ANALYZING DEPENDENCE BETWEEN TEENAGE PREGNANCY AND MATERNAL DEATH IN BURUNDI

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Abstract

The purpose of this study was to ascertain if teenage pregnancy has a higher risk of unfavorable pregnancy outcomes. The study employed quarterly data from the $DHIS_2$ to accomplish this goal, and the Poisson distribution will be used to estimate this phenomenon. The Poisson distribution was used in the study to estimate the association.We used R programming language to analyze data. The findings validate a noteworthy and affirmative correlation. Adolescents in provincial towns where retail is the primary industry were more likely to become pregnant. The findings also show that regions with several health centers tend to have a higher incidence of maternal deaths.

1 Introduction

Teenage pregnancy is a health problem that impacts not just physical changes but also psychological, social, and economic ones. These numerous impacts can harm both the health and well-being of teenagers and affect the health quality of a country.

According to the world health organization (WHO) teenage pregnancy (fact sheet, 15th September 2022) is a global phenomenon with clearly known causes and serious health, social and economic consequences. Globally, the adolescent birth rate (ABR) has decreased, but rates of change have been uneven across regions. Studies of risk and protective factors related to teenage pregnancy indicate that levels tend to be higher among those with less education or of low economic status. Further, there is slower progress in reducing adolescent first births amongst these and other vulnerable groups, leading to increasing inequity. Child marriage and child sexual abuse place girls at increased risk of pregnancy, often unintended. In many places, barriers to obtaining and using contraceptives prevent adolescents from avoiding unintended pregnancies.

Child sexual abuse increases the risk of unintended pregnancies. A World health organization report (teenage pregnancy) dated 2020 estimates that 120 million girls aged under 20 years have experienced some form of forced sexual contact. This abuse is deeply rooted in gender inequality; it affects more girls than boys, although many boys are also affected. Estimates suggest that in 2020, at least 1 in 8 of the world's children had been sexually abused before reaching the age of 18, and 1 in 20 girls aged 15–19 years had experienced forced sex during their lifetime.

Teenage pregnancy presents a high health risk for both the teen and the baby. Generally, complications of pregnancy and childbirth are the main causes of mortality for teenage girls aged 15-19 years (Neal et al., 2012). These are global problems that get attention even in developed countries. However, the high risk of stillbirth in teenage pregnancy needs to be researched further, whether it is due to maternal factors, the mother's first pregnancy, or both (Yussif et al.,2017)

Complications associated with pregnancy and childbirth are considered the major cause of mortality among teenagers in developing countries. More than half of maternal deaths globally are caused by bleeding, gestational hypertension, and sepsis (Kassa et al., 2021)). Teenagers at an early age

will experience prolonged trauma, a crisis of confidence, an unwillingness to become parents, being single parents, negative stigma, and divorce (Uyun and Saputra, 2011).

As reported by World health Organization (fact sheet, 15th September 2022), adolescent birth rate has decreased from 64.5 births per 1000 women in 2000 to 42.5 births per 1000 women in 2021. However, rates of change have been uneven in different regions of the world with the sharpest decline in Southern Asia (SA), and slower declines in the Latin American and Caribbean (LAC) and sub-Saharan Africa (SSA) regions. Although declines have occurred in all regions, SSA and LAC continue to have the highest rates globally at 101 and 53.2 births per 1000 women, respectively, in 2021.

As stated by the United Nations Population Fund (UNFPA) in 2013 in the report of the study on pregnancies in schools. In Burundi, the phenomenon of school pregnancies is taking on a worrying aspect: according to the annual report of the Ministry of Basic and Secondary Education, Vocational Education, Vocational Training and Literacy, the number of pregnancies in schools is increasingly high, during the 2011-2012 school year, out of 6,120 students returning to school after dropping out for various reasons, 1,000 girls had interrupted their schooling because of pregnancy, i.e., 16%. According to the same report, 1287 cases of unwanted pregnancies were recorded in secondary schools and 707 in elementary school during the 2010-2011 school year. For the 2011-2012 school year, the numbers did not change much with 1286 cases. In the first quarter of the 2012-2013 school year, some provincial directorates of secondary education had already recorded more than 150 cases of pregnancy (274 in Makamba, 191 in Ngozi). According to data from the 2008 RGPH, 5.2% of girls between the ages of 12 and 18 have one or more children; 28% of minors with a child are between 12 and 14 years old.

