

# Prevalence and Risk Factors for Maternal Mortality at a Tertiary Care Centre in Eastern Nepal- Retrospective Cross Sectional Study

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## Research Article

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# Abstract

## Background:

Maternal mortality ratio is an important public health indicator that reflects the quality of health care services. The prevalence is still high in developing countries than in the developed countries.

This study aimed to determine the MMR and to identify the various risk factors and causes of maternal mortality.

## Methods:

This is a retrospective study conducted in a tertiary care center of Eastern Nepal from 16<sup>th</sup> July, 2015 to 15<sup>th</sup> July 2020. Maternal mortality ratio per 100,000 live-births over 5 years of study period was calculated. The causes of death, delays of maternal mortality and different sociodemographic profiles were analyzed by descriptive statistics.

## Results:

There were total of 55,667 deliveries conducted during the study period. The calculated maternal mortality ratio is 129.34 per 100,000 live-births in year 2015 to 2020. The mean age and gestational age of women having maternal deaths were  $24.69 \pm 5.99$  years and  $36.15 \pm 4.38$  weeks of gestation respectively. The common causes of maternal deaths were obstetric hemorrhage, hypertensive disorder of pregnancy and sepsis. The leading contributory factors to the death were delay in seeking health care and delay in reaching health care facility (type I delay: 40.84%).

## Conclusions:

Despite the availability of comprehensive emergency obstetric care at our center, maternal mortality is still high and almost 75% of deaths were avoidable. The leading contributory factors were due to delay in seeking care and delayed referral from other health facilities. Contributory factors related to maternal mortality are preventable through combined safe motherhood strategies, prompt referral, active management of labor and puerperium.

## Introduction

Maternal mortality is defined as death of pregnant women 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(1).

According to WHO, more than 70% of all maternal deaths are due to hemorrhage, infection, unsafe abortion, hypertensive disorders of pregnancy and obstructed labor. The major causes of these deaths are poverty; inadequate, inaccessible or unaffordable health care; low status of women and illiteracy. The

global maternal mortality ratio showed significant reduction in maternal deaths (declined by 38 per cent) from 342 deaths to 211 deaths per 100,000 live births (from 2007 to 2017), according to UN inter agency estimates. However, 94% of all maternal death has occurred in low and lower middle income countries. The MMR in low income countries in 2017 is 462 per 100,000 live births versus 11 per 100,000 live births in high income countries (2).

Maternal mortality ratio is an important public health indicator that determines the quality of health care services and the women's status in their society (3).

According to Sustainable Development Goals 3(SDG 3), they plan to reduce global maternal mortality ratio to fewer than 70 per 100,000 live births by 2030 and no country should have a MMR greater than 140 per 100,000 live births, a number twice the global target(4).

According to Nepal demographic and Health Survey(NDHS) 2017, MMR in Nepal was found to have decreased from 539 to 239 maternal death per 100,000 live-births between 1996 and 2016. About 12% of deaths among women of reproductive age were due to maternal deaths(5).

The common causes of maternal mortality are hypertensive disorder of pregnancy, obstetric hemorrhage, sepsis and anemia and most of the causes are preventable, so providing access to the health care and quality care in pregnancy and in the puerperium may help to reduce maternal death. Our institute is a tertiary care center located in the Eastern part of Nepal, where almost ten thousands of delivery occurs in a year. Almost 65% of maternal deaths have occurred in patients who have sought delayed care or reached health care center later. Improving antenatal care and identifying high risk factors at grass-root level and timely referral to the higher center would decrease the load of maternal mortality.

This study aimed to calculate the MMR and to identify the various risk factors and causes of maternal mortality in a tertiary care center.

## **Materials And Methods**

This is a retrospective study conducted in a tertiary care center of Eastern Nepal. Data were collected from the files from record section. Detailed retrospective reviews of records were undertaken from the case notes of 56,787 admission in obstetrics unit during 5 years period from 16<sup>th</sup> July, 2015 to 15<sup>th</sup> July, 2020. The information was retrieved from the case notes available in the medical records department of the hospital as well as from the daily records in the maternity and delivery sections of the hospital during study period.

