SPATIAL ANALYSIS OF ADOLESCENT PREGNANCY AND HIV INCIDENCE IN OHAOZARA, EBONYI STATE, NIGERIA

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Abstract

Despite the extensive interventions and research focused on adolescent pregnancy, there is a notable deficiency in the analysis of the spatial distribution of HIV among adolescent pregnant women in Nigeria. This study seeks to conduct a spatial analysis of adolescent pregnancy and HIV incidence in Ohaozara, Ebonyi State. The data encompassed age records, spatial attributes and HIV status of teenage pregnant women who visited antenatal clinics (ANCs) at primary health care facilities from 2018 to 2022. A total of 3,827 records of teenage mothers were analyzed. Similarly, a total of 692 teenage mothers who attended antenatal care were also sampled on the social-economic consequences of teenage pregnancy. Data were analyzed using prevalence rates, spatial autocorrelation, and hot spot analysis. The annual growth rate of teenage pregnancy was 1%, exhibiting a clustered pattern and prevalence rate of 0% to 39.73%. The hotspot areas of adolescent pregnancy were also identified. There was an estimated decrease of 44.1% in the incidence of HIV among teenage mothers for every quarter of the year. The study recommended that it is essential to educate and motivate parents and teenagers through seminars on the risks associated with adolescent sex.

Keywords: *HIV, Hotspot, Teenage Pregnancy and Primary Health Care.*

Introduction

Teenage pregnancy is defined as the condition in which a female under the age of 20 becomes pregnant (Shri et al., 2023; Stevens-Simon & White, 1991). This phenomenon is observed in both high-income (Bennetsen et al., 2024) and low- to middle-income socities (Noori et al., 2022), although the prevalence rates differ significantly (Brahmbhatt et al., 2014; Felix et al., 2021; Shri et al., 2023). In the context of sub-Saharan Africa, one of the primary risk factors linked to teenage pregnancy is the heightened vulnerability to Human Immunodeficiency Virus (HIV) (Essuman et al., 2024; Tilahun et al., 2024). While, the contraction of HIV may result from engaging in unprotected sexual practices, pregnancy itself serves as an additional indicator of adolescent involvement in such activities. Sub-Saharan Africa is notably the epicenter of the HIV epidemic, with over 20 million individuals affected (Payagala&Pozniak, 2024).

Evidence from sub-Saharan Africa indicates that 35% of pregnancies among 15–19 year olds were unplanned, unwanted, or untimed and that the teenagers' relationships were unstable (Hancock, 2012; Tilahun et al., 2024). Only about two-thirds of these unintended pregnancies end in childbirth, while a third results in unsafe abortions. The rate of unsafe abortions among adolescents in Nigeria is recorded at 106 per 1,000 births, which is considerably higher than that of other countries in Africa

(Bell et al., 2020; Brahmbhatt et al., 2014; Hancock, 2012; Okorie&Abayomi, 2019). Consequently, the increasing incidence of adolescent pregnancies in Nigeria remains a critical concern for the government and various stakeholders. Several studies have identified the predictors of unsafe sexual practices during the early adolescent years, such as individual, socio-demographic, poverty, cultural and family patterns of early sexual experience, and lack of school or career goals.

Several studies have argued that young school girls engage in sex with older partners and have transactional sex, whereby gifts or money are exchanged for sex (Hancock, 2012; Tilahun et al., 2024). Such relationships result in young women having little or no negotiating power with their partners to insist on condom usage, a situation that may result in a high risk of becoming pregnant and contracting sexually transmitted infections, including HIV. Adolescents having unprotected heterosexual intercourse are at risk of HIV infection and unwanted pregnancy. Several observational studies from Nigeria have reported that the incidence of HIV is higher among pregnant women than among the general population (Bell et al., 2020). A prospective study conducted in Nigeria found that HIV acquisition was higher among pregnant women than among either lactating women or non-pregnant and non-lactating women (Ike & Esther, 2022; Organization, 2004; Stevens-Simon & White, 1991). In light of the numerous interventions and research conducted on adolescent pregnancy, there remains a significant lack of analysis regarding the spatial distribution and accessibility of healthcare services for adolescent pregnant women in Nigeria, particularly in Ebonyi State. Ohaozara has previously been recognized as a hotspot for teenage pregnancy (Obeagu et al., 2023).

