Pregnancy related deaths in southern Rajasthan, India

A community based study of care-seeking using verbal autopsy

Action Research and Training for Health (ARTH)

Udaipur, India

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1. Background

Rajasthan has a high maternal mortality ratio of 445 per 100,000 maternal deaths (1). Information on the causes and circumstances surrounding the maternal deaths is however deficient. The majority of these deaths happen outside hospitals, making it difficult to attribute a specific cause of death. Verbal autopsy of maternal deaths is a technique used to investigate the circumstances surrounding a maternal death. This technique can provide rich information on each death, and a careful analysis can help to attribute a probable cause to the death (2). The technique has been widely used to ascertain a cause of death in settings in which death registration is low. [3, 4, 5] For assessing maternal deaths, the verbal autopsy method has been found to have a high degree of specificity, but low sensitivity. [6] Action Research & Training for Health (ARTH), a non-profit organization working in southern Rajasthan and operating a field program in population of 50,000, carried out a study of deaths among women of the reproductive age group (15-49 years) in one rural block of southern Rajasthan (population about 142,379) over a one year period (population estimated on the basis of Census 2001) (7) .

We had originally planned to study only maternal deaths using the verbal autopsy technique. We however realized that if one tries to enumerate only maternal deaths, there is a risk of some maternal deaths getting missed (particularly early pregnancy deaths and abortion deaths) because of incorrect reporting. In order to ensure complete enumeration and to also facilitate subsequent advocacy on women's health beyond the maternal dimension, we decided to make a technical change. Instead of studying only maternal deaths, we decided to study *all* deaths (from maternal and other causes) occurring among women of the reproductive age group (15-49 years) residing in the study block during a one year period.

The study collected information on where, how, and why these deaths were occurring, and what associated actions were taken. Its objectives were to describe the socio-cultural, economic and health service factors associated with deaths of women of reproductive age in a rural area of the state of Rajasthan.

Definitions:

Maternal death : The Tenth Revision of the International Classification of Diseases (ICD-10) defines maternal death as *the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes*.

According to ICD-10, maternal deaths should be divided into two groups: direct obstetric deaths and indirect obstetric deaths based on whether the cause of death resulted from obstetric complications of the pregnant state or from a disease during pregnancy which was not due to direct obstetric causes, or was aggravated by the physiologic effects of pregnancy.

Pregnancy-related death : Deaths from “accidental or incidental” causes have historically been excluded from maternal mortality statistics. However, in practice, the distinction between incidental and indirect causes of death is difficult to make, especially in situations where most deaths occur outside of hospitals and the precise cause of death cannot be given. To facilitate the identification of maternal deaths in circumstances where cause of death attribution is inadequate, ICD-10 introduced a new category, that of pregnancy-related death, which is defined as *the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the cause of death.* In this study, we have used the "pregnancy-related death" category of the ICD-10 to identify maternal death before proceeding to attribute a cause.

Late maternal death : The 42-day limit is somewhat arbitrary, and in recognition of the fact that modern life-sustaining procedures and technologies can prolong life and delay death, ICD-10 introduced a new category of late maternal death, which is defined as *the death of a woman from direct or indirect obstetric causes more than 42 days but less than one year after termination of pregnancy.*

In practical terms, there are two distinct approaches to identifying maternal deaths, one based on the medical cause of death following the ICD definition of maternal death, and the other based on timing of death relative to pregnancy (- using the ICD definition of pregnancy-related death).

In this study, we classified the deaths of women of reproductive age group in 3 categories:

(i) Pregnancy-related death: Death occurring during pregnancy from direct obstetric, indirect obstetric, or incidental causes.

(ii) Illness-related death: Death occurring due to an illness in a non-pregnant woman.

(iii) Injury related death: Death occurring due to an accident or injury in a non-pregnant woman.

2. Study Objectives

This study intended to answer two questions:

1. What were the major causes of deaths among rural women (15-49 years) in southern Rajasthan?
2. What socio-cultural, economic, and gender factors influenced care-seeking behavior among women who eventually died in pregnancy, or due to causes related to illness or injuries ?

Being the first study of its sort in the state, we feel that it will help us to advocate for policy and programme changes that can improve health care for women, especially during and beyond the maternal period.

3. Methodology

The study was carried out in a block of a district located in southern Rajasthan. The study block is representative of similar rural blocks southern Rajasthan, which were graded on the basis of 3 indicators - percentage urban population, female literacy rate and percentage population belonging to scheduled caste and tribes. The mean score of 39 blocks of southern Rajasthan is 5.1, which ranged from 1 to 11 on a 12 point scale, while the score of the study block was 5. The district's population is 87 per cent rural and sex ratio is 1000 females per 1000 males (2001 census). The population of the study block includes 28 per cent tribal and 9 per cent scheduled caste communities. The study covered all 160 villages of the block. The duration of the study was January 2002 to December 2003.

Steps

i. *Listing and enumerating deaths* : For enumerating deaths among 15-49 year old women two research assistants went to all the 160 villages of the study block and met key informants in every large or nodal hamlet. They inquired about all women between the ages of 15-49 years who had died during the last one year. At this point, they did not go to the deceased woman's house. Preparation of this initial list took about 2 months time. Subsequently, a team of research investigators went to the villages and contacted the families of deceased women to confirm the death and the age of the deceased woman. The list was modified during the data collection step, if the field investigators found that any of these deaths were outside the reproductive age group, or the women had died before the recall period (more than 18 months) or if they received information about additional deaths during interviews.

ii. *Development of a plan analysis*

iii. *Development of protocols*: 5 kinds of forms were developed for the study:

i. General information

ii. Pregnancy related death

iii. Death due to illness

iv. Injury related deaths

v. Care seeking

All these forms were pre-tested with deaths outside the study block, and several changes were introduced as a result. The care-seeking form, for example, which was initially based on institutions, was later made provider based, after we realized that several providers may visit a patient at home, and several of them treat patients from their houses. All forms were translated into the local (Mewari) dialect.

iv. *Data collection*:

- A team of 2 research investigators and one field supervisor (1 female and 2 male, all postgraduates) went from village to village and contacted the families of deceased women. They also revised the lists on the basis of inquiries made as to whether any other women, not covered in the listing, had died during that period.
- An effort was made to meet the best possible respondent who was present with the woman around the time of death. In some cases it was not possible to meet the desirable respondent, for example, when the husband was staying in a city. The team made second or third visits, to contact the respondent who was most familiar with woman's condition around death.
- Every week, filled in forms were reviewed by public health doctors. If any additional information was needed the team visited the house again.
- For a few patients, who had died in or were admitted to hospitals, we made direct contact with those hospitals and tried to get information on causes of death. However, most hospitals were suspicious and concerned that the information might be used against them and so were reluctant to reveal information.
- Doctors from ARTH assigned cause of death. Each form was also sent to external reviewers for assigning cause of death, at which time the cause assigned by ARTH doctors was hidden. These experts included a gynecologist (for maternal deaths), a surgeon, and 2 physicians. If

there was disagreement in the conclusion of the internal and external reviewers, then it was resolved by mutual discussions between the two.

The data was entered and analysed in Epi Info. The study has been reviewed and approved by the Institutional Ethics Committee of ARTH. All identifying information of deceased women and providers has been changed or masked.

4. Findings

A total of 190 women were enumerated during the listing exercise. Of these, 160 were eligible for the study. After data collection and cleaning, 156 women's deaths could be included in the study. The recall period was between 9 and 18 months (mean 11.8 months, median 12 months).

4.1 All deaths of women of reproductive age group

4.1.1 Respondents

Information was taken from a primary respondent. In cases where the information was deemed incomplete, additional information was sought from other respondents. Thus multiple respondents (n=301) were interviewed. An analysis of respondents shows that the husband (46.2%) was the most common respondent, followed by mother-in-law (41.0%), father-in-law, or other members of husband's family. Mother, father, or other members of the deceased's natal family were primary respondents in nearly 18% of cases. In 9% of cases, when information from the husband's family appeared to be incomplete or unreliable, the woman's natal family was also contacted. In some cases, the adult children or nephew/niece of the deceased provided the information.

