DETERMINANTS OF FETAL MORTALITY IN ZAMBIA

PERSPECTIVE

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A pregnancy that does not terminate into a live birth is a public health concern. The aim of the paper was to determine factors associated with fetal deaths in Zambia.

This paper uses data from the 2013/2014 Zambia Demographic Health Survey (ZDHS) and used a cross sectional study design. The study was purely quantitative and was conducted through structured interviews. A representative sample of 18,052 households was drawn and interviewed women in the reproductive age group 15-49.

The results showed that only 5.3% women in Zambia had a fetal death. The multivariate logistic regression findings indicate that the odds of having a fetal death was 1.46 (CI: 1.20-1.79) higher for women whose health care was decided by their partner; increasing maternal age increased the odds of having a fetal death by 1.02 (CI: 1.01-1.03) and the odds of having a fetal death was lower for women who had children or a child alive.

Evaluating factors associated with fetal death makes it possible to recognize that interventions in some social, economic, demographic and maternal factors is key in the reduction and prevention of adverse birth outcomes such as fetal deaths.

Keywords: Fetal death, Determinants, Maternal health, factors,

Introduction

Fetal death is a public health challenge in the care of pregnant women worldwide, particularly in developing countries. Unlike in most developed countries, pregnancies in most developing countries are unplanned and usually present with complications which end up in adverse outcomes for both an infant and mother (1).

Fetal deaths are grossly underreported in most developing countries, and this makes comparisons difficult. This situation hinders attempts to adapt interventions and set health care priorities to meet local needs. For instance, researchers in Jamaica found that compared with 94 percent of live births, only 13 percent of late fetal deaths and 25 percent of infant deaths had been registered (2). While in Thailand, only 55 percent of infant deaths and none of the late fetal deaths were recorded in official registers (3).

Worldwide, the rate of fetal mortality varies considerably depending on the definitions applied for classifying fetal deaths (4). The most devastating adverse pregnancy outcome is when the pregnancy does not terminate into a live birth but ends up as an abortion or stillbirth. This is devastating for the mother but also of concern for clinical practice.

Fetal mortality is said to be an important indicator of the quality of antenatal and obstetric care (5,6). However, the contribution of other factors such as socio-demographic factors cannot be overlooked. Research in developing countries has been and is still being carried out to establish the factors associated with fetal death. In Zimbabwe results show that perinatal mortality is unacceptably high and associated factors vary across demographic subgroups (7,8). Other studies also indicate that socio-economic factors largely operate through proximate factors such as maternal biological, antenatal, and intrapartum factors (9).

The gap in fetal mortality between developing and developed countries (10) can only be reduced if preventable factors are identified and well addressed in developing countries. Most fetal deaths can be averted by implementing programmes and policies that support women's access to affordable and high-quality family planning, antenatal delivery and postnatal care (11). Therefore, In order to address the problem of fetal mortality in Zambia, there is need to identify factors associated with pregnancies that do not end up in live births. This study was carried out to determine factors that are associated with fetal death among women in Zambia.

Methods

Zambia covers a land area of 752,612 square kilometres. This study was conducted in Zambia's 10 provinces. The provinces include Central, Copperbelt, Eastern, Lusaka, Southern, Luapula, Muchinga, Northern, North-Western and Western Provinces.

This paper used data from the 2013/2014 Zambia Demographic Health Survey (ZDHS) which is a national sample survey designed to provide up-to-date information on health status and behaviour.

The study adopted a cross sectional study design targeting all women aged 15-49 who were either permanent residents

of the households or visitors present in the households on the night before the survey. It was purely quantitative and was conducted through structured interviews.

A representative sample of 18,052 households was drawn for the 2013-14 ZDHS to provide estimates at the national, provincial and regional (Rural/Urban) levels. An updated list of enumeration areas (EAs) for the 2010 Population and Housing Census provided the sampling frame for the survey comprising 25,631 EAs and 2,815,897 households. The survey used a two-stage stratified cluster sample design, with EAs (or clusters) selected during the first stage and households selected during the second stage. In the first stage, 722 EAs (305 in urban areas and 417 in rural areas) were selected with probability proportional to size. The sample was representative of women in the reproductive age group. The total number of women sampled and interviewed were 16,411. However, for this study, all women who were both nulliparous and had never had a fetal death were excluded from the study. This study also focused only on fetal deaths that occurred 5 years prior to the survey. Thus fetal deaths that occurred more than 5 years from the study period were also excluded from the study. Therefore, after the exclusion of the afore mentioned, the total number of women included in the sample for this study was 11, 486 and a weighted estimate of 11, 546 women in the reproductive age group was derived. Hence, all statistics presented under results reflect weighted numbers.