As stated in $DHIS_2$, in the last years (2021 and 2022) 105508 cases of adolescent girls and 682 cases of maternal deaths were observed. For the year 2021 most of the cases were observed in some provinces 5816 cases of adolescent girls in Muyinga province were pregnant out of 14 cases of maternal deaths, 4409 cases of adolescent girls in Ruyigi province out of 21 cases of maternal deaths. And for the year 2022 Muyinga returned to the first place with more cases compared to 2021 with 6060 cases of early pregnancy and 23 cases of maternal deaths and 4647 cases of pregnancy with 7 cases of maternal deaths in Kirundo. he highest number of maternal deaths was observed in Bujumbura Mairie, 83 maternal deaths out of 3233 cases of pregnancy. To prevent the impact of teenage pregnancy, especially in developing countries,

changes in public policy are one of the efforts that governments can make, including improving the quality of education, providing health access, and eliminating cultural stigma (Lemon, 2016).

In this study we intend to examines the existence of the relationship between the teenage pregnancy and the maternal death by using the bivariate Poisson model regression and to formulate a joint distribution using copula which captures the dependence of the two variables (teen pregnancy and maternal death).

2 Problem statement

The high incidence of teenage pregnancies and maternal fatalities are the study's main concern. As a result, teenage females (ages 15 to 19) who experience numerous pregnancy and delivery problems have a higher chance of becoming mothers. This study looked at the association between teenage pregnancy and maternal death in Burundi in order to determine the cause of maternal deaths.

3 Research Question and Hypothesis

This study looks at trends in the relationship between teenage pregnancy and maternal deaths in Burundi from 2017 to 2022. Does teenage pregnancy have any bearing on the death of mothers? This is the main area of inquiry.

This research will add to the amount of data showing whether treating teenage pregnancies can lower the rate of maternal death.

In this study, the research question will serve as the basis for testing the following hypothesis:

– There is no discernible relationship between teenage pregnancy and maternal death.

4 Data Description

Our data set comprises monthly observations on maternal death and teenage pregnancy for different municipalities in Burundi : Bubanza, Bujumbura, Bujumbura-Mairie, Bururi, Cankuzo, Cibitoke, Gitega, Karusi, Kayanza, Kirundo, Makamba, Muramvya, Muyinga, Mwaro, Ngozi, Rumonge, Rutana and Ruyigi. We will use data from 2017 to 2022, data are collected from $DHIS_2$.

5 Methodology

Poison distribution was used in the study to explain the relationship between the two variables. The strength of the association between the variables may also be shown using correlation analysis.

We're also going to do the following:

-Recap empirical data on the frequency and current patterns of teenage pregnancies and maternal fatalities.

-Over a five-year period, the evaluation examines correlations between teen pregnancy and maternal death using a descriptive and correlational methodology.

6 Results

The association between teenage pregnancy and maternal death is discussed in this section, along with a description of maternal death according to the number of health care facilities in each region.

The findings indicate that while maternal death reduced slightly from 318 in 2017 to 315 in 2022, the overall number of teen pregnancies climbed slightly over time, from 52446 in 2017 to 53604 in 2022.

In this section summary of descriptive statistics are represented in table 1 and table 2. Table 1 shows the data descriptive of pregnancy cases and table 2 the data descriptive of maternal death cases.

The mean is significantly different to zero for the pregnancy cases and the maternal death cases in the sample municipalities.

Table 1, the lowest standard deviation and close to the mean is noticed in Bururi (St.D of 3.25 close to mean 4.94) and Mwaro which means that the cases of early pregnancies are not evolving in an overstate way while in Muyinga it noticed that the evolution of the cases of pregnancies is very remarkable, the standard deviation is more spread out to the mean (St.D of 77.78 is more spread out to mean 458.88). Ngozi, Cibitoke, Kirundo and Ruyigi show also a remarkable a repetition of the events.