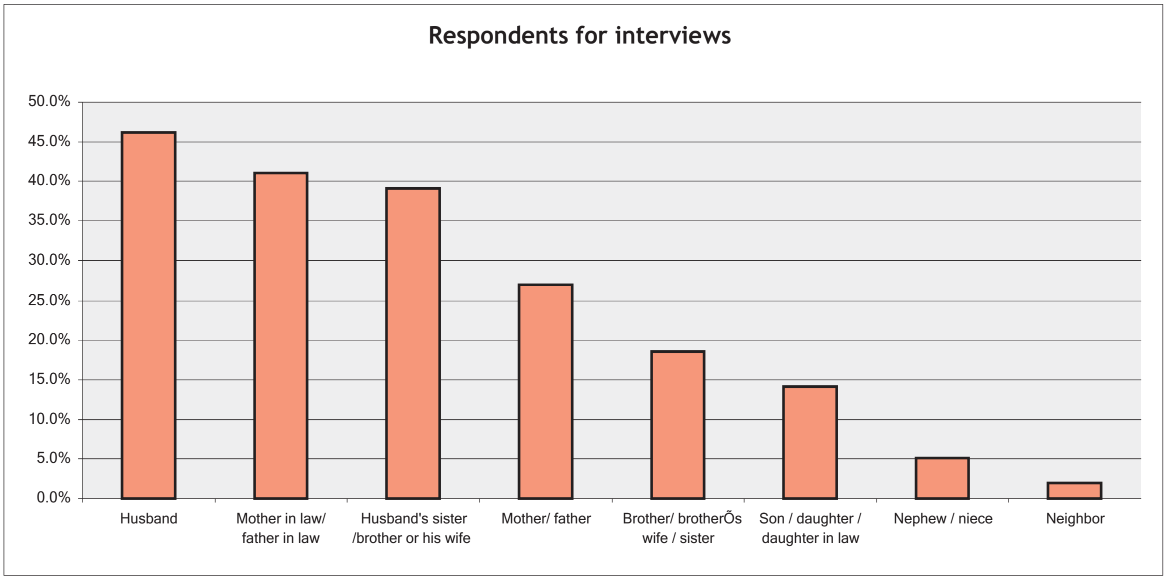


Figure 1

Table 1: Place of initial interview on women's deaths

Place of Interview	Number	Percent
Parents' house	25	16.0%
Husband's house	119	76.3%
Other	12	7.7%
Total	***156***	***100%***

4.1.2 Classification of Deaths

After classification, 107 were found to be related to illness, 31 were pregnancy-related deaths, and the remaining 18 were injury-related deaths.

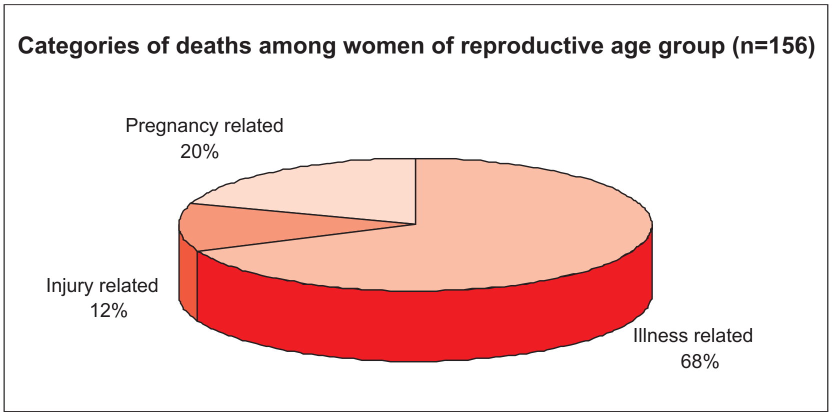


Figure 2

4.1.3 What proportion of women aged 15-49 years died from pregnancy-related causes?

In the study block, the total population of women in reproductive age group was estimated to be 34171, based on census 2001 population. Going by this, the death rate of women of reproductive age group turned out to be 4.56 deaths per 1000 population.

Based on the birth rate of the district in 2001, which was 33.3 per 1000, it was expected that 4837 births occured in one year. We deducted 189 stillbirths from among these (based on WHO estimates of 30 stillbirths per 1000 births in India-- [9] leaving us with 4648 live births. Given the finding of 31 pregnancy related deaths, which included 27 maternal deaths in the same year, we estimated the Maternal Mortality Ratio at 581 per 100,000 live births. The equivalent ratio in relation to pregnancy related deaths was 667 per 100,000 live births.

The proportional mortality ratio for maternal deaths i.e. the number of women who died of maternal complications was 17.3% of all deaths among women of reproductive age group (WRA). The proportional mortality ratio of pregnancy related deaths was 20% of all deaths among women of the reproductive age group.

4.1.4 Place of death

The majority (87%) of women died at home, only 8% of women were in hospital at the time of death. As many as 74% of women who suffered a pregnancy related death were at home at the time of death, 16% were in a hospital, while 8% died during transport. The situation was worse for women who had died due to illness.

Table 2: Where were women at the time of their deaths?

Place of death	Pregnancy-related deaths	Injury related deaths	Illness-related deaths	Total
Home	23	13	100	136
Transport	3	1	3	7
Hospital	5	4	4	13
Total	***31***	***18***	***107***	***156***

4.1.5 Demographic profile of women who died

Marital Status: All deceased women except one were ever married. Of these, 10 had been widowed or separated, while 145 were married at the time of death (Table 3). For 13% of women, it was a second marital alliance. Among women who had pregnancy related deaths, 23% had a second marital alliance.

Age: The mean age of women in the study sample was 31 years, and the median age was 31.7 years. More than half the deceased women were 30 years or younger; and more than half of them suffered either a maternal death or an injury related death. The median age of women who died due to injury was 25.5 years. The median age of women who had pregnancy related deaths was 29 years, and those dying due to illnesses had a median age of 35 years. (Table 3)

On correlating the age group with type of death, the study found that a large proportion of deaths due to injury were among women in the younger age groups, whereas pregnancy-related deaths were more common in the 25-29 year and 30-39 year age groups. Deaths due to illnesses were most common among women in the older age groups (40-49).

Caste: Fifty-nine percent of deceased women belonged to scheduled castes or tribes (SC/ST). This is disproportionately high compared to the total SC/ST population of a block of southern Rajasthan, which is only 37% (*Census 2001*). This suggests that women belonging to SC/ST had a higher chance of dying at earlier ages. The discrepancy was greatest among women who suffered pregnancy-related deaths 74% of pregnancy-related deaths in this study occurred among women belonging to SC/ST groups (Figure 3).

Table 3: Demographic profile of women who died

Background Characteristics	Pregnancy-related deaths (n=31)	Injury related deaths (n= 18)	Illness-related deaths (n= 107)	Total (n=156)
Marital Status:				
Married	30	18	97	145
Unmarried	0	0	1	1
Widowed/separated	1	0	9	10
% who had a second marital alliance (*Nata*)	7 (22.6%)	2 (11.1%)	12 (11.2%)	21 (13.5%)
Age				
15-19 years	1 (3.2%)	2 (11.1%)	7 (6.6%)	10 (6.4%)
20-29 years	15 (48.4%)	9 (50%)	31 (29%)	70 (44.9%)
30-39 years	15 (48.4%)	5 (27.7%)	33 (30.8%)	38 (24.4%)
40-49 years	0	2 (11.1%)	36 (33.6%)	38 (24.4%)
Median age	29	25.5	35.0	31.7 years
Range (SD)	18-39 (5.3)	17-42 (7.3)	15-49 (8.7)	15-49 (8.3)
Caste				
Scheduled Caste	5 (16.1%)	0 (0.0%)	5 (4.7%)	10 (6.4%)
Scheduled Tribe	18 (58.1%)	7 (38.9%)	57 (53.3%)	82 (52.6%)
Other	8 (25.8%)	11 (61.1%)	45 (42.1%)	64 (41.0%)
Number of Total Births				
Mean	2.8	2.1	3.2	3.1
Median (range)	2.0 (0-8)	2 (0-7)	3.0 (0-10)	3.0 (0-10)
Number of Living Children				
Mean	1.7	1.5	2.1	1.96
Median	2.0 (0-4)	1.0 (0-6)	2.0 (0-7)	2.0 (0-7)