Fetal death which was a dependent variable is defined as a pregnancy that was terminated in a miscarriage, abortion, or still birth, or any pregnancy that did not result in a live birth.

The independent variables included respondents'; Age, Region, Years lived in place of residence, Highest educational level, Religion, Wealth index, Total children ever born, Number of living children, Currently/formerly/never in union, marital status, fertility preference (desired number of children) and Person who usually decides on respondent's health care.

Data analysis was done using Stata version 13 and the sample data was weighted in order to come up with population estimates. Bivariate analysis or Chi-square analysis was conducted in an attempt to describe and establish the relationship between fetal deaths and socio-economic and demographic factors. A multivariate logistic regression analysis was conducted to ascertain association between fetal deaths and socio-economic and demographic factors that were significant at bivariate analysis level.

Ethical Consideration

The paper used secondary data hence posed no risk or harm to the respondents. The data did not contain any of the respondent's names nor traces of the respondents. This paper, therefore holds respondents information with the highest confidentiality. Permission to use the data was sought from the Zambian Central Statistics Office (CSO).

Results

Socio-economic and Demographic Characteristics

Twenty one percent of the women were in the age group 25 to 29; 57.2% of the women were from rural areas; 51.7% had a primary education; 81.2% were protestant; 41.9% were rich based on the wealth index; 34.1% bore 5 and more children; 28.4% had 5 and more living children; three quarters (75.4%) were in a union; over half (56.1%) preferred having another child and 42.8% of the women's health care was decided by both the partner and themselves as a couple (Refer to table1).

Prevalence of fetal deaths

The results show that only 5.3 (612) percent of women in Zambia had a fetal death or a pregnancy that did not result in a live birth within 5 years prior to the survey.

Association between fetal deaths and socio-economic and demographic variables

The chi-square results in table 1 with a p-value less than 0.05 at 95% confidence interval (CI) indicate that there was a statistically significant relationship between each of the following independent variables and the dependent variable (fetal deaths); age of mother, years lived in a place of residence, children ever born, number of living children, marital status, fertility preference, person who makes decisions on the mothers health care. The percentage of women with fetal deaths increased with increasing age; more women in rural areas (5.5%) had fetal deaths compared to urban women (5.1%); 8.3% of women who lived in a place of residence less than a year had a fetal death; women with a higher education had a fetal death (6%); the percentage of fetal deaths reduced with increase in the number of children ever born and the number of children alive; 5.8% of fetal deaths were among women in a union; 6.5% of fetal deaths were among women who were undecided about fertility preference (undecided about having another child); and 11.4% of fetal deaths occurred to women's whose health care was determined by someone else. However, women's socio-economic characteristics such as; region, education status, religion and wealth index were not significantly associated with fetal deaths.

Table 1: Associations between socio-economic and demographic factors on one hand and fetal death on the other.

	Fetal death					
	No	No	Yes	Yes	Total	Total
	%	95% CI	%	95% CI	%	95% CI
Age in 5-year groups						
15-19	7.5	[6.9-8.1]	9.4	[6.9-12.6]	7.6	[7.0-8.1]
20-24	18.9	[18.1-19.8]	23.8	[20.0-28.2]	19.2	[18.3-20.1]
25-29	21.4	[20.5-22.4]	20.1	[16.4-24.4]	21.4	[20.5-22.3]
30-34	18.9	[18.1-19.8]	19.7	[16.2-23.6]	19	[18.1-19.9]
35-39	15.2	[14.4-16.1]	13.7	[10.8-17.3]	15.1	[14.3-16.0]
40-44	10.6	[10.0-11.3]	9	[6.6-12.1]	10.5	[9.9-11.2]
45-49	7.4	[6.8-8.0]	4.3	[3.0-6.3]	7.2	[6.7-7.8]
Total	100		100		100	