Table 2, the highest St.D and spread out to the mean is observed in Bujumbura, Bujumbura Mairie and Gitega which means that the evolution of the cases of maternal death is very remarkable while the lowest is observed in Makamba, Cankuzo, Kayanza and Rutana which means that the cases of maternal death are not evolving.

We also wanted to see whether pregnancy and mortality cases differ according to geographical position of the population. Table 1, indicates that throughout the entire period of study, northern region has registered higher rates of teen pregnancy compared to other regions. Table 2, indicate that regions with several health centers tend to have a higher incidence of maternal deaths.

Table 1: Descriptive statistics for pregnancy cases

municipalities	Mean	Med	Min	Max	St.D	Skewness	Kurtosis
Bubanza	233.11	227.0	151	392	45.04	0.91	1.09
Bujumbura	155.38	155.5	106	220	22.02	0.26	0.06
Bujumbura Mairie	274.82	263.5	179	408	44.82	0.60	0.12
Bururi	4.94	5.0	66	17	3.25	1.10	0.49
Cankuzo	176.43	175.0	106	287	39.73	0.41	-0.20
Cibitoke	347.08	346.0	252	579	53.48	1.12	3.31
Gitega	249.86	242.5	160	352	43.74	0.35	-0.52
Karusi	262.74	260.0	127	415	56.24	0.23	-0.01
Kayanza	185.46	185.0	124	249	26.91	0.16	-0.35
Kirundo	350.18	338.5	264	487	58.08	0.60	-0.44
Makamba	279.44	274.0	181	437	40.56	0.79	1.71
Muramvya	66.54	64.0	33	110	13.91	0.45	0.81
Muyinga	458.88	452.0	293	688	77.78	0.43	0.26
Mwaro	48.57	49.0	29	68	9.01	0.14	-0.61
Ngozi	343.83	337.5	253	509	44.17	0.67	1.25
Rumonge	178.14	169.5	99	323	36.60	1.14	2.17
Rutana	214.51	212.5	147	375	43.31	1.23	2.39
Ruyigi	342.64	339.5	215	480	57.31	-0.10	-0.27

Table 2: Descriptive statistics for death cases

municipalities	Mean	Med	Min	Max	St.D	Skewness	Kurtosis
Bubanza	1.14	1.0	0	5	1.29	1.1O	0.34
Bujumbura	0.76	0.5	0	8	3.51	0.26	15.23
Bujumbura Mairie	4.94	5	17	0	3.25	1.10	1.97
Bururi	0.58	0	0	4	0.88	1.74	2.92
Cankuzo	1.01	1	0	4	0.99	0.84	0.44
Cibitoke	1.26	1.0	0	6	1.11	1.29	3.01
Gitega	3.74	3	0	14	2.65	1.53	2.94
Karusi	0.97	1.0	0	4	1.02	0.92	0.35
Kayanza	1.18	1.0	0	5	1.20	1.00	0.47
Kirundo	0.93	1.0	0	4	1.00	0.98	0.60
Makamba	1.92	1.5	0	13	1.93	3.10	13.87
Muramvya	0.64	0.0	0	4	0.97	1.58	1.80
Muyinga	1.54	1.0	0	6	1.41	1.16	1.21
Mwaro	0.51	0.0	0	6	0.95	3.13	13.63
Ngozi	1.88	2.0	0	7	1.43	1.26	1.79
Rumonge	0.57	0.0	0	4	0.82	1.52	2.59
Rutana	0.85	1.0	0	3	0.83	0.57	-0.62
Ruyigi	1.85	1.0	0	8	1.77	1.23	1.28

7 Correlation analysis

The correlation between the maternal death and teenage pregnancy of each municipality have been calculated. Table 3 shows that in all municipalities tau is not equal to zero, which leads to the conclusion that teenage pregnancy has a positive significant relationship with maternal death. This implies that the higher the teenage pregnancy rate, the higher the number of women dying of pregnancy.

