A Principal Component Analysis of the Key Determinant Factors of Teenage Pregnancy: A Case of Secondary School Girls in Ndhiwa Sub-County, Kenya

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ABSTRACT

Teenage pregnancies occurrence and incidences vary significantly across different regions. High rates or low rates of adolescent pregnancies are often attributed to varying degrees of influence from several determinant factors. This study sought to identify key determinant factors of teenage pregnancy among secondary school girls in Ndhiwa sub-county using principal component analysis (PCA).Teenage pregnancy remain a significant challenge in many communities including Ndhiwa Sub-County where its prevalence threaten the education and future prospects of adolescent girls. Despite various intervention, the rate still remains high suggesting that deeper data driven insight required to identify key factors influencing it occurrence in the region. PCA is a statistical method that simplifies multivariate data by reducing variables while retaining essential information.In this study PCA was used to explore highly significant determinant factors of teen pregnancy among secondary school females in Ndhiwa Sub-county, specifically determining among 10 determinant factors namely, age of the teenager, peer pressure, family factor (poverty), lack of communication between daughter and parent, electronic media use, lack of contraceptive awareness, lack of knowledge on fertile period, lack of sex education, drugs and substance abuse, and early sex debut (pre-marital sex) which would significantly contribute to teenage pregnancy. The study was conducted in selected girls' secondary schools in Ndhiwa sub-county. This institutional-based cross-sectional study involved 379 participants selected through random and stratified sampling from a target population size of 7128 female students. Data was collected using a structured questionnaire with responses measured on a 5-point Likert scale. Statistical analyses including correlation analysis, descriptive statistics, and PCA were performed using SPSS version 25. The study found a 14.2% prevalence of teenage pregnancy among secondary school girls in Ndhiwa sub-county. Notably, peer pressure showed a strong positive correlation with premarital sex, suggesting predictive potential. PCA identified four principal components peer pressure, early sexual debut, substance abuse, and lack of communication between daughter and parent as crucial, explaining 51.13% of the determinant factors' variability**.** These findings can guide stakeholders and policymakers in developing targeted interventions to reduce teenage pregnancy rates among school-going girls.

Keywords: Teenage pregnancies, Determinant factors, Principal Component Analysis, Random and Stratified Sampling, Correlation Analysis,

INTRODUCTION

According to Njogu (2019) the term “teenage pregnancy” refers to pregnancies occurring in young girls aged 13 to 19. This issue is not a light matter, it is a serious matter as far as the global public health is concerned and is mostly common in regions with low economic status. World Health Organization (WHO) statistics show that about 16 million girls within ages 15-19 gives birth annually with sub-Saharan Africa shouldering the highest burden. The problem of adolescent pregnancy can be seen as an urgent issue of global public health because these conditions have severe lifelong consequences on both the teenagers’ own well-being and their children’s health. It goes without saying that the impacts of teenage pregnancies are enormous; they are not limited to increased risk for maternal mortality, infant mortality, low birth weight and developmental delays among offspring born to mothers who were teenagers at the time of delivery. This fact has become prominent not only in developed nations but also in developing countries around the world, emphasizing its profound social,

economic, and educational ramifications this according to the study done by (Mathewos & Mekuria, 2019). For instance, almost one third of adolescents become pregnant in Homa-bay county, Kenya given that this county has poverty rate standing at 22.7%; therefore, this situation aggravates the problem further leading to high numbers of teenage pregnancies. Ndhiwa Sub-County in Homa-bay, mirrors similar challenges and is plagued by alarming rates of teenage pregnancies as well.

The high rate of teenage pregnancy in Kenya is consequential, impacting on various aspects of social well-being for adolescent mothers and also recording poor performance in school as well as school dropout.

The challenges of teenage pregnancy are exacerbated by a combination of factors including insufficient sex education, family factors, early sexual activity, limited knowledge regarding use of contraceptives and social norms that promote early marriage and childbearing Kirby (2001). It is crucial that adolescent girls have full knowledge about their reproductive health. To tackle these issues harmoniously and most effectively government should prioritize efforts to ensure access to contraceptives among secondary school girls. By providing scientifically informed alternatives, tailored to address the key determinant factors prevalent in areas with high teenage pregnancy rates, would also be helpful to mitigate this pressing public health concern.

The immediate concern of teenage pregnancies registered in secondary schools within Ndhiwa Sub-County necessitates an urgent need for an in-depth inquiry into the influential factors leading to this occurrence. It is very necessary for a comprehensive study to be carried out on the causes of teen pregnancies with a view of averting the negative results such as school dropout and poor academic performance. A detailed understanding of these determinants will inform specific interventions that are capable of addressing the problem of teenage pregnancy thus enhancing good educational results and holistic community well-being.

There is no adequate Kenyan research that deals with the key determinant factors of teenage pregnancy based on regions. Despite various intervention, the teenage pregnancy rate still remains high suggesting that deeper data driven insight required to identify key factors influencing it occurrence in various the regions as evident by variation in prevalent by regions. Classifying these determinant factors of teenage pregnancy in order of their significant can be seen as an excellent tool to be used by policy makers when it comes to decision making by government on matters relating to teenage pregnancy of school going teenagers.