Pearson: Uncorrected chi2(6) = 20.6353
Design-based F(5.84, 4095.30) = 2.5330 Pr = 0.020

Region						
urban	42.8	[41.1-44.6]	41.2	[36.7-45.8]	42.8	[41.1-44.4]
rural	57.2	[55.4-58.9]	58.8	[54.2-63.3]	57.2	[55.6-58.9]
Total	100		100		100	

Pearson: Uncorrected chi2(1) = 0.6634
Design-based F(1.00, 701.00) = 0.4661 Pr = 0.495

Years lived in place of residence						
Less than a year	8.3	[7.6-9.2]	13.4	[10.5-17.1]	8.6	[7.8-9.5]
One to Three years	19.3	[18.3-20.5]	23.1	[19.5-27.2]	19.5	[18.5-20.7]
Four to ten years	23.3	[22.3-24.4]	23.9	[20.0-28.4]	23.3	[22.3-24.4]
Eleven to fourty one years	14.8	[13.9-15.7]	10.7	[8.1-13.9]	14.6	[13.7-15.4]
Always	31.7	[29.8-33.6]	27.2	[23.2-31.6]	31.4	[29.6-33.3]
Visitor	2.6	[2.2-2.9]	1.6	[0.8-3.2]	2.5	[2.2-2.9]
Total	100		100		100	

Pearson: Uncorrected chi2(5) = 34.0194
Design-based F(4.94, 3459.52) = 5.2270 Pr = 0.000

Highest educational level						
no education	10.1	[9.3-11.1]	10.5	[7.6-14.3]	10.2	[9.3-11.1]
primary	51.7	[50.1-53.4]	50.1	[45.2-54.9]	51.7	[50.1-53.2]
secondary	33.4	[32.0-34.9]	34.2	[29.7-38.9]	33.5	[32.0-35.0]
higher	4.7	[3.9-5.6]	5.3	[3.4-8.2]	4.7	[3.9-5.7]
Total	100		100		100	

Pearson: Uncorrected chi2(3) = 0.9529
Design-based F(2.98, 2089.73) = 0.2113 Pr = 0.888

Religion						
catholic	17.7	[16.5-19.0]	15.1	[12.0-18.8]	17.5	[16.3-18.8]
protestant	81	[79.7-82.3]	84	[80.3-87.2]	81.2	[79.9-82.4]
muslim	0.6	[0.3-1.2]	0		0.6	[0.3-1.2]
other	0.7	[0.5-1.0]	0.9	[0.3-2.5]	0.7	[0.5-1.0]
Total	100		100		100	

Pearson: Uncorrected chi2(3) = 7.2397
Design-based F(1.74, 1218.98) = 0.7084 Pr = 0.474

Wealth index						
Poor	38.6	[37.1-40.2]	38.1	[34.1-42.2]	38.6	[37.1-40.1]
Middle	19.4	[18.1-20.8]	20.9	[17.8-24.4]	19.5	[18.2-20.9]
Rich	41.9	[40.0-43.9]	41	[36.4-45.8]	41.9	[40.0-43.8]
Total	100		100		100	

Pearson: Uncorrected chi2(2) = 0.8360
Design-based F(1.90, 1333.43) = 0.3497 Pr = 0.694

Total children ever born						
Zero	0		15.3	[12.3-19.0]	0.8	[0.6-1.0]
One	19.5	[18.6-20.5]	19.4	[16.1-23.2]	19.5	[18.6-20.5]
Two	17.7	[16.8-18.5]	16.6	[13.3-20.6]	17.6	[16.8-18.4]
Three	15.5	[14.7-16.3]	12.1	[9.3-15.7]	15.3	[14.5-16.1]
Four	12.8	[12.1-13.6]	10.9	[8.4-14.1]	12.7	[12.0-13.5]
Five & above	34.5	[33.4-35.7]	25.6	[21.8-29.7]	34.1	[32.9-35.2]
Total	100		100		100	

Pearson: Uncorrected chi2(2) = 0.8360
Design-based F(1.90, 1333.43) = 0.3497 Pr = 0.694