The application of Geographical Information Systems (GIS) in analyzing spatial distribution allows for the identification of hotspots of adolescent pregnancy and HIV incidences, which is also lacking in the study area. In addition, recognizing these hotspots will assist program designers and implementers in crafting context-specific and population-targeted interventions aimed at reducing adolescent pregnancy rates. Acknowledging this empirical deficiency, our study aims to provide a comprehensive spatial analysis of adolescent pregnancy and HIV incidence in Ohaozara, Ebonyi State, Nigeria. The decision to focus on spatial distribution and HIV incidence is driven by the need to pinpoint areas with a high prevalence of adolescent pregnancy within Ohaozara, Ebonyi State.

Materials and Methods

The Study Area

Ohaozara is situated between latitude 5^0, 51′ 32.1″ N to 6° 56′ 49″ N and longitude 7° 39′ 51″ E to 7° 50′ 50.652″ E (Figure 1).
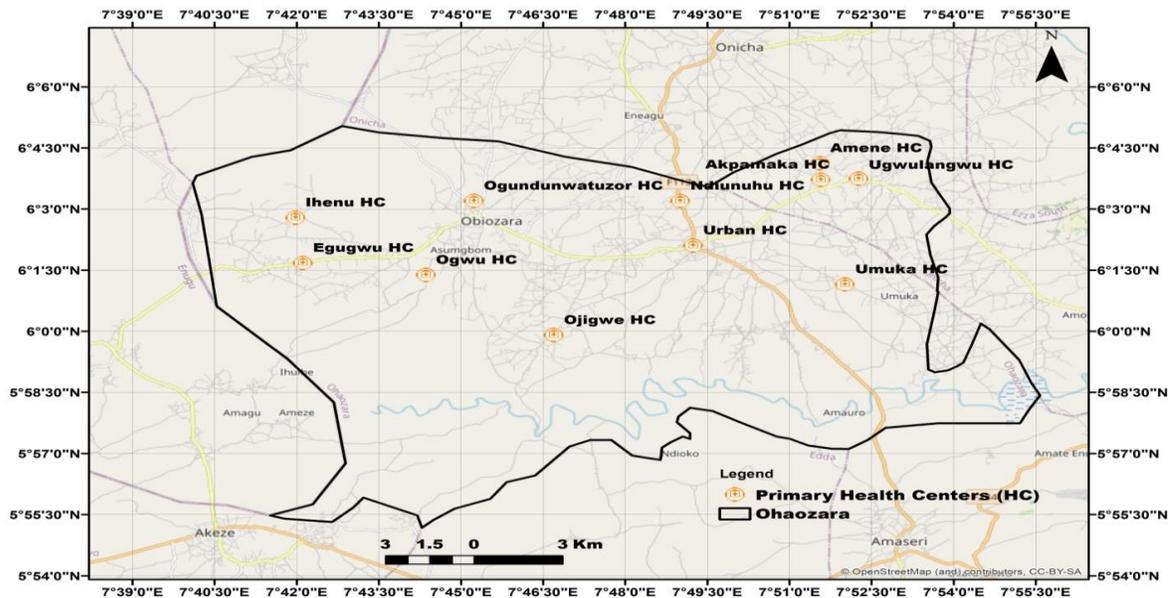
Figure 1: The Study Area
Source: GIS Lab, ABSU

The region spans approximately 296.72 square meters and has an estimated population of 148,317 residents (NPC, 2022). This area is comprised of nine autonomous communities, namely Ugwulangwu, MgbomUgwulangwu, Uburu, EtitiUburu, EwezeUburu, Okposi, OkposiOkwu, MgbomN'Echara, and EnuUburu. The average temperature ranges from 27°C to 28°C, with two main climatic seasons: the rainy season, which extends from April to October, and the dry season, which lasts from November to March. Relative humidity remains consistently high throughout the year, exhibiting significant variation between the rainy and dry seasons. The vegetation in the area consists of a mix of woodland and tall grass savannah, characterized by the presence of tall trees and grasses, as well as patches of rainforest, freshwater swamps, and mangrove ecosystems.