Table 3: Relationship between teenage pregnancy and maternal death cases

	Kendall tau		
municipalities	Z	p-value	tau
Bubanza	1.4048	0.1601	0.1263633
Bujumbura	0.059615	0.9525	0.005630088
Bujumbura Mairie	1.2136,	0.2249	0.114129
Bururi	-1.3241	0.1855	-0.1250211
Cankuzo	-0.31368	0.7538	-0.02860088
Cibitoke	1.7868	0.07397	0.1610464
Gitega	-0.87759	0.3802	-0.07498902
Karusi	-0.16498	0.869	-0.01499518
Kayanza	0.42798	0.6687	0.03852833
Kirundo	-1.5323	0.1255	-0.1399296
Makamba	-0.40886	0.682	-0.03618505
Muramvya	0.33944	0.7343	0.03186345
Muyinga	-0.1563	0.8758	-0.01382957
Mwaro	-0.52285	0.6011	-0.04994454
Ngozi	0.19754	0.8434	0.01753666
Rumonge	0.70149	0.483	0.06581084
Rutana	-0.79208	0.4283	-0.07301221
Ruyigi	0.33921	0.7344	0.02964349

Analyzing the dependence between teenage pregnancy and maternal death using a Poisson distribution in Burundi while considering the number of hospitals in different regions would involve a more nuanced approach. The results in Table 6 show positive and significant relationship, the p-value is less than 0.05, it is statistically significant. Numbers of pregnancy cases and health care center are important determinant of mortality cases.

Table 4: Zero inflated distribution death cases

	Poisson			
ZIP municipalities	Std Error	p-value	Std Error	p-value
Bubanza	0.002968	0.00352	0.03014	0.0966
Bujumbura	0.006644	0.572	0.01449	0.0442
Bujumbura Mairie	0.001237	0.0861	0.01396	0.0864
Bururi	0.01851	0.0566	0.05518	0.0736
Cankuzo	0.003407	0.0389	0.1143	0.0311
Cibitoke	0.1181	0.003067	0.8193	0.07299
Gitega	0.001447	0.0398	0.05255	0.05255
Karusi	0.0023527	0.0279	0.013411	0.0238
Kayanza	0.0049491	0.383	0.03191	0.0270
Kirundo	0.003680	0.0375	0.04833	0.0427
Makamba	0.002336	0.0747	0.07206	0.0143
Muramvya	0.01463	0.0194	0.05700	0.0248
Muyinga	0.0013923	0.0561	0.01342	0.0339
Mwaro	0.02650	0.0277	0.1260	0.214
Ngozi	0.08942	0.022	0.3882	0.0451
Rumonge	0.005645	0.01897	0.03329	0.0152
Rutana	-0.001040	0.0576	0.7349	0.0560
Ruyigi	0.001732	0.0194	0.01449	0.047

8 Discussion and conclusion

The results mentioned above have demonstrated that the circumstances and socioeconomic traits that influence adolescent childbearing vary. Adolescents in provincial towns where retail is the primary industry were more likely to become pregnant. The findings also show that regions with several health centers tend to have a higher incidence of maternal deaths. The risk of maternal death associated with teenage pregnancy may be increased by a number of factors, such as inadequate access to appropriate prenatal care, a higher likelihood of complications during childbirth, and socioeconomic issues that may limit access to healthcare facilities. Additionally, the relationship between teenage pregnancy and maternal death in Burundi is likely to be influenced by educational opportunities for teenage girls. In Burundi, where maternity healthcare facilities may be limited, teenage pregnancies may raise the risk of maternal death. The consequences for Burundi's healthcare infrastructure planning and public health policies. Determine whether areas have higher rates of teenage pregnancy and maternal death so that specific interventions, including better access to maternity care facilities and reproductive healthcare services, may be implemented there. Examining the connection between the number of hospitals in each town, maternal death, and teenage pregnancy. Find out whether there is any proof that these factors are correlated or dependent on one another. The results of this investigation also demonstrated a statistically significant positive correlation between teenage pregnancy and maternal death. This suggests a positive correlation between maternal death and teenage pregnancy. This implies that a decrease in the prevalence of teenage pregnancies will probably result in a decrease in death rates. maternal death might be positively impacted by family planning programs that purposefully target teenage pregnancy.

Future studies and data gathering initiatives should consider potential confounding variables including socioeconomic position, healthcare access, and cultural norms in order to fully investigate the intricate connection between teenage pregnancy, maternal death, and Burundi's healthcare system.

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