Number of living children						
Zero	1.3	[1.0-1.6]	17.5	[14.2-21.4]	2.1	[1.8-2.5]
One	21.1	[20.1-22.2]	21.1	[17.4-25.3]	21.1	[20.1-22.2]
Two	18.9	[18.0-19.7]	17.4	[13.9-21.4]	18.8	[17.9-19.6]
Three	16	[15.2-16.9]	14.2	[11.2-17.7]	15.9	[15.1-16.7]
Four	13.9	[13.1-14.7]	10.2	[7.8-13.1]	13.7	[12.9-14.5]
Five & above	28.9	[27.8-30.0]	19.7	[16.4-23.5]	28.4	[27.3-29.5]
Total	100		100		100	

Pearson: Uncorrected chi2(5) = 735.7369
Design-based F(4.94, 3460.51) = 104.4339 Pr = 0.000

Currently/formerly/ never in union						
never in union	9.5	[8.7-10.2]	8.2	[6.0-11.0]	9.4	[8.7-10.1]
currently in union/living with a man	75	[73.8-76.2]	82.5	[78.8-85.7]	75.4	[74.2-76.6]
formerly in union/living with a man	15.5	[14.7-16.5]	9.3	[7.0-12.2]	15.2	[14.4-16.1]
Total	100		100		100	

Pearson: Uncorrected chi2(2) = 20.2786
Design-based F(2.00, 1399.16) = 7.5913 Pr = 0.001

Fertility preference						
have another	55.5	[54.1-56.8]	67.6	[62.8-72.0]	56.1	[54.8-57.4]
undecided	5.3	[4.7-5.9]	6.5	[4.4-9.5]	5.3	[4.8-6.0]
no more	36.2	[35.0-37.4]	24.3	[20.7-28.1]	35.5	[34.3-36.7]
sterilized (respondent or partner)	1.7	[1.4-2.1]	0.8	[0.3-2.0]	1.7	[1.4-2.0]
declared infecund	1.4	[1.1-1.7]	0.9	[0.3-2.5]	1.3	[1.1-1.6]
Total	100		100		100	

Pearson: Uncorrected chi2(4) = 43.8033
Design-based F(3.81, 2672.33) = 7.9938 Pr = 0.000

Fertility preference						
have another	55.5	[54.1-56.8]	67.6	[62.8-72.0]	56.1	[54.8-57.4]
undecided	5.3	[4.7-5.9]	6.5	[4.4-9.5]	5.3	[4.8-6.0]
no more	36.2	[35.0-37.4]	24.3	[20.7-28.1]	35.5	[34.3-36.7]
sterilized (respondent or partner)	1.7	[1.4-2.1]	0.8	[0.3-2.0]	1.7	[1.4-2.0]
declared infecund	1.4	[1.1-1.7]	0.9	[0.3-2.5]	1.3	[1.1-1.6]
Total	100		100		100	

Pearson: Uncorrected chi2(5) = 735.7369
Design-based F(4.94, 3460.51) = 104.4339 Pr = 0.000

Person who usually decides on respondent's health care						
respondent alone	31.7	[30.0-33.5]	29.4	[24.6-34.7]	31.6	[29.9-33.3]
respondent and husband/partner	43.1	[41.3-45.0]	38.4	[33.5-43.6]	42.8	[41.0-44.7]
husband/partner alone	24.8	[23.3-26.3]	31.3	[26.8-36.2]	25.2	[23.7-26.6]
someone else	0.4	[0.3-0.6]	0.9	[0.3-2.3]	0.5	[0.3-0.7]
Total	100		100		100	

Pearson: Uncorrected chi2(3) = 13.1704
Design-based F(2.94, 2060.06) = 3.4106 Pr = 0.018