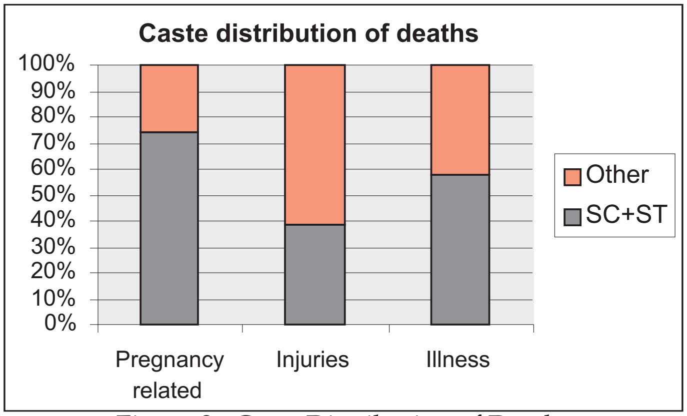


Figure 3 : Caste Distribution of Deaths

Births: The women in this study had borne an average of 3 children, of whom an average of 2 were alive. Women who suffered injury related deaths had an average of 1 living child, while those who suffered pregnancy- or illness-related deaths had an average of 2 living children. Among those who experienced pregnancy-related deaths, 41.9% had given birth to 4 or more children. It would not be incorrect to attribute this proportion of deaths to an unmet need of contraception, as well as to the desire for more children (out of concern for child survival). The wide difference between the mean number of births and living children confirms that child survival is also a critical health issue in this area.

4.1.6 Socioeconomic Status of Women who Died

Literacy Status: The majority of the deceased women were illiterate, as were the majority of their husbands. Only 34% of husbands were educated at the primary level or above (Table 4).

Migration: In more than one-fourth of cases (28%), husbands of women lived in another city. Although husbands migrating away from home for work may improve the economic condition of a family, it might also be an impediment for women in need of health care.

Household Characteristics: Three-fourths of women in the study lived in houses without masonry construction ("kuccha")[6], and the average number of rooms in these houses was two. The poor socioeconomic status of these women was also evident in the fact that only 5.8% of families had a supply of running water, and only one in five had electricity in their houses. Nearly 27% of deceased women used open wells as their source of water. The majority of families in the study relied on wood as a source of fuel for cooking.

Registration of deaths: A little over half (53%) of the deaths had been registered at the time of interview (mean 11 months). This shows that the vital registration system cannot be relied to give complete information on the number of deaths, and an analysis based on this system would only capture approximately half of all deaths.

Table 4: Socioeconomic Status

Socioeconomic Status	
Indicator	**Total (n=156)**
Number of family members	Mean 5.1 Median 5.0
Husband educated primary or above	53 (33.9%)
Husband lived in another village or city	44 (28.2%)
Husband employed for most of the year	125 (80.1%)
Housing	
Number of rooms in the house	Mean 1.89 Median 2.0 (Range 1-5)
House Kuccha (made without use of cement and iron)	118 (75.6%)
House Pucca (made of cement, bricks, stones and iron)	37 (23.7%)
Separate kitchen	41 (26.3%)

Table 4: Socioeconomic Status (Continued)

Socioeconomic Status	
Water supply	
Running water supply	9 (5.8%)
Hand-pump	102 (65.4%)
Open well	42 (26.9%)
Other	2 (1.3%)
Light arrangement	
Electricity	32 (20.5%)
Kerosene	119 (76.3%)
Other	4 (2.6%)
Fuel for cooking	
Gas	2 (1.3%)
Coal	1 (0.6%)
Wood	152 (97.4%)
Whether death was registered	
Yes	82 (52.9%)
No	58 (37.4%)
Don't know	15 (9.7 %)

4.1.7 Major Causes of Death

Nearly one in five deaths were pregnancy related deaths (20%), more than two thirds were due to an illness (68%), and 12% were due to injury.

Illnesses: The highest proportion of women in the study died because of tuberculosis, responsible for 35.5 % illness related deaths. This was followed by cancers, pneumonia, and then malaria and anemia.

Table 5: Causes of illness-related Deaths

Illness/Condition	Causes	Number of women
Fever and infectious diseases	Malaria	6
	Typhoid	1
	Tuberculosis	38
Digestive disorders	Gastroenteritis	2
	Acute abdomen	1
Respiratory diseases	Bronchitis	2
	Pneumonia	8
Disorders of CNS	Paralysis (CVA)	4
	Meningitis	2
	Brain tumor	3
Diseases of circulatory system	Anemia	6
	Congestive heart disease	4
	Heart attack	1
Cancer	Cancer	15
Liver Disorders	Jaundice/Viral hepatitis	2
Renal	Renal failure (acute\chronic)	3
Others	Mental illness	1
	Skin disease	1
	Diabetes	3
	HIV/AIDS	3
	Sepsis	1
Total		107

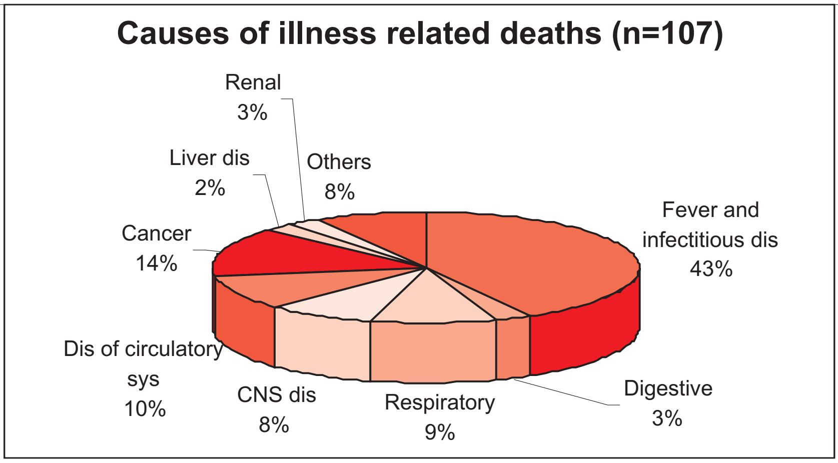


Figure 4: Cause of Illness-related Deaths

Pregnancy-related deaths: The most common cause of pregnancy-related death was post-partum hemorrhage, followed by sepsis, unsafe abortion, tuberculosis (TB), and severe anemia. Fifty eight percent of all pregnancy-related deaths were due to direct obstetric causes, 29% were due to indirect causes, and 13% were due to accidents. Four women who had a pregnancy related death died from injuries such as drowning, burns or snakebite.

Accidents: Half the women who died due to injuries had fallen into a well (Figure 5). Most of these were reported as suicide[1]. Snake bites were the second highest reason for injury deaths, responsible for 4 deaths. The other causes of injury related deaths were road accidents and burns.

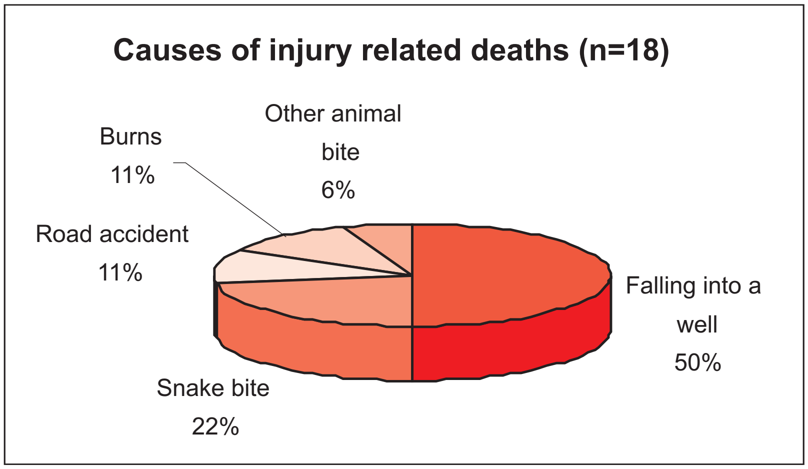


Figure 5: Causes of Injury Related Deaths

Late maternal deaths: Further analysis of data in relation to timing of delivery showed that 10 women who experienced illness related death actually died between 42 days and 12 months after their last delivery. All these women have been included in the category of illness deaths. The causes of death among these women were: tuberculosis (6), sepsis or fever (2), bronchial asthma (1), and rheumatic heart disease (1). Anemia was a coexisting cause in 5 of these deaths (Table 6).