Principal Component Analysis is a statistical tool used for analysing multidimensional data, particularly in research that involves manipulating large numbers of attributes. PCA is a multivariate statistical method that reduces a data set's dimensionality while preserving as much of the variation present in the original data set. This is achieved by identifying patterns of correlation among the original variables and transforming them into a condensed set of linear combinations of correlated variables called principal components (PCs). This definition is based on the works of Pearson (1901) and Hotelling (1933).

PCA convert a set of p variables, X_1, X_2, …, Xp into p linear combination variables PC_1, PC_2, …, PCp (PC stand for principal component) in such way that most of the information in the original set of variables can be encapsulated in a reduced set of new variables.

These new variables are uncorrelated with one another. Represented as,

$$\mathbf{PC_1 = a_{11}X_1 + a_{12}X_2 + ... + a_{1j}X_j + ... + a_{1p}X_p}$$

$$\mathbf{PC_2 = a_{21}X_1 + a_{22}X_2 + ... + a_{2j}X_j + ... + a_{2p}X_p}$$

...

$$\mathbf{PC_i = a_{i1}X_1 + a_{i2}X_2 + ... + a_{ij}X_j + ... + a_{ip}X_p}$$

...

$$\mathbf{PC_p = a_{p1}X_1 + a_{p2}X_2 + ... + a_{pj}X_j + ... + a_{pp}X_p} \quad \text{..... (1)}$$

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where the a_{ij}'s are constants called PC coefficients.

Alternatively, according to Deshpande (2004), Yan (2009), Ionita and Schiopu (2010), Dogbegah, et. al. (2011), and Dinno (2012) PCA reduce the dimensionality of a dataset (x_{ks} '), by finding a new smaller ks set of variables ($y_{k's}$), from x_1, $x_2 \ldots x_k$ to produce k new variables y_1, $y_2 \ldots$, yk for the linearly combined system.

is represented as follows:

$$\mathbf{Y_1 = a_{11}X_1 + a_{12}X_2 + \ldots + a_{1k}X_k}$$

$$\mathbf{Y_2 = a_{21}X_1 + a_{22}X_2 + \ldots + a_{2k}X_k}$$

...

$$\mathbf{Y_k = a_{k1}X_1 + a_{k2}X_2 + \ldots + a_{kk}X_k}$$

Matrix form: Y = AX ……………………………………………………………………………(2)

The equation **(2)** above displays both the systems of equations and their equivalent matrix form to perform the PCA. The coefficients of the system are the a_{11} to a_{kk} and the matrix is 'A'. The coefficients of the system (**a_{11}** to **a_{kk}**) or matrix **'A'** are in linear combinations, mutual orthogonality and decrease in order of variance.

The ***$y_{k's}$*** must also be uncorrelated (orthogonal) so that **y_1** explains much of the first original variance, **y_2** explains the second and **y_k** explains the least. Therefore, to retain the needed number of principal components (PCs), it was recommended by Deshpande (2004) that we ignore either PCs that offer little increase in the total variance, or whose variance explained is less than 5% in a correlation matrix or whose variances lie asymptotically to the horizontal axis in the scree plot.

Furthermore Deshpande (2004), Yan (2009), Ionita and Schiopu (2010), Reiswich and Tompkins (2010), Ofori and Dampson (2011), Beaumont (2012) and Dinno (2012) explain that the KMO as a statistic test that indicates the degree of association of the variables. The value tests whether an initial hypothesis is an identity matrix.

The KMO statistic is mathematically defined as:

$$\mathbf{KMO = \Sigma\Sigma\, r^2_{ij} / (\Sigma\Sigma\, r^2_{ij} + \Sigma\Sigma\, u^2_{ij})} \ldots\ldots \mathbf{(3)}$$

Where:

r^2_{ij} represents the squared correlation coefficients between variables.

u^2_{ij} represents the squared partial correlation coefficients between variables.

The value of (3) varies between 0 and 1, and the minimum suggested range is should be greater than 0.5 KMO statistic is a proportion of variance among variables that might be common variance: varies from zero to one, in which zero is inadequate, while close to one is adequate.For the purpose of describing the determinant factors of teenage pregnancies, the Kaiser-Meyer-Olkin (KMO) value >0.5 is considered as first criteria to be satisfied for conducting factor analysis this according to Hair et al. (2006). Moreover, communalities value >0.5, and eigenvalues >1 is used to determine the number of components to be extracted for further analysis. Therefore, factor rotation using Varimax method with Kaiser Normalization is also used to facilitate interpretation as stated by Rencher (2003), providing simpler factor structure with high loadings on each determinant factor of teenage pregnancies. Highly weighted variables from each principal component (PC) are defined as the variables within the highest factor loading and retained in the data set as suggested by Kaiser (1974). The weighted variables are taken to be significantly correlated, and later other variables is considered to be redundant aand hence eliminated from the PCs. Among the significantly correlated variables remaining in the PC, the variable with the highest sum of correlation coefficients is chosen to be part of the principal components (PCs).