The study population included women who delivered in the hospital as well as referred from other centers presenting with pregnancy related complications and expired during the course of management. We had included the mortalities due to ectopic pregnancy, molar pregnancy, abortion and its related complications. We had excluded the case of "dead on arrival" during pregnancy or puerperium as details of pregnancy or required data may not be available or identified. Death of pregnant/ puerperal women

due to violence or accidental cause was also excluded, which is not under the definition of maternal death.

The study was conducted after ethical clearance from Institutional Review Committee (IRC number: IRC/1772/020) of the hospital. The Hospital Director and the Head of the Department of the hospital were informed about the purpose of the study, and approval were obtained for the retrieval of data from case sheets. They were assured about the confidentiality of information obtained. Informed consent from the patient to review their case sheets was waived due to retrospective and non-interventional study design.

Data retrieved from case notes included general socio-demographic profile, clinical presentation, history of present and past obstetric outcomes, primary and final cause of death. We also documented the total number of deliveries, total number of live births and number of maternal mortality during this period. Additional methods used to identify the number of maternal mortality in the hospital included review of daily delivery records, review of records in the surgical departments as well as records from maternal death reviews which are conducted periodically in the hospital.

**The variables studied were demographic characteristics:** age, gravida, residence, ethnicity

**Obstetric characteristics:** antenatal care, booking status, presentation to hospital(antenatal/ postpartum), condition of women at presentation, complications during index pregnancy, POG at delivery, mode of delivery, place of delivery, complications during delivery

**Variables related to maternal mortality:** Maternal mortality ratio, cause of mortality (primary cause and contributory cause), time duration from presentation to mortality, timing of mortality (early pregnancy, antepartum, postpartum).

## Data collection tool

The data were collected from the maternal death review(MDR) form designed by government of Nepal, Family health division.

## Statistical analysis

The data was entered in Microsoft Excel sheet and analysis was performed using SPSS version 24. Descriptive statistics like frequency, percentage, mean and standard deviation were calculated and presented in tables.

The characteristics of the study population and prevalence of maternal death were presented using percentage and absolute numbers. MMR was calculated as number of deaths due to maternal causes per 100,000 live births within the period.

## Results

There were total of 55,667 deliveries and 54,892 live births over the study duration of five years. During this period, there were 71 maternal deaths and calculated maternal mortality ratio (MMR) was 129.34 per 100,000 live births.

Among 71 maternal death, 65 women had death related to obstetrics events and six deaths were related to early pregnancy complications (abortion, molar and ectopic pregnancy). They are analyzed in details separately.

Baseline characteristics of all maternal mortality are presented in Table 1. The most common age group of the women with maternal mortality ranged from 20 to 34 years with mean age of  $24.69 \pm 5.99$ . Almost 70% of women had presented in the emergency room in the state of shock (mostly hypovolemic shock) and 60% had required blood transfusion at or after admission.

The duration of hospital stay (admission to death time) was less than 24 hours in around 32%. Almost 82% of women needed maternal ICU for critical care management or for ventilatory support. Other women had died in emergency itself during resuscitation process as they had arrived in critical state.

Table 1  
Maternal mortality and its characteristics. (n = 71)

variables		Frequency	Percentage(%)	Mean $\pm$ SD
Ethnicity	Brahmin	22	31.0	
	Dalit	13	18.3	
	Janajati	18	25.4	
	Madeshi	13	18.3	
	Muslim	3	4.2	
	Newar	2	2.8	
Geographical location	Mountain	3	4.2	
	Hill	11	15.5	
	Terai	57	80.3	
Age(years)	< 19 or less	10	14.1	24.69 $\pm$
	20–34	55	77.5	5.99 (16–45)
	35 or more	6	8.5	
Gravida	1	31	43.7	
	2–4	34	47.9	
	5 or more	6	8.5	
Shock at admission	Yes	21	29.57	
	No	50	70.43	
Referral	Referred	49	69.01	
	Not referred	22	30.99	
ICU	Yes	58	81.7	
	No	13	18.3	
Admission to death duration	< 24 hours	23	32.4	
	> 24 hours	48	67.6	

Table 2 shows the obstetric characteristics of women who had mortality during antenatal or in postpartum period.

Among 65 women 22 of them were admitted during postpartum period and almost 45% (10 case) were admitted during first 48 hours of delivery with postpartum hemorrhage in state of shock. Though 79% of women had received at least few visit of antenatal care, only around 5 % had done antenatal checkup in

our hospital. After arrival at our center, 18 women (27%) had died before delivery of the fetus during antepartum or intrapartum period.