Multivariate logistic regression: Determinants of fetal deaths

After taking care of multicollinearity by taking care of variables with a variance inflation factor of above 10 and factors that were not significant at bivariate (chi-square) analysis, a multivariate logistic regression was fitted as shown in table 2. Using stepwise regression and backwards elimination method based on p-values to explain determinants of fetal deaths, table 2 shows that fetal deaths in Zambia can be explained by factors that were significantly associated with fetal deaths as shown in table 2 model 4. The final model (model 4) reveals that fetal deaths could be explained by three factors which include; a women's age, a person who makes decisions on a woman's health care and the number of living children that a woman has. The model thus shows that the odds of having a fetal death was 1.46 (1.20 - 1.79) higher for women whose health care was decided by their partner compared to those who made the decisions on their health care by themselves. The model also shows that increasing a woman age by 1 unit increases the odds of having a fetal death by 1.02 (CI: 1.01-1.03). Finally, the model shows that the more living children that a woman has, the less the odds of having a fetal death, this is in comparison with women who never had any living children. Therefore, women who had one, two, three, four, five and more living children were 91% (OR: 0.09, CI: 0.06-0.14), 94% (OR: 0.06, CI: 0.04-0.08), 95% (OR: 0.05, CI: 0.03-0.08), 96% (OR: 0.04, CI: 0.03-0.07) and 96% (OR: 0.04,CI: 0.02-0.06) less likely to have a fetal death respectively compared to women who never had any living children.

Table 2: Factors associated with fetal deaths-Multivariate logistic regression (odds ratios)

Factors	Model1	Model2	Model3	Model4
	OR	OR	OR	OR
Fertility preference				
Have another	1			
Undecided	1.33			
	(0.8 - 2.3)			
No more	0.73**			
	(0.6 - 1.0)			
Declared infecund	0.54			
	(0.2 - 1.8)			
Years lived in a place of residence				
Less than a year	1	1		
One to Three years	0.78	0.79		
	(0.5 - 1.1)	(0.5 - 1.1)		
Four to ten years	0.73	0.74		
	(0.5 - 1.1)	(0.5 - 1.1)		
Eleven to forty one years	0.54**	0.55**		
	(0.3 - 0.9)	(0.3 - 0.9)		
Always	0.74	0.75		
	(0.5 - 1.1)	(0.5 - 1.1)		
Visitor	0.53	0.53		
	(0.2 - 1.2)	(0.2 - 1.2)		

Decisions on respondents health care				
Respondent alone	1	1	1	1
Respondent and husband/ partner	0.93	0.95	0.97	
	(0.7 - 1.2)	(0.7 - 1.3)	(0.7 - 1.3)	
husband/partner alone	1.42**	1.42**	1.44**	1.46***
	(1.1 - 1.9)	(1.1 - 1.9)	(1.1 - 1.9)	(1.2 - 1.8)
Someone else	1.67	1.53	1.53	
	(0.4 - 6.4)	(0.4 - 5.7)	(0.4 - 5.8)	
Age	1.03***	1.02***	1.02**	1.02**
	(1.0 - 1.1)	(1.0 - 1.0)	(1.0 - 1.0)	(1.0 - 1.0)
Number of living children				
Zero	1	1	1	1
One	0.12***	0.12***	0.12***	0.09***
	(0.1 - 0.2)	(0.1 - 0.2)	(0.1 - 0.2)	(0.1 - 0.1)
Two	0.08***	0.08***	0.08***	0.06***
	(0.1 - 0.1)	(0.0 - 0.1)	(0.0 - 0.1)	(0.0 - 0.1)
Three	0.07***	0.07***	0.07***	0.05***
	(0.0 - 0.1)	(0.0 - 0.1)	(0.0 - 0.1)	(0.0 - 0.1)
Four	0.05***	0.05***	0.05***	0.04***
	(0.0 - 0.1)	(0.0 - 0.1)	(0.0 - 0.1)	(0.0 - 0.1)
Five and above	0.05***	0.05***	0.04***	0.04***
	(0.0 - 0.1)	(0.0 - 0.1)	(0.0 - 0.1)	(0.0 - 0.1)

Confidence interval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Discussion