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Also, Beaumont (2012) states that Bartlett's test compares the observed correlation 'A' to the identity matrices of the null hypothesis H such that:

$$H_0 : A = \text{diag}(\sigma_{11}, \sigma_{22}, \ldots, \sigma_{kk}) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(4)$$

If the result in (4) identity matrix (independent), only one factor is sufficient and there would be no point extracting PCs. Bartlett's test compares the observed correlation matrix to the identity matrix (off-diagonal is zero). If they are similar, it will be necessary as many factors as variables, and the analysis is useless. However, if it is orthogonal, we need as many factors as possible to generate the PCs. Yan (2009) hints that the Bartlett's test tends to always be statistically significant when the number of factors increases. Overall, KMO values above 0.50 and $p < 0.05$ for Bartlett's sphericity test are considered acceptable. So, one need to support it with the correlation matrix tests of significances. Deshpande (2004) and Beaumont (2012) specify correlation matrix tests of significances of the coefficients (**r_{ks}**) for the sample correlation matrix (A) of the **k^{th}** row and **j^{th} column** as follows:

$$A = \begin{bmatrix} 1 & r_{12} & \ldots & r_{1k} \\ r_{21} & 1 & \ldots & r_{2k} \\ \ldots & \ldots & 1 & \ldots \\ r_{k1} & r_{k2} & \ldots & 1 \end{bmatrix}$$

……..(5)

The **r_{ks}** in (5) above cannot all be zeros throughout (uncorrelated) in the PCA analysis. The conclusion is that at 5% level of significance, all the p-values must be less than 0 or over 50% of them in **'A'** are less than **0**. Test of Significance of the Scree Plots gives an excellent pictorial test for the extracted PCs is the scree plot. The scree plot is defined as the plot of the eigenvalue versus the PCs this according to Dinno (2012).

The eigen equation is given by;

$$AX = \lambda X$$

……(6)

The eigen-analysis involves using equation (6) where the scalar represents the eigenvalue, and the vector, X represents the eigenvector. According to Holand (2008), the eigenvalues correspond to the variances explained by each PC and decrease monotonically. Harris (2001) and Yan (2009) define the PCs as the product of the original data (A) and the eigenvectors (X). This algorithm reduces n-dimensional data to n-k dimensions after a specified number of iterations on 'A'.

The first eigenvector is associated with the largest eigenvalue, while the least is associated with the last k^{th} PC. This means that most of the variance is concentrated in the first few PCs, allowing us to drop the last PCs without losing much information. Rencher (2003) suggests using the Varimax rotation with Kaiser Normalization to the retained factors, ensuring that they are uncorrelated and do not deviate from normality due to outliers or nonlinearity.

Statement of the problem

Teenage pregnancy represents a critical public health challenge with far-reaching implications for the well-being of adolescent girls, educational outcomes, their families, and broader community welfare. In Kenya, the prevalence of teenage pregnancy not only compromises the social welfare of adolescent mothers but also undermines academic performance, leading to increased rates of school dropout. Despite concerted efforts to address this issue, teenage pregnancy persists as a significant concern, mostly in developing countries such as Kenya. Consequently, there is an urgent need to identify the main determinant factors contributing to teenage

pregnancy within specific regions to inform the development of targeted interventions aimed at prevention and reduction.

While previous studies have endeavoured to identify determinant factors of teenage pregnancy in Kenya and other developing nations, these efforts have largely focused on general determinants without delineating the key factors among them. This study sought to address this gap by employing Principal Component Analysis to discern the main determinant factors among secondary school girls in Ndhiwa Sub-County, Kenya. PCA would uncover the key determinant factors by leveraging statistical technique aiming at beyond anecdotal evidence and give data driven solution that can inform policy making programs. The central problem thus revolved around uncovering the key factors driving the heightened incidence of teenage pregnancy in the region and subsequently ranking these factors according to their significance.

Aim and objectives of the study

The primary objective of this research is to apply principal component analysis to identify key determinant factors of teenage pregnancy among secondary school girls in Ndhiwa Sub-County, Kenya. Specifically, this study aims to:

i. To determine the prevalence of teenage pregnancy among secondary school girls in Ndhiwa sub-county, Kenya.

ii. To determine which of ten determinant factors contribute more to teenage pregnancy among secondary school in the Ndhiwa Sub- County.

iii. To determine whether there is significant correlation among ten determinant factors of teenage pregnancy within secondary school in Ndhiwa Sub-County.

Hypotheses of the study

The null hypotheses of the study are stated as follows:

$H0_1$: The prevalence of teenage pregnancy among secondary school girls in Ndhiwa Sub- County is not significantly different from national or global average.

$H0_2$: The PCA does not effectively identify key determinant factors of teenage pregnancy among secondary school girls in Ndhiwa sub-county, Kenya.

$H0_3$: There is no statistically significant correlation among the determinant factors of teenage pregnancy in Ndhiwa Sub- County.