1 *In this area, there is common impression that instances of "falling into the well" are sometimes cases of homicide, but are reported as suicide in an effort to cover up the true nature of the incident.*

Table 6: Period when late maternal deaths occurred

Time Period	Number of deaths	Category	Causes of deaths
42 days–3 months	3	Direct (2) Indirect (1)	Sepsis with anemia Fever with anemia TB with anemia
3–6 months	4	Indirect	TB with severe anemia (2) Rheumatic heart disease Bronchial asthma
6–9 months	3	Indirect	TB (3)
9–12 months	0	n/a	n/a

4.2 Pregnancy-Related Deaths

The following sections provide further details associated with pregnancy-related deaths. Of all deaths in this study, 20% were pregnancy-related deaths.

4.2.1. Timing of death

Majority of women (24, 77%) died in postpartum period - a total of 48% died within 7 days of birth, while another 29% died within 8-42 days after delivery (figure 9). Of those who died in postpartum period, as many as 5 women (16%) had died within 6 hours of birth, revealing a very high risk at delivery and within few hours of birth. Five women died in pregnancy and 2 died after an abortion.

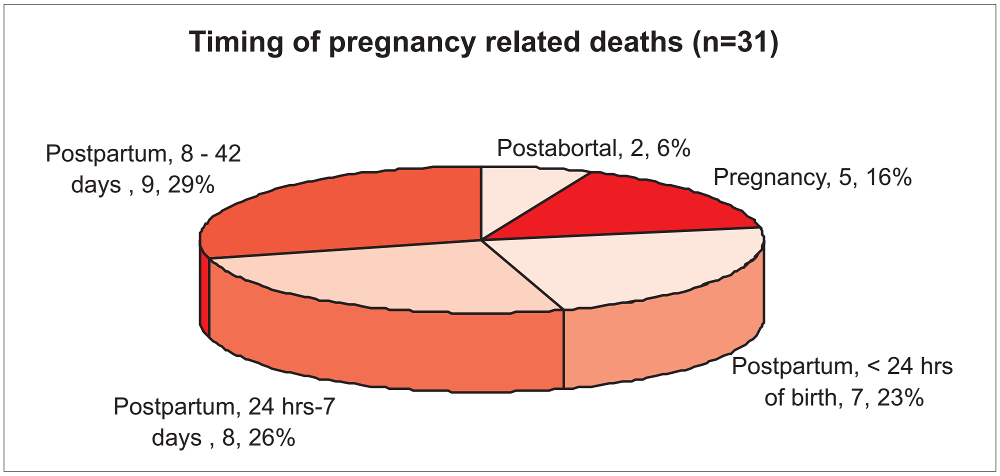


Figure 6: Timing of pregnancy- related deaths

4.2.2. Causes of Death

A list of causes of pregnancy deaths has been provided in Table 7. It shows that 58% of pregnancy related deaths were attributable to direct obstetric causes, whereas 29% were attributable to indirect causes and 13% were due to injuries. The single most common cause of death was postpartum hemorrhage, followed by sepsis, tuberculosis, and anemia.

Table 7: Causes of pregnancy-related deaths

Category	Causes	Numbers	Percentages (%)
Direct obstetric cause (n=18)	Antepartum hemorrhage	1	58%
	Postpartum hemorrhage	9	
	Septic abortion	2	
	Puerperal sepsis	6	
Indirect obstetric cause (n=9)	Severe anemia	3	29%
	Malaria	1	
	Heart disease	1	
	TB	3	
	Hepatitis	1	
Accidents (n=4)	Snake bite	1	13%
	Drowning	2	
	Burns	1	
Total		***31***	

On correlating the cause of death by timing of death, we found that most deaths due to postpartum hemorrhage occurred within 24 hours of birth, and even from them, half occurred within 2 hours of delivery (table 2). Majority of deaths between 24 hours to 42 days after delivery were due to sepsis, TB and anemia. Deaths due to accident occurred in pregnancy as well postpartum period.

Table 8: Correlation between phase of pregnancy and cause of pregnancy-related deaths

Phase of death	Cause of death	Number	Subtotal	Onset of problem
During pregnancy	APH	1	5	During pregnancy
	Anemia	1		
	Malaria	1		
	Injuries (drowning)	2		
Post-abortal	Septic abortion	2	2	
Immediate postpartum (within 24 hours of delivery)	Postpartum hemorrhage	7	7	At delivery
2nd to 7th day	Postpartum hemorrhage	1	8	At delivery
	Sepsis	4		2nd-3rd day after delivery
	Anemia	1		Pregnancy
	Injuries (snake bite & burns)	2		3rd & 4th day after delivery
8th to 42nd day	Postpartum hemorrhage	1	9	Day of delivery
	Sepsis	2		5 days & 25 days after delivery
	Anemia	1		Pregnancy & 3rd day after delivery
	TB	3		Before pregnancy & pregnancy
	Heart disease	1		4th day after delivery
	Hepatitis	1		4th day after delivery

4.2.3. Place of delivery and birth attendant

Out of 24 women who died after childbirth, 19 (79%) had delivered at home. Of these, 8 each had been delivered by a TBA and a relative, while one woman delivered on her own without anyone to assist her. Of the remaining 5 women, 3 had delivered at the city government hospital, while one each delivered at a private hospital and PHC. In one instance, the woman developed postpartum haemorrhage soon after delivery, within the hospital itself, and died within an hour of birth. In another instance, the woman delivered by caesarean section at a private hospital, after which she suffered haemorrhage and died within 12 hours.

Delivery was conducted by professionally trained persons for 29% of women. For two women who delivered at home, a skilled attendant was called home for the delivery. However, in both the cases, the birth attendant went away soon after delivery, after which the women developed postpartum haemorrhage and died. One of these women died one hour after delivery, while the other died 3 hours after delivery.

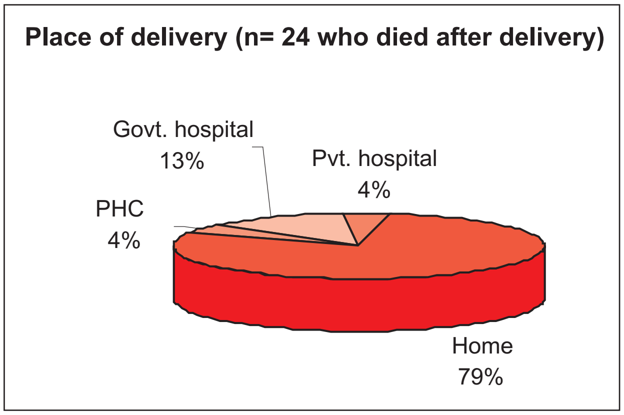


Figure 7: Place of delivery

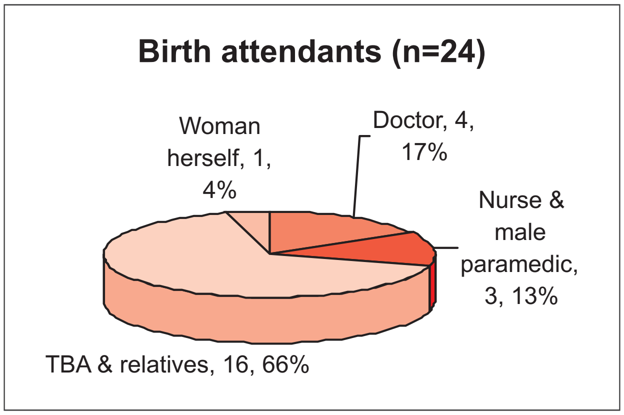


Figure 8: Birth attendants

4.2.4 Antenatal Care

Eighteen women received antenatal care, 11 (62%) from nurses and 7 from doctors (38%). Structured questions revealed deficiencies in the quality of antenatal care -- although all women had received tetanus immunization, only 4 had received an abdominal examination and two received a combination of blood pressure, blood test (indicating hemoglobin estimation) and urine examination.

Sonki Daluram

Sonki was a 24-year-old tribal woman who lived in a village of the study block, and was pregnant for the second time. Her previous child was no longer alive. This was Sonki's second marriage.