Table 2  
Characteristics of obstetric case among maternal mortality (n = 65)

		Frequency	Percentage(%)	Mean ± SD
Period of admission	Antepartum	43	66.15	
	Postpartum	22	33.85	
Period of death	Antepartum	18	27.69	
	Postpartum	47	72.31	
Gestational age(weeks)				36.15 ± 4.38(19–41)
ANC care	Yes	56	78.9	
	No	9	12.7	
	Don't know	6	8.5	
Booking status	Booked	3	4.62	
	Not booked	62	95.38	
Complication in index pregnancy (n = 65)	Yes	47	72.30	
	No	18	27.70	
Mode of delivery	Vaginal	24	36.92	
	Cesarean	23	35.38	
	Not delivered	18	27.70	
Place of delivery (n = 47)	BPKIHS	28		
	Outside	19		
Fetal outcome(n = 47)*	Alive	32	68.08	
	Stillbirth	12	25.53	
	NND	2	4.26	
Hysterectomy	Yes	8	12.30	
	No	57	87.70	
*one women had spontaneously expelled fetus at 19 weeks.				

We had also searched for the primary causes of maternal mortality and is as shown in Fig. 1. The major cause of maternal mortality in our study was related to obstetric hemorrhage which comprised 34% of the cases. Out of 22 cases of obstetric hemorrhage, 17 cases had primary postpartum hemorrhage, and 5 had presented with antepartum hemorrhage (APH) i.e., three with placenta previa and 2 with placental abruption. Eight cases underwent peripartum hysterectomy where 3 cases were associated with morbidly adherent placenta and others for atonic PPH.

The second most common cause of death was related to hypertensive disorder of pregnancy. Among 14 cases with hypertension, eight cases had presented with eclampsia at the time of admission.

Fourteen percent of women had died due to sepsis emphasizing puerperal sepsis as the third common cause of maternal mortality. The common causes of sepsis were surgical site infection (2), urosepsis (2), and acute respiratory distress syndrome due to pneumonia (4). Primary cause of death in 9% of women was related to anemia and its complication.

Other causes of death were related to uterine rupture (3), heart disease (3), acute fatty liver of pregnancy (1), suspected pulmonary embolism (3) and SLE (1).

Six women had mortality related to early trimester complications which is shown in details in the Table 3.

Table 3  
Details of women who had mortality related to molar, ectopic and abortion (n = 6)

Cause of death	Frequency(n)
Ruptured ectopic pregnancy with hypovolemic shock	1
Complications of molar pregnancy	2
Unsafe abortion leading to septic abortion	3

Assessment of types of delays associated with maternal mortality showed that the majority of deaths were associated with type I delay (40.84%) and were reported to be due to delay in seeking health care or due to delay in reaching health care facility. Type II delay was seen among 23.94%, which were due to late referral from other facilities. Likewise, type III delay was seen in 21.13 % of deaths as explained in details in Table 4.

Table 4  
Distribution of maternal mortality according to three types of delays.

Types of delay	Frequency	Percentage(%)
Delay 1	29	40.84%
Delay 2	17	23.94%
Delay 3	15	21.13%
Lack of supplies/ equipment	6	
Inadequate skill of provider	2	
Delay in receiving treatment in the health facility	7	
No delay	10	14.09%

## Discussion

Deaths from complications of pregnancy and childbirth are still high with WHO recording 295,000 maternal deaths globally in 2017(2). At that time, global maternal mortality ratio, though decreased to 196 per 100,000 from 282 per 100,000 of 1990, didn't reach the agreed target of 75% reduction(6).

This study was conducted to identify the maternal mortality ratio and causes of maternal death in a tertiary care center of a developing country. The MMR was found to be 129.34 per 100,000 live births, which is lesser as compared to other review done in developing countries (7)(8).

The MMR is very much less in our center as compared to the rate as mentioned by NDHS 2016 (MMR of 239) as this is a hospital study(5).

The common causes of maternal mortality in our center were obstetric hemorrhage, hypertension, sepsis and anemia which is similar to the findings from other studies(8)(9)(10)(11).