LITERATURE REVIEW

The incidence of teenage pregnancy varies among regions across worldwide. Around 12 million girls aged 15–19 years and minimum 777,000 girls under 15 years give birth annually in developing regions (World Health Organisation [WHO],2020). Additionally, there are at least 10 million unintended pregnancies occur yearly among adolescent girls aged 15–19 years in the developing world. Teenage pregnancy is a worldwide, and a significant public health issue being predominant in sub-Saharan Africa and impacts both high- and low-income countries. About 14 to 15 million teenage girls are becoming mothers' yearly (Shaw,2009). This makes teenage pregnancy an agonising issue in the society because it affects education of girls significantly through poor performance and school dropout. Approximately 14 % of adolescent girls give birth before age 18 (United Nation Children's Fund [UNICEF],2021). Early pregnancy and childbirth have social ramification for girls such as stigmatization, diminished status in the family, violence and rejection by family members, and forced marriage. An estimated 13 million children are born worldwide annually to women under the age of 20, with over 90% of these births occur in Sub Saharan Africa, as indicated (Envulada, 2014). Worku et al. (2021) reported that the overall prevalence of teenage pregnancy in East Africa was 54.6%, with incidence rate range from 36.15% in Rwanda to 65.29% in Zimbabwe.

In relation to publication of Kenya Demographic and House Survey [KDHS] (2022) it was found that Fifteen percent of women age 15–19 had experienced pregnancy at some point of which 12% had a live birth and 1% had a pregnancy termination. The KDHS (2022) further revealed that the percentage of women aged 15–19 who had experienced pregnancy was highest in Samburu at 50%, it was lowest in Nyeri and Nyandarua both at 5% each. Notably Homa bay and Migori had 23 percent while regions like Siaya, Kajiado and Baringo had percentage between 20 and 22.

The occurrence of teenage pregnancy varies with regions indicating that there could be determinant factors of teenage pregnancy that is key to specific areas.

In line with Goicolea et al. (2009) various studies have identified different determinant factors of teenage pregnancy, including like not living with parents, early initiation of sexual intercourse, limited contraceptive literacy and low socioeconomic status. Mangatu et al. (2019) commented that lack of sex education, cultural factors and poverty factors have influence on teenage pregnancy. Ayele et al. (2018) delineate that the factors linked to adolescent pregnancy in their study encompass lower family monthly income, marriage within the age 18 to19 year age bracket, lack of communication with parents regarding reproductive health matters, and maternal history of teenage pregnancy. These studies among many others do not conclusively identify the key determinant factors significantly contribute to teenage pregnancy in specific region.

Langat et al. (2024) highlighted the efforts government of Kenya has taken to reduce teenage pregnancy and its consequences including sex education, community mobilization against harmful traditional cultural practices like FGM, a national strategy for adolescent and youth reproductive health and a policy framework addressing youth and HIV/AIDS. Despite implementation of various interventions, teenage pregnancy continues to persist as public health issue and challenge in Kenya.

Since teenage pregnancy is believed to vary in presentation from one region to another, it is important to gain knowledge on what key determinant factors significantly contributes to teenage pregnancy in specific region especially in areas with high prevalence like Homa bay county, Kenya with focus to secondary school girls where we have greatest number of teenage girls.

PCA is frequently used to diminish the dimensionality of datasets, containing large number of variables. In order to do this, large set of variables is transformed into a smaller number of uncorrelated variables, known as principal components.

In their study titled "Application of Principal Component Analysis on Perceived Barriers to Youth Entrepreneurship," Alice and Joseph (September 5, 2020) utilized a 5-point Likert scale to gauge responses. Findings revealed that youth identified lack of skill, lack of capital, lack of support, risk and lack of market opportunities as the primary barriers to youth entrepreneurship. The PCA analysis discovered 9 variables with Eigenvalues greater than one, and accounted 73.35% of the variation.

Ljubicic et al. (2021) used Principal component analysis to construct initial PCA models using hormone parameters showed in sex- and age-adjusted standard deviation (SD) scores. This approach was employed to effectively characterize the collective 'endocrine profiles' of patients diagnosed with classical and non-classical Congenital Adrenal Hyperplasia (CAH).

In their research paper, Iezzoni and Pritts (1991) explain that horticultural researchers often need to measure complex traits, which are made up of multiple individual traits that vary together. Identifying a single variable to represent the complex trait may not be possible, so researchers often need to analyse many related variables separately. This can result in a large number of separate analyses. To address this issue, PCA was used to discover patterns in the data set and reduce redundancy in univariate analyses. PC analysis essentially condensed correlated variables into smaller components of the original variables.

Muangthong, Somphinith, and Yamoat (2018) undertook a study aimed at identifying the primary factors influencing the quality of the Lower Songkhram Wetland (LSW) in Thailand. Utilizing data from diverse sources, they applied PCA for analysis. The findings unveiled 7 distinct groups of factors impacting the wetland quality, encompassing the community's economic aspects, community participation and awareness,

shifts in the country's economic system, water conservation efforts, community policies and community planning and coordination.

Research Gap

The gap in these studies was, there is no attempt to discover the highly significant determinant factor of teenage pregnancy as well no research study has applied principal component analysis on issues related to teenage pregnancies. Determinant factors of teenage pregnancy are believed to be multifactorial. Principal component Analysis therefore can be used to explore highly significant determinant factors of teenage pregnancy among the multiple factors. This due to dimension reduction nature of the PCA. The Varimax rotation, Kaiser Normalization an aspect of PCA simplify the factors enhancing interpretability by maximizing the sum of squared loading variance yielding the low or high factor loadings for attributes. This process ensures the residual components will have eigenvalues greater than one (Stephens,1996).