Even before becoming pregnant, Sonki used to feel very weak and used to become tired while working. According to her relatives, she used to cough, and looked pale-white. When Sonki became pregnant, she received three antenatal checkups from the government auxiliary nurse-midwife (ANM). The ANM had given her tetanus injections and iron tablets. The family was not aware whether Sonki consumed these tablets or not.

In the seventh month of her pregnancy, Sonki started having headache and fever. In her eighth month of pregnancy, she also started having difficulty seeing in the darkness (night blindness), and her weakness and cough continued. She continued to look pale-white.

At nearly full term, Sonki delivered at home with assistance from a TBA. There was no problem during the delivery, and she delivered a live child. According to the family members, she became so weak after the delivery that she was not even able to stand. She used to complain of darkness in front of her eyes. She often felt dizzy and even fell down once.

On the second day after delivery, her breathing became fast and her cough grew severe. On the fourth day after delivery, she developed high fever, pain, and swelling in her legs. Fourteen days after delivery, Sonki was taken to the government hospital in a neighboring district, at a distance of 29 km. There she was investigated (chest X-ray and sputum test) and the doctor diagnosed her as having TB. She was given an injection and medicines, and was asked to return after 3 days. The family spent Rs 1,150 on treatment at the government hospital, which they had to borrow. Sonki could not return to the hospital for follow-up because of the death of her grandmother. However, her own condition continued to worsen. When she became very weak, 25 days after her delivery, she was taken to the TB hospital at Udaipur, 90 km from her house. There she was hospitalized and was investigated again (sputum test, x-ray). Sonki was given tablets, injections, and an IV drip. The doctor at this hospital too diagnosed her to be suffering from TB. Three days after admission, she died – nearly one month after delivery. The family spent Rs 1,000 on transport and Rs 2,000 on her treatment at this hospital, which they also arranged through loans. Her baby died at 3 months of age.

The verbal autopsy record suggested that Sonki died from pulmonary TB (and anemia) that remained undetected throughout pregnancy, notwithstanding three antenatal examinations. When TB was diagnosed two weeks after delivery, despite belonging to a socio-economically marginalized group, she did not receive free treatment at two public facilities covered by the Revised National Tuberculosis Control Programme. Sonki's family ended up spending substantial sums for which they had to borrow.

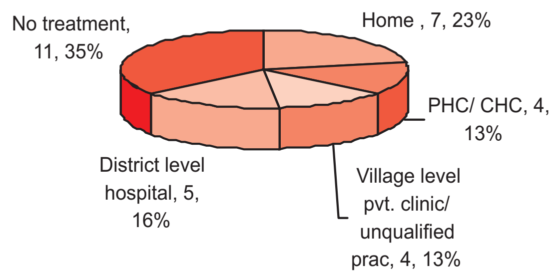
4.2.5 Care seeking patterns

Families of eleven women did not seek care from any modern provider. They included 4 women with injuries, with whom there was little time to seek care, 3 instances in which the family did not suspect that the situation was life-threatening (anemia, PPH and sepsis) and 4 in which the family perceived that it could not afford the high cost of seeking emergency care (APH, PPH, sepsis and anemia).

Table 9: Care seeking patterns among pregnancy related deaths (n=31)

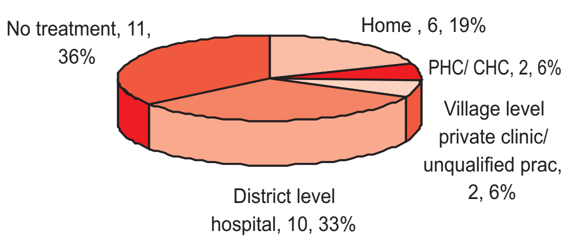
Did not seek any care	11 (32%)
Visited any medical provider	20 (68%)
• Sought care only at home	6 (23%)
• Went to a facility for care	14 (45%)
Visited only traditional provider/ faithhealer	3 (9%)
Hospitalized at a formal facility at least once	9 (29.0%)
Maximum distance traveled per woman (km) (for all women)	
• Mean	33.4
• Median (range)	20.0 (0-100)

Figure 9: Place of first treatment (N=31)



First place of treatment: Of the remaining 20, the families of seven invited a modern provider (nurse or village practitioner) home to treat the woman, and 13 elected to visit a facility. The latter included eight women who were taken to a local facility (4 to a village level clinic, 4 to a government health centre) and 5 who went directly to a hospital in the city (figure 9).

Figure 10: Highest level of treatment (n=31)



Highest level of treatment: Eventually, a total of 14 were taken outside home to seek care. Ten of these 14 women eventually reached a city based facility (figure 10). However, only 9 of 14 women who tried to seek care from a facility were hospitalized – this reflects that illnesses of some of the deceased women were not considered serious enough for admission (table 9).

Distance traveled

For women who sought care, the facilities were located at a median distance of 20 kms & the mean distance was 33 km (table 9). City based CEOC facility were at a distance of 45-100 km from various parts of this block.

Following cases highlight the situations where women developed complications and died despite delivering in institutions.

Meera Kishansingh

Meera, a 38 year old mother of four children (of whom two were surviving) lived in a large village 50 km away from the district headquarters. Her husband worked in Mumbai. One of her previous deliveries was by caesarean section for twin pregnancy. Meera was pregnant for the fifth time. Even before becoming pregnant, Meera would feel tired an weak, and her hands and legs would ache. These complaints continued when she became pregnant for the fifth time. She went once to the PHC for antenatal check-up. Meera went to the district hospital for delivery, where she underwent a caesarean section and delivered a live baby. After delivery, she started having excessive bleeding. The doctor advised the family that Meera had lost a lot of blood and would need transfusion and referred her to the teaching hospital, 70 km away. During 8 hours of her stay in the District Hospital, her family had spent Rs. 15000 ($ 375). The family took Meera to the teaching hospital where she was given IV fluids, some injections were given, and blood transfusion started.While the blood was being transfused, she died. For 2 hours of her hospitalization in the teaching hospital, the family spent Rs. 7000 ($175).

The medical cause of death was postpartum hemorrhage following caesarean section. The district hospital which performed the cesarean section was unable to arrange for a vital blood transfusion, and instead referred her 70 km in a critical state.

Lehri Bai Dallaji

Lehri was 32 years old woman belonging to tribal community living in a village 20 km from district headquarter. Her husband was illiterate and used to work in the city. She had delivered 5 children in the past, of whom 3 were alive. This was her sixth pregnancy.

She had received 2 antenatal visits from the local ANM, who had given her tetanus injections and iron tablets. During pregnancy, she used to complain of breathlessness, cough and used to look pale white. In eighth month of pregnancy, she also developed swelling of her face and hands. Her neighbors phoned her husband, who came to the village. The husband arranged for money by borrowing from several people, and he also mortgaged sold land.

When her labour pains started, initially a Dai was called. After some hours, the Dai informed that the delivery could not be conducted at home. The family hired a jeep and went to a district level private hospital. She delivered a live baby. During admission, she was given IV fluids, injections and also received a blood transfusion in the hospital. The family spent Rs. 4000 ($ 100) during this period. She was discharged from this hospital after 3 days. Doctor had given her some medicines at the time of discharge and told her that her swelling would go away with these tablets. One day after coming home, she started having severe pain in her abdomen at night at 10 pm. Next morning, they hired a jeep and started going to Udaipur, 90 km from their village. However, by 11 am she died during transport about 10 km before Udaipur.

Medical cause of death was puerperal sepsis with severe anemia. Although Lehri was anemic from her pregnancy, and tried to seek antenatal care from an ANM but her anemia was not detected and treated during pregnancy. At the time of her delivery in a private hospital, an attempt was made to partially treat her anemia. However, her condition worsened soon after coming home and it is likely that better assessment of her condition before discharge could have prevented her death by detection of early signs of these complications and their management.