An observational study conducted in a tertiary care referral center of Western Nepal found that MMR of 151 per 100,000 live births with mean age of mother being 28 years. Most of the patient had presented to the center in unstable health condition, with common cause of death being hypertension and sepsis. These findings were also comparable to our study. Most of them (73.30%) had died in postpartum period(12).

Our institute receives most of the referred complicated obstetric patients and also women can be admitted directly from home without referral. In this study almost 70% of women were referred from other health care center. Almost 30% of cases presented in state of shock at the time of admission resulting in delayed intervention and hence adverse outcome. It was similar to the findings from other studies done in developing countries(8)(13)(14).

In a study conducted in Nigeria, six leading causes of maternal mortality were hemorrhage, eclampsia/preeclampsia, sepsis, ruptured uterus, complications of abortion and prolonged obstructed labor. Among these causes 43.4% accounted for hemorrhage followed by 36.0% of preeclampsia and eclampsia which coincides with the finding seen in our study (13). In our study 3 women had ruptured uterus. Among them 2 women were referred from outside after delivery in state of shock and expired during resuscitation process. Other women had ruptured uterus diagnosed during intrapartum period but we couldn't operate on her immediately due to busy operating theater at the moment. The women who were referred from outside had difficult vaginal delivery and gave history of fundal pressure. It seems that use of fundal pressure during vaginal delivery is still being practiced in peripheral setup.

Another study conducted in India, they had found MMR of 802 per 100,000 live births which was very much higher than the finding of our study. In this study, maternal anemia (53.57%) was the most common morbidity present unlike the finding in our study where hypertensive disorder of pregnancy was the most common comorbidity. Almost 93% of death had occurred in postpartum period and 94.6 % of women were referred from another center(8).

Overall, high MMR was found in various studies which were conducted in referral center in developing countries, which reported MMR of 426 per 100,000 live births and 1513.4 per 100,000 live births(15). Comparable to several studies, most of the death (77.50%) had occurred in women of 20–34 years of age(8)(9)(11)(16). Mean gestational age at death is  $36.15 \pm 4.38$  weeks in our study which is similar to other study(11).

In three delay model of maternal mortality, delay I (40.84%) was seen in maximum death followed by delay II in our study. Most of these cases were related to late referral from other health center. This calls for strengthening the capacity of health care worker in early recognition of danger signs and referral to appropriate center on time.

This study has highlighted the gaps between the community to the tertiary care center. Those women who had delivered at home or primary care center are being referred to many other center before reaching tertiary care center or not referred on time due to lack of skills/ knowledge to identify the high risk patient. Furthermore, delays in interventions and inadequate supply of equipment, inadequate skills of providers had also contributed to the deaths.

## **Strengths And Limitations**

This hospital based study provides little representation of what is happening in the community and may lead to under reporting. However, this study done over 5 years of duration provides trends of maternal mortality in our population. Also, this sample may not represent general population as this is a referral center where patients were self-referred or referred by another center. As this is a descriptive study which lack comparison group, it may not provide causative association for maternal deaths. The contributory factors leading to delay I and II were also not studied separately.

As this is a retrospective study with less sample size, a longer study period with large sample size would give meaningful data. However, we have ensured accurate data as we had used multiple approaches to identify all cases of maternal deaths in the hospital.

## **Conclusions**

Despite the availability of comprehensive emergency obstetric care at our center maternal mortality is still high and almost 75% of deaths were avoidable. The leading contributory factors were due to delay in seeking care or delayed referral from other health facilities. Contributory factors related to maternal mortality are preventable through combined safe motherhood strategies, prompt referral, active management of labor and puerperium. The findings of this study call for improving/ identifying high risk patient on time with timely referral with proper documentation so that early action/ intervention can be done in a referring center in case of obstetric emergency. There needs to be another study which will address all the delays of maternal mortality and find the causative association of cause of maternal mortality.

## **Abbreviations**

ANC: Antenatal Checkup

APH: Antepartum Hemorrhage

ICU: Intensive Care Unit

MMR: Maternal Mortality Ratio

POG: Period of Gestation

PPH: Postpartum Hemorrhage

NDHS: Nepal Demographic and Health Survey

SDG: Sustainable Development Goals

## **Declarations**

### **Ethical approval and consent to participate:**

Ethical approval for the study was obtained from institutional review committee(IRC) of BP Koirala Institute of Health Sciences Dharan, Nepal (IRC number: IRC/1772/020). All of the methods were performed in accordance with the relevant guidelines and regulations.