Materials: Conceptual Frameworks

A conceptual framework is a representation of relationship between variables in the study using a diagram as defined by Mugenda and Mugenda (2003). Independent variables exert influence on the dependent variables, while a dependent variable is a criterion that can be predicted or explained. Independent variables in the study comprised of: age of the teenager, peer pressure, family factor (poverty), lack of communication between daughter and parent, lack of knowledge on fertile period, drugs and substance abuse, lack of contraceptive awareness, electronic media use, lack of sex education, and early sex debut/activities (pre-marital sex) whereas the dependent variable was teenage pregnancy among Secondary School girls in this study.

METHODOLOGY

Location of the study

The study was carried out in Ndhiwa Sub-County situated in Homa-Bay County, Kenya. It is bordered by Suba, Homa Bay Town and Rongo Sub- County in Migori county. It has a population of 218,136 persons and it covers an area of 713.5 square kilometres. The main tribe in the area are Luos with few other tribes within towns in the area. It has seven wards. The major river in Ndhiwa Sub County is River Kuja and River Riana which flow throughout the year. It covers both urban and rural population. It has one among the largest town in the county, that is Ndhiwa town. The major economic activity in Ndhiwa is farming especially Sugarcane and Maize. The area is chosen because of its close proximity to the researcher, being that it has schools both in urban and rural where various determinant factors of teenage pregnancy have been witnessed.

Study area and population

The study population were secondary school girls aged 14 to 19 attending various schools in Ndhiwa Sub-County. These secondary schools are where girls are reported to be pregnant, have given birth at one point or are aware of the determinant factors of teenage pregnancy as reported by the Ministry OF Education.

Sample Size and Sampling Technique

Mugenda and Mugenda (2013) define sample as a subset of a target population whereas sampling entails the selection of some portion of an aggregates or totality on the basis of which an inference about the aggregate can be drawn (Kothari,2006). According to Tromp and Kombo (2004) a suitable sample size should be a representation of target population.

The sampling size was drawn from 48 secondary schools in Ndhiwa Sub-County, calculated using Taro Yamane's formula (Yamane, 1967).

$$n = N/[1 + N(e)^2] \quad \ldots\ldots (7)$$

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where;

N = 7128 (total population)

e = 0.05 (sampling error)

$$n = 7128/ [1+7128(0.05^2)]$$

$$= 378.7460148778$$

$$\approx 379$$

The sample size was calculated to be approximately 379 of the participants

Sampling technique

The study utilized two stage sampling methods. Firstly, a simple random sampling technique was used to select the 10 schools from the 48 schools distributed across Ndhiwa sub-county then allocating probability proportional to the size of the selected school. The selected schools were considered as clusters due to assumption that they are homogenous in characteristics and a sample size for each school was determined from calculated sample size of 379.

Data collection Tool

A systematic questionnaire was made using Five-point Likert scale where 1 represented strongly disagree to 5 represented strongly agree to identify the highly significant determinant factors of teenage pregnancy among the 10 outlined variables. Close-ended queries were used to collect demographic information. It was made simple and brief in order not to be cumbersome to the respondents. The questionnaires were disseminated during break time or non-school hours and individually completed by each selected participant.

Data and statistical analysis

Questionnaires were assigned number code based on the school and the Form of the students. All information collected were coded. The data were subjected to correlation and principal components analysis using SPSS. Karl Pearson's correlation analysis resulted to correlation matrix of determinant factors of teenage attributes. The PCA reduced determinant factors of teenage pregnancy to a small set of linear combinations of themselves. To determine the number of final factors from the initial ones and to also facilitate interpretation of the results, Kaiser's criterion where (Eigenvalue >1) was utilized while the factors were orthogonally rotated according to the 'varimax' method as stated by Massart et al. (1988).

Ethical Consideration

Given the nature of this project, approval was obtained from Ndhiwa Sub-County Education Office. Ethical considerations were meticulously followed, with respect, courtesy, and confidentiality maintained throughout all interactions with participants. Informed consent was obtained and well documented, ensuring clear communication regarding the research's aims and methodologies. Anonymity of participants was safeguarded during and after the research, and consent was explicitly requested for questionnaire administration. To protect participants' privacy, each individual was assigned a unique serial number.

Data analysis

The collected data were analysed using descriptive statistical methods, correlation analysis and Principal component analysis. Objective (i) was achieved using descriptive statistics such as frequencies and percentages. Objective (ii) was achieved using principal component analysis and descriptive statistics. While objective (iii) was achieved using correlation analysis.

Measurement of variable

Demographic characteristics and pregnancy status

i. Age: Respondents were asked to indicate their chronological age in years.
ii. School grade: level of respondents was measured by nominal value by ticking where appropriate, Form 4 [ ] Form 3 [ ] Form 2 [ ] Form 1 [ ].
iii. Type of School; Type of school was selected by ticking where appropriate, Mixed day [ ] Pure Boarding [ ] Mixed day and Boarding [ ].
iv. Prevalence of pregnancy: Respondents were asked the question, have you ever been Pregnant? The respondent selected where appropriate by selecting NO [ ] or YES [ ].
v. Age at which pregnancy occurred: The response here depended on response (V) If yes, at what age, they were to specify.

Determinant factors of teenage pregnancy

The participants' responses to the determinant factors of teenage pregnancy were assessed using a five-point Likert scale. The scale was coded as Strongly Disagree (1), Disagree (2), Neutral (3), Agree (4) and Strongly Agree (5).

