. According to this report, 98.7% of the ASHA are working against the set target in HP. The average population covered in HP by ASHA according to the National Rural Health Mission (NRHM) Report is 789 (15). However, L&S had a higher number of SCs with one per 1000 population, while Kinnaur had one per 2500 population. Due to low density of population and geographical location, the number of PHCs were also higher as compared to more dense districts of Chamba and Kinnaur. As per the norm, one SC in hilly or tribal area should cater to 3000 population, one PHC to 20 000 and one CHC to 80 000 population. The tribal area of HP shows no shortfall in the infrastructure of primary health care. Despite the presence of infrastructure, the manpower (auxiliary nurse midwife and male health worker)

was deficient. Ten tribal area evaluation revealed 49% deficiency of male health workers at SCs. This is comparable to the deficiency in HP, with 51-65% deficiency (16). It is aptly discussed by Bajpai; mere availability of infrastructure does not mean it is delivering the required services, which, along with infrastructure, also depends on availability of amenities like water, electricity, beds, medical and paramedical manpower and spatial distribution of available infrastructure (17).

The road connectivity and national ambulance service availability at all the primary, secondary, and tertiary level centres was 100% in all three districts. Despite better transport facilities to primary and secondary health care facilities if the emergency delivery and newborn services are limited; people usually move towards tertiary centres. Half of the CHCs were functioning 24hours a day and 7 days a week, while 72.5% were conducting deliveries. People are ready to travel for kilometres if the emergency MCH services are available (18). A key component of health development is the availability and access to proper health care. Rural, tribal and difficult-to-reach areas of India are particularly lacking in healthcare facilities, and this has been recognized as one of the determinants of the infant mortality and morbidity in this country (19).

Mortality

Infant mortality rate in all three tribal districts was 24 per 1000 LB. The infant mortality rate in Himachal Pradesh in 2018 as per SRS was 19 per 1000 LB which decreased from 34 per 1000 LB in NFHS-4 (2015-16). The IMR for India in 2018 was 32 per 1000 LB. Hence, the tribal area infant mortality rate was higher than the state average. This was highest in L&S and lowest in Chamba. The major cause of infant mortality was birth asphyxia (attributed to 23.8% of deaths) and equal proportion (23.8%) due to pneumonia. Low birth weight and prematurity are attributed to 19% of infant deaths. There was no maternal death in any of the tribal areas in last one year.

The government has already aimed to improve child health through a number of programmes, such as Integrated Management of Neonatal and Childhood Illnesses (IMNCI), Navjaat Shishu Suraksha Karyakram (NSSK), home-based care of newborns, universal immunization through mother and child tracking system and early detection and appropriate management of acute respiratory infections (ARI), diarrhoea and other infectious diseases, etc. (20). However, the main barrier to extensive coverage of integrated packages for the health of mothers, neonates, and children in countries like India (21) is inadequate operational management, especially at the district level (22).

The one year follow up may be a limitation for this cohort with no maternal death in any of selected block. The representativeness of these blocks for all tribes may not be completely correct. The infant and under five child mortality rates observed are below

the national averages. Comparison between study units also not informative since outcome measures are low. The strength of study is that it provides baseline figures, and methodological support for future similar studies.

Conclusions & Recommendations

The survey revealed that the IMR in all three tribal districts of Kinnaur, Chamba and Lahaul & Spiti was 24 per 1000 LB. This was much lower than the IMR of scheduled tribes in India. State government should give priority for the improvement of public health facilities through reinforced in institutional deliveries, fill the eligible and trained human resources, make available of adequate functioning testing machine and infrastructures at SC, PHC, CHCs and DH.

Table 4: Mortality rates in tribal area of Himachal Pradesh, India

	Kinnaur	Chamba	L&S	Tribal area of HP
Live births, No.	500	313	52	865
Mortality rates per 1000 live births				
Early neonatal mortality	4	3.2	0.0	3.5
Late neonatal mortality	4	6.4	19.2	5.8
Post-neonatal mortality	18	9.6	19.2	15.0
Infant mortality	26	19.2	38.5	24.3
1-5-year child mortality	0	3.2	0.0	1.2
Under-5 mortality	26	22.4	38.5	25.4
Causes of infant mortality, No. (%)				
Birth asphyxia	2 (15.4)	2 (33.3)	1 (50.0)	5 (23.8)
Pneumonia	3 (23.0)	1 (16.7)	1 (50.0)	5 (23.8)
Low birth weight/prematurity	3 (23.0)	1 (16.7)	0 (0.0)	4 (19.0)
Diarrhoea	2 (15.4)	1 (16.7)	0 (0.0)	3 (14.8)
Congenital anomalies	2 (15.4)	0 (0.0)	0 (0.0)	2 (9.5)
Sudden infant death syndrome	1 (7.8)	1 (16.7)	0 (0.0)	2 (9.5)
Total	13 (100)	6 (100)	2 (100)	21 (100)

Public Health Implications

- While young people and older adolescents face an increasing risk of dying with age, newborns face the greatest risk of dying among children under age five.
- Even today, areas where tribals live, the health services remain grossly underdeveloped and population access to good quality health services is at best abysmal. It is necessary to disaggregate the mortality data and quantify the variation between states of a country with diverse health status among states of India.
- This would help policy makers to prioritise the underperforming states where intense efforts need to be expanded. Results of the project highlight the importance of strengthening civil registration system of the country.

Author Declarations

Competing interests: The authors declare that they have no competing interests.

Ethics approval and consent to participate: This study was approved by the Institutional Ethics Committee (IEC) of Dr. Radhakrishnan Government Medical College, Hamirpur, Himachal Pradesh. For independent survey, an individual written informed consent was sought from each verbal autopsy respondent before entry into the study. Agreement to participate was indicated by signature or other imprint on prepared consent forms. The individual's right to refuse consent or to withdraw at any time after to consent was preserved without prejudice to their position in the community and the respondents were not required to provide any explanation for their decision. Participants in the study were identified only by a unique ID number of the survey databases.

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Author contributions: AB conceptualized the study, interpreted the data and reviewed the final draft of manuscript. MS analysed the data and prepared the first draft of manuscript. SK and PS were involved in collection, interpretation of data and review of manuscript.

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