This is a retrospective study and the decision to conduct the research was made after the death of the women, hence we do not have the consent from patient perse. Thus, the aims and objective of this study proposal was designed and submitted to the institutional review committee (IRC) of B.P. Koirala Institute of Health Sciences, Dharan. The ethical approval was obtained from the Institutional Review Committee with reference number 442/076/077- IRC and code No.: IRC/1772/020, email ID: [irc@bpkihs.edu](mailto:irc@bpkihs.edu) for the study despite not having the patient consent. The Hospital Director and the Head of the Department of the hospital were informed about the purpose of the study, and approval were obtained for the retrieval of data from case sheets after ethical clearance from the IRC.

## **Consent for publication:**

not applicable

## **Availability of data and materials:**

the datasets used and / or analyzed during the current study are available from the corresponding author on reasonable request.

## **Competing interests:**

The authors declare that they have no competing interest.

## **Funding:**

no funding was received for this study

## **Authors contribution:**

SS: conceptualization, methodology, data collection, analysis, manuscript writing. TB, AA, DD, TM, PS: result analysis, manuscript writing and editing. All authors read and approved the final manuscript.

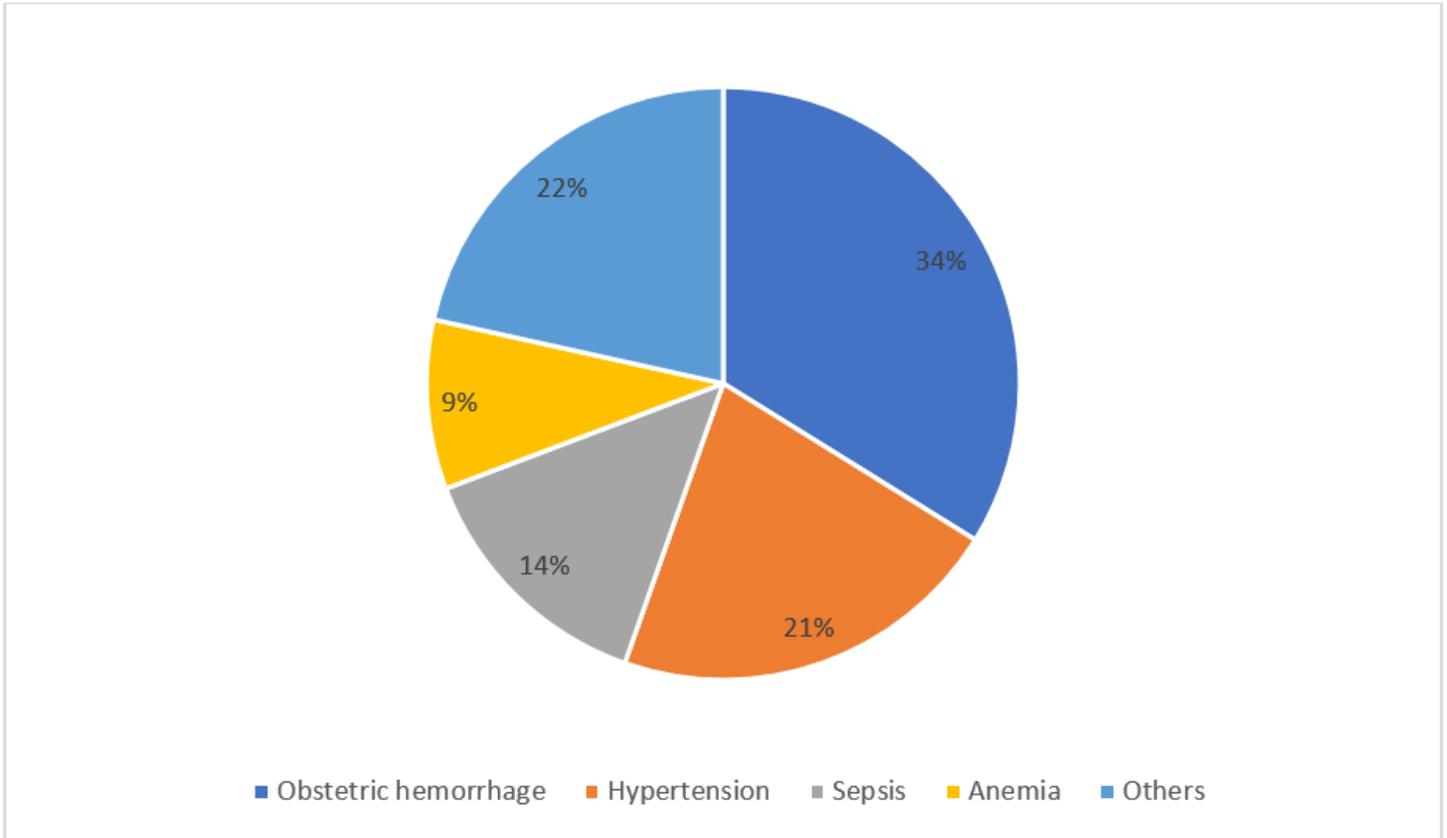
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## **References**