RESULTS AND DISCUSSION

Participants' demographic profile

This section provides an overview of the demographic profile of the respondents derived from the data that were collected from questionnaire administered to 379 respondents who were sampled from 10 schools in Ndhiwa sub county. The information contained here includes the key responses of the teenage female students on their age, type of school, school grade and pregnancy status. The median age of the respondents was 17.00 while their mean age stood at 16.57 as indicated in **Table 1**

Table 1 Demographic Profile of Respondents

Characteristics	Category	N	Percent
Age	14	20	5.3
	15	52	13.7
	16	96	25.3
	17	133	35.1
	18	58	15.3
	19	20	5.3
Type of school	Mixed Day	64	16.9
	Mixed Day & Boarding	236	62.3
	Pure Day and Boarding	79	20.8
Pregnancy status	No	325	85.6
	Yes	54	14.2

Prevalence of teenage pregnancy

The results show that the prevalence of teenage pregnancy among secondary school girls in Ndhiwa Sub-County is 14.2% compared to the national rate of 15% (Kenya Demographic and Health Survey, 2022) and the global prevalence of 13% (UNICEF, 2021). This indicates that Ndhiwa's teenage pregnancy prevalence is closely aligned with national trends but slightly higher than the global average. To determine whether this difference is statistically significant, a proportion test was conducted comparing the prevalence in Ndhiwa with national and global benchmarks.

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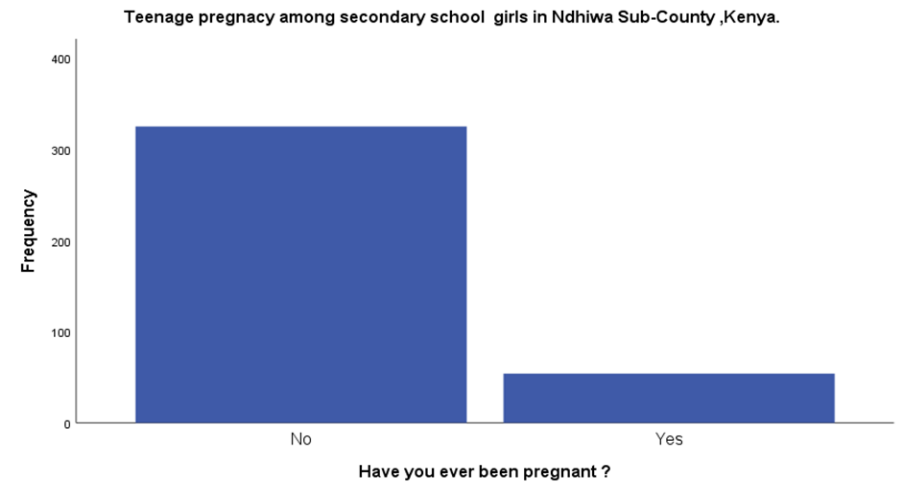
The statistical analysis revealed that the difference between Ndhiwa's prevalence and the national rate (15%) was not statistically significant ($p > 0.05$), indicating that teenage pregnancy in Ndhiwa follows the broader national trend. However, when compared to the global prevalence (13%), the difference approached significance ($p < 0.05$), suggesting that local determinant factors may contribute to slightly higher teenage pregnancy rates in this region. These findings align with previous studies indicating that rural and socio-economically disadvantaged regions often experience higher rates of teenage pregnancy due to factors such as poverty, limited access to contraceptives, and inadequate sex education (Mutua et al., 2020).Given these results Ndhiwa's teenage pregnancy rate is indeed concerning and hence calls for targeted interventions. Although the prevalence differs little from the national rate, it nevertheless highlights the necessity for improved reproductive health information, education and parent communication, and greater access to contraceptive services. Further studies should look into socio-cultural and economic determinants which might be responsible for disparities in teenage pregnancy rates seen between Ndhiwa and regions where lower prevalence has been recorded.

The mean age at which the pregnancy was reported in most of the teenagers was 15.60 , and median age for the same was 16.00. The finding of the study regarding the teenage pregnancy was obtained by asking the question "Have you ever been pregnant" The outcomes was represented in the bar graph as illustrated in the Figure 4.1. The analysis revealed that 54(14.2%) of the respondents were pregnant or having a child while 325 (85.6%) were never pregnant in their lifetime.

Figure 1



Descriptive analysis of determinant factors of teenage pregnancy

The descriptive statistics analysis includes the mean (M), standard deviation (SD), and percentage agreement (% of respondents who selected 4 or 5) to indicate the perceived influence of each determinant factor of teenage pregnancy among secondary school girls in Ndhiwa sub-county. **Table 2** presents the descriptive statistics for the ten determinant factors of teenage pregnancy among secondary school girls in Ndhiwa Sub-County.

The results indicate that lack of knowledge on the fertile period had the highest mean score (M = 3.61, SD = 1.415) and the highest percentage agreement (60.9%). This suggests that many adolescent girls engage in sexual activities without a clear understanding of their reproductive cycles, making them vulnerable to unintended pregnancies. Similarly, peer pressure (M = 3.59, SD = 1.504, 54.4%) emerged as a significant factor, highlighting the strong influence of social circles on adolescent decision-making regarding sexual activity.