Tamli Nokharam

Tamli, a 27 year old mother of three lived in a tehsil town. She had visited the community health centre twice for antenatal checkup, and had received tetanus injections and iron tablets. She was in good health and carried on with routine work throughout pregnancy. In the ninth month, she started having some abdominal pain, which however persisted for 3 days. Accompanied by her husband and a neighbour, Tamli walked to a PHC 3 km away, to see a doctor they were familiar with. After examining her, the doctor informed them that the fetus was already dead, and advised them to go to the teaching hospital, 73 km away. Tamli's husband refused to go, saying that they could not afford the cost, and pleaded with the doctor to manage her there itself. The doctor grudgingly agreed, saying that the responsibility for any consequences would not be his. With the help of injections, IV fluids and tablets, Tamli went into labour and delivered a stillborn baby after two hours. Soon thereafter, she started bleeding profusely. According to a family member "all her clothes were soaked, the cot was soaked, the mattress was soaked, and a bucket was full" (of fluid and blood). Tamli died two hours after delivery. A neighbor recalled during the interview, "She went walking to the hospital that morning, and a few hours later, they brought her home dead"

Tamli died from postpartum hemorrhage following induction of labour for intra-uterine fetal death, in a primary health centre. Given that she did not have labour pains when she went to the this PHC and delivered in a span of few hours, it is possible that in addition to drugs to induce labour, some manipulation was also carried out to deliver the baby, which led to severe PPH. Death audits for all institutional deliveries would shed light on these deaths.

Eleven women died without receiving any medical treatment. There were several reasons for this – most importantly, lack of money, lack of postpartum contacts who could recognize the health problem, and rapidity of death. The following cases illustrate the various situations:

Champa Kaluram

Champa was woman of the tribal who lived in a village of a block of southern Rajasthan. She was 32 years old, and had delivered 3 children. All these children were alive. Champa was pregnant with her fourth child. During this pregnancy, she had not received any antenatal check-ups, nor had she received tetanus injections. During her eighth month of pregnancy, she had gone to a hill to graze animals and collect firewood. Apparently her husband had told her not to collect wood, and he had promised that he would collect it. She made a big pile of wood and was bringing it down the hill when she slipped and fell down. She left the pile of wood there and returned home.

She started to have vaginal bleeding after her fall, but she did not inform anyone at home for two days, because she was scared that if she informed her husband he would scold her. She continued to do the household work. When her condition became very bad, then she informed her sister-in-law (devarani) and mother-in-law. At that time, her husband had gone to a nearby town for work, and there was no man at home. There was not enough money at home to get her treated. Champa's mother-in-law sent her younger son to call Champa's husband. She also called the TBA. The TBA tried to deliver the baby, but could not. Champa was having very severe bleeding. Her husband came at night, and thought he would take her to the hospital the next morning after arranging for money. However, she died during the night without giving birth to the baby. The family believed that she died because the baby had died inside of her body, and its poison had spread to Champa.

According to her mother in law and sister in law (devarani): "She shouldn't have carried such large load of wood. If she had told us in time, we could have helped her. We didn't have enough money. After all how is it possible to get someone treated without money? You need money for treatment."

Champa's medical cause of death was antepartum hemorrhage. It was however evident that lack of liquid cash and a decision-maker prevented her family from immediately accessing transport and emergency treatment. The family carried the impression that emergency services at the government hospital would cost a lot of money -- even her husband who had migrated for work, had planned to borrow money before taking her there.

Manki Bhimaji

Manki was a 26-year-old tribal woman. She lived in a village of a block of southern Rajasthan. She had delivered one child, who was alive. This was her second pregnancy. During pregnancy, her legs and arms used to ache from the 5th month of pregnancy, and she had headache, hence she had consulted the government ANM. At term, she delivered a live baby at home with the help of family members. The bleeding after delivery was normal.

After delivery, her lactation did not start and her breasts became swollen. The baby was given goats' milk. Five days after delivery, she developed a high fever with chills. Her breasts developed lumps, and became very painful. Her husband brought some sand from a "Devra," which was applied to her breasts, but it didn't help to relieve the condition. On the 15th day following delivery, in the morning, her brother left to call the nurse from another village, approximately 20 km from their village. The nurse could come at 5 pm (almost 7 hours later). By the time the nurse arrived, Manki had died. The nurse did not come inside the house and returned to her village without examining the woman.

Manki's death appears to be due to a fever-related breast infection, which lasted for at least 10 days. No health provider made contact with Manki in the postpartum period. It is likely that if an early postnatal check-up had been done by an ANM, Manki's condition could have been recognised and treated. It appears that the family did not have enough money for transport & treatment to seek care outside home.

Andu Dalla Ji

Andu was a 25-year-old tribal woman, mother of 2 living children. This was her second marriage ("nata"). This was her third pregnancy. Andu had sought care from the government ANM twice during this pregnancy, and had received tetanus injections and iron tablets. However, she had not consumed the iron tablets. Andu used to get breathless during her pregnancy, and used to look pale-white. She delivered at home with the help of her sister-in-law and a TBA. After the placenta was delivered, she started bleeding excessively. On the second day after delivery, she developed pain and swelling in her legs, and started having abdominal pain. On the fifth day after childbirth, when the family came to know about her problem, her husband went to a "devra," but by the time he returned she had died. According to the sister-in-law (jethani), Andu did not tell anyone about heavy bleeding; thus, the family came to know about it only when the situation became very severe. She said, "We would have collected the money for treatment, but before that she died."

Andu seems to have died as a result of postpartum haemorrhage. Had she delivered with the assistance of a skilled provider, her PPH could likely have been prevented and managed. She had not received any postnatal visit by any provider, which may have helped to detect her heavy bleeding and worsening condition.

The situations of some women who tried to seek care has been highlighted by following cases.

Motki Bhuraram

Motki, a 26-year-old woman, had no living child from her previous 2 deliveries. This was her third pregnancy. Around the fourth month of pregnancy, Motki began to look pale-white and had headaches. She began getting breathless while working during the sixth month of pregnancy, and also experienced fever and blurred vision. In the seventh month of pregnancy, Motki had swelling of face and hands, severe abdominal pain, and fast breathing. Her eyes also appeared pale and her appetite reduced. According to the family, she didn't sleep well for one month before delivery, and used to keep sitting most of the time.

In the eighth month of pregnancy, Motki consulted an ANM, who suspected jaundice. The ANM advised the family to go to the district hospital. Six days later, the family took her to the government PHC, where a blood test was done. Motki was given IV fluids and was advised to seek higher-level services at Udaipur because of weakness. She was admitted at this PHC for a total of 4-5 hours and it cost the family Rs 900. However, the family could not afford to take her to Udaipur, and instead they went home.

Four days after returning from the PHC, Motki started having labour pains towards evening. The family called an ANM, but she refused to come. Motki delivered at home with the assistance of family members; however, the baby was stillborn. After delivery of the placenta, Sonki started bleeding profusely. She was taken to the government district hospital the next morning. There she was given medicines, injections, and oxygen. The following day around 4 pm, Motki died at the hospital while receiving treatment. The family had spent Rs 1,000 on her treatment, which they had borrowed. Apparently, the family showed the BPL card (a card that allows poor families to receive treatment free of cost at government hospitals and to avail of some other subsidies), but they were told that it would not work there.

Motki apparently died from postpartum hemorrhage compounded by anemia of pregnancy. Her visits to the ANM and PHC during pregnancy did not help to detect and manage the anemia. The family did not follow the advice to go to a hospital before delivery, perhaps because of the uncertainty related to an unfamiliar place and the cost of treatment. Motki's family unsuccessfully tried to call an ANM for the delivery. Even though her family managed to take her to a government district hospital, she was not given blood transfusion which could have saved her life.

Arti Mukesh

Arti was a 25-year-old woman who lived in a village in southern Rajasthan. She had delivered two children prior to this pregnancy. She had made three antenatal care visits to a doctor at sub-district Hospital, and also to an ANM. She had also received tetanus injections and iron tablets. She did not have any problems during the pregnancy which lasted a full term. Her delivery was conducted at home by a ayurvedic doctor (Vaidraj) at 9 am, and Arti delivered a live child. Vaidraj left soon after delivery. One hour after delivery, she started having abdominal pain and profuse bleeding. The Vaidraj was called again, he returned and gave an injection to Arti and advised referral. The family arranged for a jeep, and started for the sub-district Hospital. The family reported that during transport, her eyes rolled back and she died.

This is a case of very rapid death within 3 hours after delivery following postpartum hemorrhage . Although a trained and skilled provider conducted the delivery, he left too soon after delivery. Perhaps if the vaidraj had stayed for some time after delivery, he would have noticed heavy bleeding.