Fetal death refers to the intrauterine death of a fetus prior to delivery (WHO). In Zambia's new constitution Article 28, "life begins at conception". By implication, every pregnancy counts. However, the study indicates that close to 6 percent of women had a fetal death within 5 years prior to the study. There are so many factors that have been attributed to fetal deaths in many different studies, however, this study found that social and demographic factors such as maternal age, parity and person's responsible in decision making about a woman's health care play a key role on the pregnancy outcome as they were found to be associated with a risk of intrauterine fetal deaths. Several studies conducted both in developing and developed countries have observed that increasing maternal age has an impact on the risk of fetal mortality (12,13). These findings are similar with findings of (Kliman, 2004) that indicated that the odds of having a fetal death for women aged above 34 were 3.5 times higher compared to the controls (14). According to (Johnson, 2012) maternal age is an important factor in fertility because obstetric and perinatal risks increase with maternal age and that women are not knowledgeable of the increased medical risks of delayed child-bearing such as multiple births, preterm delivery, stillbirth, and Caesarean section (15). The influence of maternal age on fetal deaths can also be attributed to the fact that fertility is inversely related to maternal age. This means that as a woman grows older, her fertility declines. It is therefore imperative that women must be educated on the dangers of having children at older ages as they are at a higher risk of experiencing fetal deaths.

In the past, low fecundity among women or challenges/difficulties in having children due to physiological incapability's was associated with old age and higher parity but nowadays many women delay childbearing for social reasons (17) which posses a negative impact that can be explained by both biological mechanisms and forces of selection leading to an increase in fetal deaths. In a study on determinants of fetal death in Greece, (18) found a significantly higher risk of fetal death for higher maternal age and (7,20) other researchers observed that mothers aged 40 years or more were at higher risk of having a fetal death than younger mothers. Andersen and colleagues (17) also observed that fetal loss is high in women in their late 30s or older, irrespective of their reproductive history. However, in another study (21), even though agrees with the rest of the findings, provides an additional contrary finding that is not mentioned by other researchers in which it states that age below 20 years puts women at high risk of fetal death.

Women's decision's regarding health care are cardinal as they are an integral part of maternal and child health outcomes (19). Dual commitment in reproductive health decision making is cardinal for health concerns such as control of STDs including AIDS, family planning and infertility investigation (22). This implies that women need men as partners in reproductive health who understand the risks they might be exposed to and strategies for their prevention. For instance, preventive reproductive health initiatives and information should not be left for female alone but should involve both sexes. However, the current study found that women also require autonomy in their health care decisions if they are to avoid fetal deaths. Our current study found that the odds of having a fetal death was 1.458 higher for women whose healthcare was decided by their partner compared to those who made the decisions on their health care by themselves. In a study to explore women's level of satisfaction with their involvement in health care decisions during a high-risk pregnancy, it was observed that although most women want to be actively involved in health decision-making during a high-risk pregnancy, some prefer a passive role (23). A Nepal Demographic Health Survey (NDHS) shows that 37% of currently married women participated in important household decisions including their own health care (24). The Nepal DHS findings are similar to the study findings that found that about 4 in 10 women participate in decision making on their health care.

Having living children was inversely related to having a fetal death in this study. Therefore, women without children had higher odds of having a fetal death. The study findings were consistent with findings by Kozuki et al that found that nulliparous women had significant associations with adverse outcomes (25). However, a study by Lima et al in Cuiabá Showed that having live children was not associated with fetal death in the univariate analysis that was conducted (26).

Limitations

This study had some limitations. The study was a cross sectional study that collected data about past cases. The study also used secondary data hence not all factors that could potentially influence fetal deaths were captured. The analysis, therefore, was limited to the available indicators (variables in the dataset) that had potential to influence the health outcome.

Conclusion

There are various factors influencing fetal deaths. Maternal age being associated with fetal deaths mirrors the number of births affected by a weakened reproductive health system. Parity being negatively related to fetal deaths means that women's maternal experiences have a positive impact on health outcomes. Decision making inequalities (inability of women to make decisions on their health) have negatively

affected fetal deaths and women's access to reproductive health services. This study has implications on sensitization programs on the timing and appropriate age for conception. Sensitization programs should also be extended to the community on the importance of male involvement in maternal and child health as this has a positive effect on women's access to health care. However, male involvement should be a pillar of support for a woman's decisions regarding health and health care.

Declarations

Acknowledgements

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Availability of data and materials

The data is available in soft copy in different formats from the Central Statistics Office and the questionnaires are available in soft copy as well.

Competing interests

The authors declare that they have no competing interests.

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