Data Sources

The data used in this study were sourced from the monitoring and evaluation department of the Ebonyi State Ministry of Health and the Nigerian Health Demographic Survey (NDHS). In order to obtain data from the Ministry of Health, a formal proposal of the study was drafted and submitted to the Commissioner of Health in Ebonyi State, who gave permission for the data to be released. The NDHS data is a nationally representative survey that collects information on men, women, and children. All the data collected included the age record and HIV status of teenage pregnant women who attended antenatal clinics (ANCs) in primary health care facilities in Ohaozara from 2018–2022. Records of 3,827 teenagers for the period between 2018 and 2022 were considered based on data availability. For the year 2022, a total of 692 teenage mothers who attended antenatal care were given a closed-ended structured questionnaire on the causes of social-economic consequences of teenage pregnancy and related health challenges. To ensure the confidentiality of the respondents, data collection was conducted exclusively by health workers from 11 health facilities in the study area. This included the distribution and retrieval of questionnaires. Additionally, geographic information, such as coordinates and elevation, of the healthcare facilities offering antenatal services in the study area was also gathered.

Statistical Analysis

The data generated for the study were analyzed using frequency analysis and compound annual growth rate to generate monthly and quarterly occurrences of teenage pregnancy and HIV. Furthermore, correlation analysis was utilized to evaluate the teenage pregnancy and the incidence of HIV among teenagers in Ohaozara correlation. The statistical analysis was carried out using Statistical Package for Social Sciences (SPSS) version 25.0.

Spatial Analysis

To investigate the spatial distribution of teenage pregnancy, a range of statistical software tools, such as Excel, and Stata 16, were utilized. The weighted frequency of the outcome variable, which pertains to the prevalence of adolescent pregnancy, was integrated with cluster number and geographic coordinate data, subsequently exported to ArcGIS 10.8 for spatial analysis (Bolarinwa et al. 2022). Additionally, an analysis of spatial autocorrelation was conducted to determine the presence of a clustering effect in adolescent pregnancy within Ohaozara. The results of this analysis provide the Global Moran's I value, Z-score, and P-value, which are essential for assessing whether the data exhibits dispersion, randomness, or clustering.

Hot Spot Analysis

The hot spot analysis was conducted using Getis_Ord or Gi* statistics to identify clusters in the incidence of teenage pregnancy in the study area. The equation is given as:

$$G_i^* = \frac{\sum_{j=1}^{n} w_{i,j} x_j - \bar{X} \sum_{j=1}^{n} w_{i,j}}{S \sqrt{\left[n \sum_{j=1}^{n} w_{i,j}^2 - \left(\sum_{j=1}^{n} w_{i,j} \right)^2 \right]}} \quad (1)$$

Xi represents the attribute data concerning teenage pregnancy; j and wij denote the spatial weight associated with the distribution of teenage pregnancies i and j, respectively, while n signifies the total count of teenage pregnancies.

Ethical Consideration

Ethical approval was granted by the health commissioner, Ebonyi State and the NDHS.

Results

Occurrence of Teenage Pregnancy and HIV in Ohaozara

From Table 1, it is evident that a total of 3,837 teenage mothers who were pregnant attended antinatal care in Ohaozara LGA over the five-year study period from January to December (2018-2022), with 308 testing positive for HIV. There was a consistent rise in the number of pregnant teenage mothers who tested HIV positive from 2018 to 2021, followed by a decline in the years 2021 to 2022. The year 2018 recorded the highest incidence of pregnant teenagers with HIV, whereas the year 2022 saw the lowest occurrence. Overall, there has been a notable decrease in the incidence of HIV in Ohaozara from 2020 to 2022, despite a continuous increase in the number of pregnant mothers.

Table 1: Monthly Occurrence of Teenage Pregnancy and HIV

Month	2018 Pregnant Teenagers	HIV	2019 Pregnant Teenagers	HIV	2020 Pregnant Teenagers	HIV	2021 Pregnant Teenagers	HIV	2022 Pregnant Teenagers	HIV
JAN	46	3	31	7	67	7	72	3	47	5
FEB	32	5	69	39	79	4	25	1	61	6
MAR	47	6	40	5	86	11	81	3	23	2
APR	41	5	38	6	119	5	147	7	48	5
MAY	34	6	66	6	72	3	52	2	62	4
JUNE	58	4	61	10	64	9	107	9	78	3
JUL	75	9	34	6	69	8	96	4	63	3
AGU	49	6	48	4	128	2	81	2	85	1
SEP	40	8	29	5	62	10	63	3	57	3
OCT	80	7	21	3	58	13	73	6	59	4
NOV	32	2	69	8	163	9	59	5	41	1
DEC	45	4	37	7	172	6	67	2	68	2
TOTAL	**579**	**65**	**504**	**70**	**1139**	**87**	**923**	**47**	**692**	**39**

Source: Authors Computation

Quarterly Occurrence of Teenage Pregnancy and HIV

At the quarterly level (Table 2) we observed a steady increase in the number of pregnant teenage mothers who tested HIV positive from the year 2018-2020 and a decrease in 2021-2022 respectively. Furthermore in 2018, the highest occurrence of teenage pregnant mothers and HIV took place in the third quarter of the year while in 2019 and 2021 the highest occurrence was in the second quarter of the year. In 2020 and 2022, the highest occurrence was recorded in the last and first quarter respectively. Generally, for the five years period of study, the second quarter of the year is observed to have recorded highest occurrence of teenage pregnancy and the incidence of HIV in Ohaozara.