Lack of open communication between daughters and parents (M = 3.40, SD = 1.566, 54.6%) significantly contributes to risky behaviours among teenagers, as reflected by the high level of agreement with this statement. Early exposure to sexuality through pre-marital sex and early sexual debut (M = 3.38, SD = 1.641,

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54.2%) were acknowledged as key factors, indicating that early exposure to sexual activity increases the likelihood of teenage pregnancy.

Economic factors also played a part too, as shown by family factor, poverty (M = 3.31, SD = 1.434, 52%). This suggests that financial hardship might push young girls into relationships that lead to early pregnancies. Drug and substance abuse (M = 3.30, SD = 1.546, 51.2%) and media exposure (M = 3.31, SD = 1.533, 51.4%) had moderate levels of agreement hinting at their possible role in shaping adolescent behavior.

Lack of sex education had a relatively high mean score (M = 3.85, SD = 1.396) although percentage agreement (38.6%) was lower than expected. This suggests that respondents recognize the importance of sex education however, they may not perceive its absence as the most direct cause of teenage pregnancy. In the same way, lack of contraceptive awareness and use (M = 3.11, SD = 1.473, 42.5%) received lower agreement, implying that while access to contraception is an issue, other factors may have a more significant impact.

Age of teenagers had the lowest mean score (M = 2.84, SD = 1.533) and the lowest percentage agreement (39.3%), indicating that respondents did not strongly perceive age as a primary determinant of teenage pregnancy.

Table 2 Descriptive statistics of determinant factors of teenage pregnancy Among Secondary girls in Ndhiwa Sub-County

Determinant Factor	**Mean**	**Std. Deviation**	**% Agreement (4 & 5)**
Age of Teenager	2.84	1.533	39.3
Drug and Substance Abuse	3.3	1.546	51.2
Electronic/Media use	3.01	1.541	43.5
Family Factor (Poverty)	3.31	1.434	52
Lack of Communication Between Daughter and Parent	3.40	1.566	54.6
Lack of Contraceptive Awareness and Use	3.11	1.473	42.5
Lack of Knowledge on Fertile Period	3.61	1.415	60.9
Lack of Sex Education	3.85	1.496	38.6
Peer Pressure	3.59	1.504	54.4
Pre-marital Sex/Early Sexual Debut	3.38	1.641	54.2

The findings indicate that gaps in knowledge about reproductive health, peer influences, and family dynamics are significant factors in teenage pregnancy. The strong consensus on lack of knowledge about the fertile period aligns with earlier studies showing that many adolescents do not receive comprehensive reproductive health education, leading to unintended pregnancies (WHO, 2023). This highlights the need of integrate accurate reproductive health education into school programs to empower young girls with the information necessary for making informed choices.

Peer pressure was also recognised as a major influencing factor, consistent with research highlight the impact of social influence risky behaviours among adolescent (UNICEF, 2022). Teenagers often succumb to peer expectations, engaging in early sexual activities due to fear of exclusion or desire for acceptance. Tackling this issue requires targeted interventions, such as mentorship programs and peer-led education, to encourage positive decision-making among youths.

Family communication was identified as another vital factor, with more than half of the respondents agreeing that inadequate parent-daughter communication contributes to teenage pregnancy. This finding supports the notion that open discussions between parents and their children about sexual and reproductive health can significantly lower teenage pregnancies (Mburu et al., 2021). Encouraging parents to have constructive conversations with their daughters could reduce the risks associated with misinformation and peer pressure.

Economic challenges also play a role, as indicated by the responses on poverty as a determinant factor of teenage pregnancy. Financial struggles lead young girls into relationships with older men who provide financial support in exchange for sexual favours (UNFPA, 2023). This ongoing cycle of economic

vulnerability and exploitation underscores the agent need for targeted social and economic initiatives that empower young girls through education and vocational training, reducing their dependence on risky relationships for financial survival. Interestingly, the levels of agreement regarding the lack of sex education and contraceptive awareness were lower than anticipated. This indicates that while these issues are significant, other social and economic factors might have a more immediate effect on teenage pregnancy. Nonetheless, comprehensive sex education is still a crucial strategy for decreasing adolescent pregnancies by providing students with accurate information about reproductive health, contraception, and responsible decision-making.

The study also found that media influence and drug abuse were moderately linked to teenage pregnancy. Exposure to explicit content in digital media can shape how adolescents view relationships and sexuality, potentially leading to risky behaviours (Kibwage et al., 2022). Likewise, substance abuse can cloud judgment and heighten the risk of early sexual encounters. Tackling these issues necessitates a multi-faceted approach that includes parental guidance, media literacy programs, and community efforts to combat substance abuse among teenagers.