Yashoda Sohanlal

Yashoda, a 24-year-old mother of 3 children (of whom two had survived), had missed her period. She underwent a urine test to confirm pregnancy. Yashoda did not want to continue the pregnancy, hence she consulted some neighbours who advised her to contact a certain woman belonging to a nomadic tribe, for medicines that would abort the current pregnancy and prevent future ones. A few days after visiting this woman, Yashoda developed high fever, vomiting, abdominal distension and swelling of hands and feet. When she started fainting repeatedly, she was taken to her parents' house from where she was rushed to the district hospital (a comprehensive emergency obstetric care or CEMOC facility). The doctor there said that she had severe anemia, initiated treatment and recommended that she be shifted to the teaching hospital 70 km away. The family spent Rs 950 at the district hospital. However, instead of taking her to the teaching hospital, the family preferred to get Yashoda admitted in a private hospital nearby, where she was given IV fluids, oxygen and a blood transfusion. Yashoda delivered a premature fetus that survived for 2 hours. Ten days of inpatient treatment and Rs 40,000 later, the family was advised by the treating doctor to take her to the government teaching hospital at Udaipur. Even though Yashoda was semi-conscious, her tubes were removed and she was discharged. The family transported her to the teaching hospital (also a CEMOC facility), where she was admitted but the doctor informed them that there was little hope of survival. The family brought Yashoda home, where she died after a day.

Yashoda died as a consequence of septic unsafe abortion. She resorted to an unsafe mid-trimester abortion in a block that had only one legal private facility providing first trimester services – the government health centre did not offer abortion services. The government district hospital (a comprehensive emergency obstetric centre) and the private hospital were unable to save her life despite 11-12 days of treatment.

Kanni Roop Singh

Twenty two year old Kanni, resident of a village of southern Rajasthan, was pregnant for the first time. She made three antenatal care visits to the doctor and nurse at the community health centre (CHC), and received tetanus injections and iron tablets. During pregnancy, she experienced body ache, weakness and breathlessness. When labour pains commenced, she was taken to the CHC. The doctor referred them to the teaching hospital, 70 km away, so they hired a jeep and rushed her there. Soon after reaching the teaching hospital, Kanni delivered a stillborn girl, and was discharged after a day. The family spent Rs 2,200 at the hospital. After discharge, Kanni returned to her parent's house. Fifteen days later, she developed swelling of hands and feet, fast breathing, and lost her appetite. The family took her to a local unqualified practitioner who advised them to go to the city. So her husband and parents-in-law accompanied her to the city, where a sonograph and some tests were performed. The doctors said that she was severely anemic and needed blood transfusion. The husband was reluctant to donate blood and his mother flatly refused to let him do so. Kanni's mother advised her own son (Kanni's brother) to donate blood. The doctor even suggested that they could buy blood, and cautioned that otherwise she would die. The family discussed the situation and felt that they could not afford it, and hence brought her home without blood transfusion. Kanni died a day later, 18 days after giving birth.

The medical cause of death was severe anemia with congestive heart failure. Kanni's case underscores the low value accorded to women's lives in rural Rajasthan. Kanni's family members were unwilling to donate or arrange blood for her. It is also possible that hemoglobin was not tested during pregnancy. Even if anemia had been detected during labor or before discharge from hospital, Kanni could possibly have received treatment in time. Kanni also did not receive any postnatal visits -- her condition became very severe over a fortnight.

Heera Ramlal

Heera was a 29-year-old woman of the tribal community, who lived in a village. She had become pregnant after 12 years of marriage. This was her first pregnancy. She had received 2 antenatal visits from an ANM at nearby village and did not have any problems during pregnancy. Heera was brought to her parents' home during her sixth month of pregnancy. The delivery was conducted at home by a relative at 4 am. Some time after the delivery, a nurse came to see her. The nurse inquired about how Heera was feeling, and Heera indicated that she was feeling alright. However, three hours after delivery, she started having profuse bleeding and pain in her abdomen. She also started sweating. Four hours after delivery, she died.

This case again highlights the very rapid nature of death due to postpartum hemorrhage. Although Heera had antenatal checkups, this problem developed after delivery and could not be anticipated. It appears that the ANM who came and met Heera did not examine her to assess the amount of bleeding, nor did she give oxytocic injections to prevent further bleeding. This highlights the importance of early postpartum care.

4.2.6 Cost of treatment

For pregnancy related deaths, the mean and median costs incurred per woman were Rs 6064 ($ 138) and Rs 1300 ($ 30) respectively (Table 10). Majority had to borrow the money to meet the expenses; 60% of all families who sought medical treatment reported having had to borrow money to meet the expenditure.

Table 10: Cost of treatment (for those who received medical treatment)

Cost of treatment	Women who received medical care (n=20)
Mean	6064
Median (range)	1300 (0-43450)
Arrangement for money (n=20)	
Had money	4 (20%)
Borrowed	12 (60%)
Don't know	4 (20%)

Some of the families were in debt even by the time of interview as reflected by the following statements of family members.

My wife had swelling from one month before delivery. I was not here. I received a phone call, so I came to the village. To make ends meet, I sold some land and also borrowed some money. I got her admitted in a private hospital, where she delivered after 3 days. I was in difficulty around that time. Whatever money I borrowed from people, people come to ask about it even now. Therefore I come home after work only late at night. (Husband of a woman of tribal community, who died on the 4th day after delivery, within a few hours of discharge from a private hospital)

I have spent a lot of money – look at these bills. For 3 months, we were in the hospital, because of which our living conditions have suffered. Even you can see for yourself. (A manual labourer, whose wife died 32 days after delivery)

Some women could not be taken for treatment because their families could not afford it, as exemplified by the following example:

Her husband did not have money. He thought he would mortgage his farm and her jewellery and then take her for treatment. But who would take the farm at such short notice? And there was no one to help in her parents' family. Therefore we could not get her treated. (Sister in law of a woman who died a month after delivery due to anemia and sepsis).

4.2.7 How many women died in a hospital?

The majority of women (23) were at home at the time of death, 5 were in hospital, while three died during transport (figure 11). A correlation between the place of treatment and place of death has been shown in table 8. Of those who died at home, the families of 11 had not sought any medical treatment, 5 had called a provider home, while families of 7 women had sought care outside home.

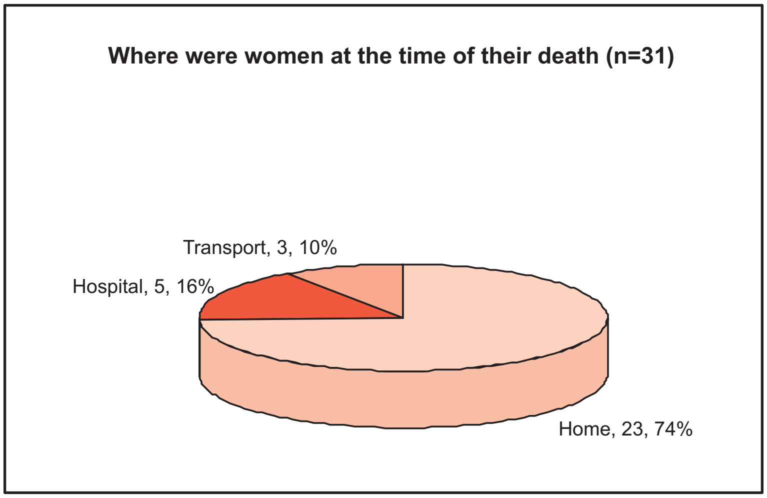


Figure 11: Place of death

Table 11: Place of death by place of treatment

Place of treatment		Place of death		
		Home	Transport	Hospital
No medical treatment at all	11	11	0	0
Medical treatment only at home	6	5	1	0
Medical treatment outside home	14	7	2	5
Total	31	23	3	5

There were 14 women who were taken to a facility for medical care, but only 5 died in a hospital. An analysis of the reasons as to why 9 women who were taken to a hospital did not die at hospital has been presented below.

- Three women, 2 of who were taken to village level facilities and one was taken to a primary health centre (PHC) were provided only outpatient treatment. One of these women was suffering from malaria in pregnancy and another one was suffering from postnatal sepsis. One woman was suffering from tuberculosis and was taken to a primary health centre, she had died 40 days after delivery.

- One woman was taken to a district level hospital for delivery. She was hospitalized there for 3 days, given blood transfusion and then was discharged. After reaching home, she worsened within a day, and died 5 days after delivery. The probable cause of her death was sepsis with severe anemia.