Table 2: Quarterly Occurrence of Teenage Pregnancy and HIV

MONTH	2018 Pregnant Teenagers	HIV	2019 Pregnant Teenagers	HIV	2020 Pregnant Teenagers	HIV	2021 Pregnant Teenagers	HIV	2022 Pregnant Teenagers	HIV
JAN – MAR	125	14	101	15	232	22	178	7	131	13
APR – JUN	133	15	165	22	255	17	306	18	188	12
JUL – SEP	164	23	111	15	259	20	240	9	205	7
OCT – DEC	157	13	127	18	393	28	199	13	168	7
TOTAL	**579**	**65**	**504**	**70**	**1139**	**87**	**923**	**47**	**692**	**39**

Source: Authors Computation

Rate and Prevalence of Teenage Pregnancy in Ohaozara

The incidence of teenage pregnancy was analyzed utilizing the Compound Annual Growth Rate (CAGR). This metric calculates the average annual growth rate over the timeframe from 2018 to 2022. The research revealed that the annual growth rate of teenage pregnancy in Ohaozara during the five-year study period (2018 - 2022) is 1.004, indicating a yearly increase of 1%. Additionally, the study identified that the spatial prevalence of adolescent pregnancy in Ohaozara varied between 0% and 39.73% (Figure 2).
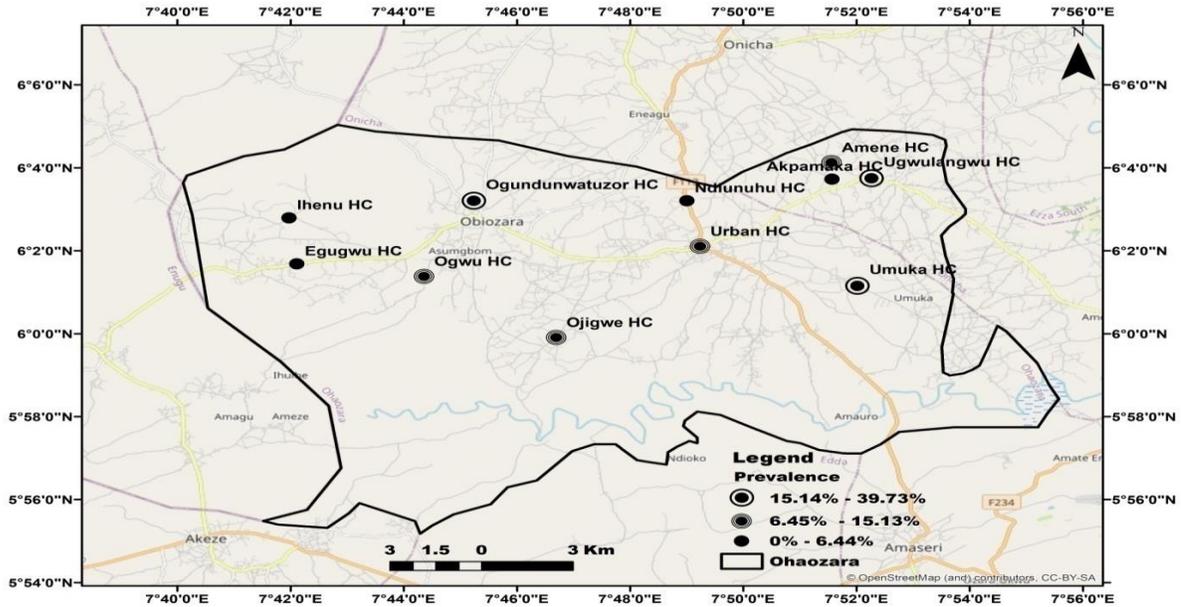
Figure 2: Prevalence of Adolescent Pregnancy
Source: GIS Lab, ABSU