1. WHO. Maternal Mortality: 1990 to 2010. Organization. 2010;32(5):1–55.
2. WHO. Trends in Maternal Mortality: 2000 to 2017. Estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division.
3. WHO. Maternal Mortality ratio (per 100 000 live births). Health statistics and health information systems. 2013:1.
4. Force MT. The Sustainable Development Goals and Maternal Mortality – Maternal Health Task Force. Havard Chan School.
5. Adult and Maternal Mortality. Nepal Demographic and Health Survey. 2016 :259-64).
6. Kassebaum NJ, Barber RM, Dandona L, Hay SI, Larson HJ, Lim SS, et al. Global, regional, and national levels of maternal mortality, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet*. 2016;388(10053):1775–812.
7. Upadhyaya I. Maternal death reviews of a tertiary care hospital. *J Nepal Med Assoc*. 2014;52(193):714–9.
8. Sundari K, Priya R, Subathra S. Maternal mortality: analysis of causes and preventable factors. *Int J Reprod Contraception, Obstet Gynecol*. 2016;5(6):1719–21.
9. Rijal P, Agrawal A, Pokharel H, Pradhan T, Regmi M. Maternal Mortality: A Review from Eastern Nepal. *Nepal J Obstet Gynaecol*. 2014;9(1):33–6.
10. Pasha O, McClure EM, Saleem S, Tikmani SS, Lokangaka A, Tshetu A, et al. A prospective cause of death classification system for maternal deaths in low and middle-income countries: results from the Global Network Maternal Newborn Health Registry. *BJOG An Int J Obstet Gynaecol*. 2018;125(9):1137–43.
11. Maro EW, Mosha NR, Mahande MJ, Obure J, Masenga G. Ten years trend in maternal mortality at Kilimanjaro Christian Medical Center Tanzania, 2003-2012: A descriptive retrospective tertiary hospital based study. *Asian Pacific J Reprod*. 2016;5(3):214–20.
12. Shrestha J, Gurung S, Shrestha A, Subedi A. Maternal Mortality and Associated Factors in a Tertiary Care Center of Western Nepal. *J Lumbini Med Coll*. 2017;5(2):58–63.
13. Sageer R, Kongnyuy E, Adebimpe WO, Omosehin O, Ogunsola EA, Sanni B. Causes and contributory factors of maternal mortality: Evidence from maternal and perinatal death surveillance and response in Ogun state, Southwest Nigeria. *BMC Pregnancy Childbirth*. 2019;19(1):1–8.
14. Nassoro MM, Chiwanga E, Lilungulu A, Bintabara D. Maternal Deaths due to Obstetric Haemorrhage in Dodoma Regional Referral Hospital, Tanzania. *Obstet Gynecol Int*. 2020;2020.
15. Yego F, Stewart Williams J, Byles J, Nyongesa P, Aruasa W, D'Este C. A retrospective analysis of maternal and neonatal mortality at a teaching and referral hospital in Kenya. *Reprod Health*. 2013;10:1–8.
16. Rodríguez-Aguilar R. Maternal mortality in Mexico, beyond millennial development objectives: An age-period-cohort model. *PLoS One*. 2018;13(3):1–17.

# Figures



**Figure 1**

Primary causes of maternal mortality(n=65)