- One woman who was admitted in a district level private hospital was referred to the zonal level hospital at Udaipur, but the family instead decided to bring her home, because they had already spent Rs 20000 on her treatment.

- In case of another women who was suffering with severe anemia and heart disease and was admitted in a district level hospital for 7 days. The family brought her home without medical advice because it had already spent a lot of money on treatment on prior treatment, and could not afford to continue the treatment. She died one day after being brought home (25 days after delivery).

- In case of one woman with severe anemia, the family brought her home without medical advice because no one in the family wanted to donate the blood for her. She died one day after coming home (18 days after delivery).

- In one case, the referral hospital staff advised the family to take the woman home. She had been referred to this hospital one day ago from a district level hospital after being admitted there for more than 10 days for complications of unsafe abortion. One woman with complicated unsafe abortion was referred from a CHC to higher level and she died during transport.

Discussion

In the study area in southern Rajasthan, the most common cause of death was tuberculosis, which accounted for 26% of all deaths. Tuberculosis has been identified as the single biggest killer of women between the ages of 15-44 [10]. Maternal deaths followed, accounting for 17.3% of the total. Research has shown that in countries with poor health services, maternal deaths account for a higher proportion of all deaths among WRA, while in developed countries, they contribute to less than 1%. [11] Studies from Egypt and Indonesia have reported that complications of pregnancy and childbirth caused a large proportion of deaths [12]. In Egypt, the commonest cause of deaths among women of the reproductive age was circulatory system disease (28%), followed by complications of pregnancy and childbirth (23%), and trauma (14%), primarily burns. In Indonesia, complications of pregnancy and childbirth were the commonest cause of death (23%), followed by infectious disease (22%, primarily tuberculosis), and circulatory system disease (13%).

Women of the marginalized groups (scheduled castes and tribes or SC & ST) faced a disproportionately higher risk of death as compared to the better off sections of the population, greatly because of their inability to access timely treatment. On the other hand, wide difference between the mean number of children ever-born and living reflects on poor child survival and is a likely contributor to higher, rebound fertility.

Twenty four (77%) pregnancy-related deaths had occurred during the postpartum period, including 7 within 24 hours. This draws attention to the importance of monitoring during delivery and during the 24 hours immediately thereafter. Delivery by a skilled attendant could logically have helped to prevent some of these deaths through better monitoring, and hence care-seeking. Demographic and health survey findings revealed that in 2005-06, only 43% women in Rajasthan accessed the services of a skilled attendant. [13] We observed that even when professionally trained providers were present for home delivery, they left within minutes after delivery. The women in question had developed a complication soon and died within 1-3 hours. This suggests that if a skilled attendant were to conduct a home delivery, s/he should be available to monitor the woman for at least the first few hours.

Nine women (29%) had died between 8 and 42 days after delivery from anemia and/or sepsis that had emerged as complications within the first week. Careful pre-discharge assessment, including hemoglobin testing followed by 1-2 routine postnatal home visits could be expected to detect such complications in the early, retrievable stage. Government of India guidelines (2005) have already recommended two postnatal visits, 2-3 days and 8-10 days after delivery [14]. However, this would be possible only if the prevailing low penetration of postnatal care –21.7% women in rural Rajasthan received postnatal care within two days of delivery (NFHS-3) – improves substantially.

Nearly one third of pregnancy-related deaths were attributable to indirect obstetric causes. This finding is consistent with other studies in south Asia [15], which have found that indirect causes were responsible for up to 47% of maternal deaths. Anemia is highly prevalent in India and contributes to nearly 20% of maternal deaths. [16] Several women who died of anemia, tuberculosis, and heart disease had been suffering these conditions right from pregnancy, but their problem probably remained undetected during antenatal examination. Antenatal care delivered through primary health care workers in India is currently guided by a "mother-child protection card" that records only tetanus immunization and iron-folate supplementation services for pregnant women (ref). In line with this, antenatal examination remains inadequate and incomplete on the ground. We therefore recommend that Government of India's mother-child protection card be revised to include antenatal as well as postnatal screening of conditions such as anemia and tuberculosis, and that it further be used to monitor the quality of antenatal and postnatal care by the health system on a routine basis.

Women found to have tuberculosis tried to obtain treatment, but high costs proved to be a barrier. Some of them were asked to pay for treatment at a government facility, while the rest could not afford the high cost of treatment at private facilities. Hence better linkages between the national programmes for Reproductive and Child Health (RCH programme) and that for tuberculosis (Revised National Tuberculosis Control Programme), and better governance to curb demand for irregular payments would be necessary, for more effective control of TB during the maternal period.

About two thirds of the deceased women sought "modern" medical care. Most visited providers at a median distance of 20 km from their homes, using their own transport facilities and paying for them directly. For half the women with pregnancy related deaths, the first level of facility visited was a local facility that did not provide basic emergency obstetric services, not did it proactively arrange for and bear the cost of referral. Programme managers and providers have often assumed that families will readily take women with complications to distant urban facilities, which are often located 50-60 kms away from the village. Our findings suggest that in the absence of transport arrangements, rural families are unlikely to undertake the trip to a referral hospital. Apart from transport, locating emergency obstetric care in rural health centres would therefore help to avert several maternal deaths.

Sixty percent of families had to borrow money to meet health care expenses. The process of borrowing appears to have contributed to significant delays in treatment. In the extreme situation, families avoided seeking any treatment because of lack of money. Given that services in the public sector are meant to be free, it is essential that action is taken to completely minimize, if not eliminate hidden costs at government hospitals, if access to services for poor rural families is to be increased.

Three fourths of the pregnancy related deaths in our study occurred at home. An alarming finding was that several women who did try to seek care outside home eventually died at home. Analysis of these situations shows that some of these women were provided only outpatient treatment, some were discharged prematurely from hospital and others were brought home against medical advice because their families could not afford further treatment. Family perception of not being able to afford treatment at distant hospitals was a common theme running through our study. This perception is likely to have emerged from the collective past experience of this community, in seeking emergency care from government hospitals. Policy makers would therefore have to grapple with measures not only to reduce the real cost of care-seeking, but to also project emergency health services as being genuinely affordable. Such an intervention might require to be guided by sample user studies of costs.

Our study has found that in addition to 31 pregnancy-related deaths, there were 10 late maternal deaths. The most common causes of late maternal death were tuberculosis and anemia. Several earlier studies have reported accelerated progression of tuberculosis during the first postpartum year. [17,18] It was thought that the nutritional strain of lactation, insufficient sleep and altered immunity, coupled with changes in intrathoracic pressure due to descent of diaphragm after delivery, combine to cause an increased susceptibility to pulmonary tuberculosis. Pregnancy has been considered to be a state of mild immuno-suppression, which in turn promotes embryonic implantation. [19] Rapid reversal of immune status during the postpartum period is believed to transform quiescent or latent infection into symptomatic disease. Some older studies from the pre-chemotherapy era also found tuberculosis to be a major cause of death after recent childbirth. [20] Further research into women's morbidities and causes of death in the first postpartum year would help to confirm our findings, and show the way for programmatic improvement.

Deaths from injuries contributed to 13% of pregnancy related deaths in our study. In western societies some studies have suggested that intentional injuries, and possibly unintentional injuries, may be more common among women during pregnancy [21]. In the UK, suicide has been reported as a leading cause of maternal death, [22] although suicide rates appear to be much lower during pregnancy and in the first year after childbirth than in women without a recent pregnancy. Some authors have even supported the idea that women may be more prone to injuries during pregnancy. [23]

At the district level in settings with high levels of maternal death, verbal autopsy by district administration or health department could be an important step towards initiating corrective measures to improve maternal health services. However, the biggest challenge would be identification of deaths. This study found that only 53% of deaths had been recorded by the civil registration system, at the time of interview.

To summarize, findings of this study indicate that several factors that contribute to maternal mortality in Rajasthan. Although the high prevalence of health conditions and disease (including TB and anemia) are identifiable as direct or indirect causes of death, important societal and health systems factors constrain women from accessing quality health services. If reduction in maternal mortality is to become a reality, women in Rajasthan and similar regions will require more efficient access to high-quality delivery and emergency services, at affordable costs.

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