Spatial Autocorrelation

The spatial autocorrelation of adolescent pregnancy was clustered in Ohaozara across all primary health care centers. The spatial autocorrelation analysis result revealed that Moran's I value of 0.116, Z-score of 13.47, and *p*-value < 0.001 indicated that adolescent pregnancy in Ohaozara was clustered (Table 3).
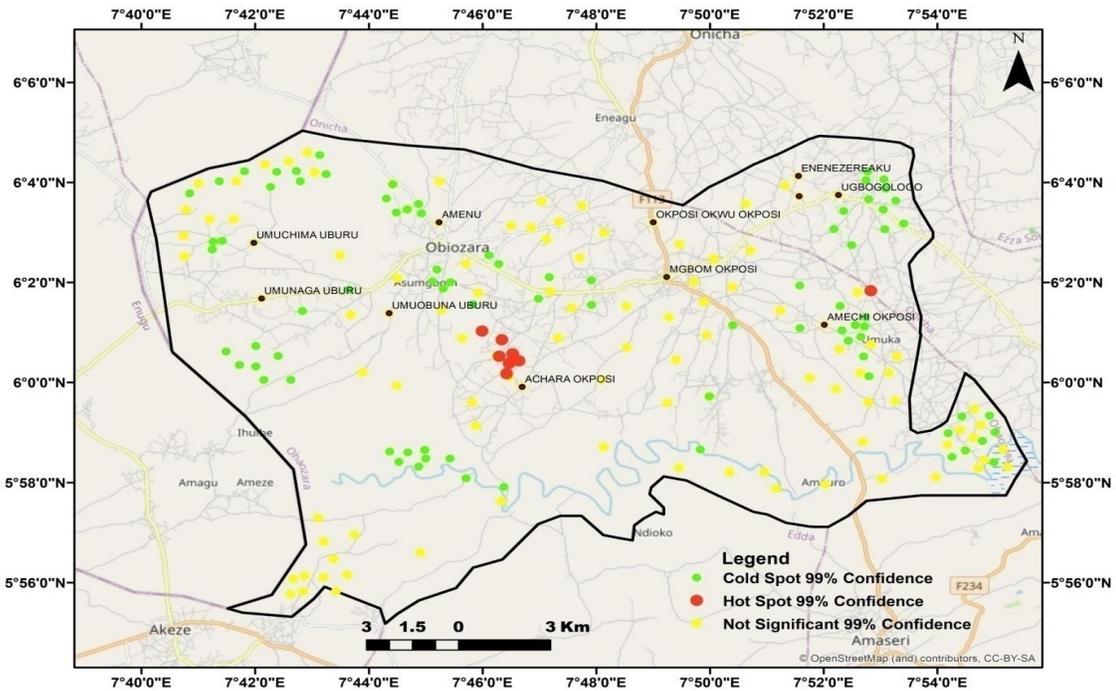
Table 3: Autocorrelation of Teenage Pregnancies in Ohaozara

Moran's I Value	Z-Score 13.47	*P*-Value
0.116	13.47	< 0.001

Source: Authors Computation

Hot Spot Analysis

Hot spot analysis was done using Getisord GI* analysis to detect hot and cold spot areas. Hot spot areas (high proportion of adolescent pregnancy) were located in AcharaOkposi, and AmechiOkposi (Figure 3).

Figure 3: Hot Spot Analysis of Adolescent Pregnancy in Ohaozra 2022
Source: GIS Lab, ABSU

Causes of Social-Economic Consequences of Teenage Pregnancy and Incidence of HIV in the Study Area

The socio-economic causes of teenage pregnancy and incidence of HIV in the study area are presented in Table 4 the findings indicate that the desire for wealth and material possessions was reported by 321 respondents, accounting for 53.5%. Sexual permissiveness in society was noted by 239 individuals, representing 39.8%. The promise of marriage from a boyfriend was mentioned by 246 respondents, or 41%. The absence of sexual education in schools was highlighted by 316 participants, equivalent to 52.2%. A lack of fear of God was reported by 307 individuals, making up 51.1%. Poverty was identified by 285 respondents, or 47.5%. Peer group influence was significant, with 403 respondents, representing 67.1%. Childhood sexual abuse was reported by 112 individuals, or 18.6%.

Table 4: Social-Economic Consequences of Teenage Pregnancy

Parameters	Frequency	Percentage (Based on the Checklist)
Sexual permissiveness	239	39.8
Promise of marriage from a boyfriend	246	41
Lack of fear of God	307	51.1
Poverty		
Peer group influence	285	47.5
Sexual abuse		
Desire for wealth	321	53.5
Absence of sexual education	316	52.2

Source: Authors Computation

The influx of pornography was noted by 312 respondents, accounting for 52%. Mass and social media influence was also significant, with 403 individuals, or 67.1%. Ignorance regarding safe periods for sexual activity was reported by 436 respondents, representing 72.6%. The least reported factors were lack of parental love at 23 respondents (3.8%) and rape at 27 respondents (4.5%). Early sexual experiences were noted by 87 individuals, or 14.5%.

The results indicate that the primary factor contributing to teenage pregnancy is ignorance of safe and unsafe periods for sexual activity, with a prevalence of 72.6%. This is closely followed by peer group influence and mass/social media impact, both at 67.1%. The least significant factors were identified as lack of parental love (3.8%) and rape (4.5%).

The analysis of the repercussions associated with teenage pregnancy indicates that a total of 289 respondents (48.1%) reported experiencing shame, while 243 (40.5%) faced discrimination. Additionally, a significant number, 451 respondents (75.1%), indicated that they had dropped out of school. The findings also revealed that 212 respondents (35.3%) had undergone abortion, 387 (64.5%) experienced poverty, 172 (28.6%) were affected by HIV, and 364 (60.6%) reported low self-esteem. Notably, school dropout emerged as the most prevalent consequence of teenage pregnancy in Ohaozara, impacting 75.1% of those surveyed, followed by poverty at 64.5% and low self-esteem at 60.6%. Conversely, the consequences of HIV and abortion were reported less frequently, at 28.6% and 35.3%, respectively.

Discussions

This research examined the spatial distribution and contributing factors related to adolescent pregnancy and HIV in Ohaozara, Nigeria, utilizing data from the Ebonyi State Ministry of Health and the Nigeria Demographic and Health Survey (NDHS) covering the years 2018 to 2022. The analysis revealed that the spatial prevalence of adolescent pregnancy in Ohaozara varied between 0% and 39.73%, with notable clusters identified in the Ojigwe, Ugwulangwu, Ogwunduwatuluzor, and Umuka communities. One potential explanation for this observation may be the high level of poverty, which may compel adolescents to engage in premarital sexual activities to fulfill their needs within the densely populated agrarian areas of Ohaozara (Alexander et al., 2007; Biddlecom et al., 2008; Brahmbhatt et al., 2014; Noroozi et al., 2014).

A potential contributing factor to this issue may be the limited educational opportunities available to adolescents in Ohaozara, which may lead to unrestrained sexual encounters with older men, ultimately resulting in unintended pregnancies (Stevenson et al., 1998; Yakubu&Salisu, 2018). Additionally, the prevalence of early marriage among adolescents could further diminish their ability to advocate for safer sexual practices, thereby heightening their risk of experiencing pregnancy during their teenage years (Stevenson et al., 1998).

Similar to the findings of Ahinkorah et al. (2021) and Baumgartner et al. (2009), this study also found that the likelihood of adolescent pregnancy in Ohaozara was high among those who had sexual debuts between 16 and 18 years. A credible explanation for this observation may be that adolescents at this stage encounter difficulties in meeting their fundamental needs, which may lead them to engage in sexual relationships with older men as a means of fulfilling those needs. It is also possible that their peers influenced adolescents who had their sexual debut between 15 and 20 years to engage in sexual relationships with elderly men to cater for their needs (Ayu et al., 2019; Harding, 2003). To reduce the effect of child marriage on adolescent pregnancy, there is a need for community

sensitization and education towards eliminating child marriage in Ohaozara. The finding on the working status and adolescent pregnancy implies that providing adolescents with employment could significantly reduce the rates of adolescent pregnancy and HIV.

Conclusion and Recommendations

The findings indicate that concerns regarding the increasing rates of HIV among adolescents in Ohaozara are misplaced. Although there has been a consistently high rate of teenage pregnancies over the years, data reveals a significant quarterly decline of 44.1% in HIV incidence among teenage mothers, alongside an estimated quarterly increase of 3.2% in the number of teenagers seeking HIV testing. This evidence implies that teenage pregnancy is not the primary contributor to the incidence of HIV among adolescents in Ohaozara. Additionally, it is essential to educate and motivate parents through seminars regarding the significance of addressing sexuality and the risks associated with premarital sex, particularly with respect to their daughters. Hence, the government and non-governmental organizations should also consider implementing the existing guidelines in line with what is recommended in this study because this will help reduce adolescent pregnancy in the study area.

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