Correlation Analysis of determinant factors of teenage pregnancy

To examine the relationships among the ten determinant factors of teenage pregnancy in Ndhiwa sub-county, a Pearson correlation analysis was conducted. The results are presented in **Table 3** indicating varying degree of correlation. Overally, the correlations indicate a significant relationship between most of the variables at either 1% 0r 5% level of significance. Positive correlations are observed between majorities of determinant factors of considered. The correlation analysis reveals significant relationships among the determinant factors of teenage pregnancy. One of the strongest correlations was observed between peer pressure and early sexual debut ($r = .306$, $p < .01$), suggesting that peer influence plays a major role in early sexual activities. Drug abuse was also significantly correlated with pre-marital sex/earl sex debut ($r = .206$, $p < .01$) and peer pressure ($r = .188$, $p < .01$), indicating that drug abuse involvement is fuelled by peer pressure as well as a factor contributing to pre-marital sex in teenagers leading to early pregnancy in adolescents. Economic factors also played a role, as family factor, poverty correlated with pre-marital sex ($r = .158$, $p < .01$) and lack of contraceptive awareness ($r = .113$, $p < .01$), reinforcing the idea that financial limitations hinder access to reproductive health resources. Additionally, media exposure showed a positive correlation with Lack of communication Between Daughter and Parent ($r = .15$, $p < .01$) .However, the following relationships stand out for their lack of significant correlation: Age of teenager versus Family factor (poverty),Peer pressure versus Lack of communication between daughter and parent, Drug and substance abuse versus age of teenager ,Electronic/media use versus Lack of contraceptive awareness and use and Lack of contraceptive awareness and use versus lack of communication between daughter and parent From the correlation analysis result we dismiss the null hypothesis of no correlation at 1% or 5% significance. However, it's important to note that while the correlation coefficient quantifies the degree of variability between variables, it doesn't inherently imply a functional relationship between them. Furthermore, it doesn't demonstrate any causal link between the variables under consideration.

These findings suggest that addressing teenage pregnancy requires a multi-faceted approach, including improving parental communication, enhancing reproductive health education, and addressing economic barriers. Policies that promote media literacy, strengthen school-based sex education programs, and support socio-economic empowerment for vulnerable families could help mitigate teenage pregnancy in Ndhiwa Sub-County.

Table 3 Correlation matrix of determinant factors of teenage pregnancy among secondary school girls in Ndhiwa Sub-County

Variable	1	2	3	4	5	6	7	8	9	10
1. Age of Teenager	1									
2. Peer pressure	.079	1								
3. Pre-marital sex/Early sexual debut	.041	.306**	1							
4. Family Factor (Poverty)	-.016	.065	.158**	1						
5. Lack of Sex Education	.049	.081	.022	.088	1					

6. Lack of Contraceptive Awareness & Use	.034	.060	.059	.113*	.044	1				
7. Lack of communication Between Daughter and Parent	.067	-.055	.000	.087	.2**	-.029	1			
8. Lack of Knowledge on Fertile Period	.147**	.091	.018	.180**	.055	.030	.103*	1		
9. Drug and substance abuse	-.009	.188**	.206**	.151**	.036	.099	.045	.031	1	
10. Electronic/Media use	.020	.062	-.047	.087	.035	-.009	.15**	.057	.075	1

Note: *p < .05; **p < .01 (two-tailed test)*

Principal Component Analysis

Appropriateness of PCA

Consistency of the questions

The Cronbach Alpha serves as a statistical parameter for evaluating reliability and measuring internal consistency within data set which are expressed on Likert scale questions representing formative measures indicating causal factors for teenage pregnancies that are non-substitutable amongst themselves Hence, we evaluated our dataset utilizing a small Cronbach Alpha Value of 0.433. As cited by Diamantopoulos and Siguaw (2006) low Cronbach Alpha Values do not necessarily mean low reliability but rather imply low internal consistency may exist as well. Similarly, a high value for alpha doesn't imply that the measure is one-dimensional. Although Cronbach Test for Reliability has been used, there are some limitations due to nature of measurements in certain situations.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy

From the **Table 4** below the KMO value of 0.576 indicates that the inner associations among the variables show a good accuracy KMO's statistic being greater than 0.5, using factor division based on fundamental principles is considered okay. We should be confident that the sample selected is adequate and we may proceed with the principal components analysis.

Bartlett's Test of Sphericity

Bartlett's sphericity test as shown in **Table 4** provides a chi-square of 151.989 and degrees of freedom at 45 provided a p-value of 0.000, suggesting sufficient correlation among variables. This shows that the data collected on determinant factors of teenage among secondary school girls was appropriate for PCA.

The Kaiser-Meyer Olkin (KMO) and Bartlett's Test measure of sampling adequacy all show the appropriateness of Principal Components Analysis. Therefore, we reject the null hypothesis; The PCA effectively identify key determinant factors of teenage pregnancy among secondary school girls in Ndhiwa sub-county, Kenya.

Table 4 Bartlett's Test of Sphericity and KMO Measure of sampling aadequacy

KMO and Bartlett's Test		
KMO value.		.576
Bartlett's Test of Sphericity	Approximate Chi-Square	151.989
	Degree of freedom (df)	45
	Significance (sig)	.000

Communality Scores for Determinant Factors of Teenage Pregnancy

The communality, defined as the cumulative sum of the squared component loading up to the extracted number of components extracted is detailed in **Table 5.** It is observed that the communalities extracted for all variables 7 exceed 0.5 indicating the suitability of the factor analysis method for this investigation. Significantly,

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variables such as the teenager's age, peer pressure, and lack of contraceptive awareness and usage exhibit optimal representation within the common factor space.

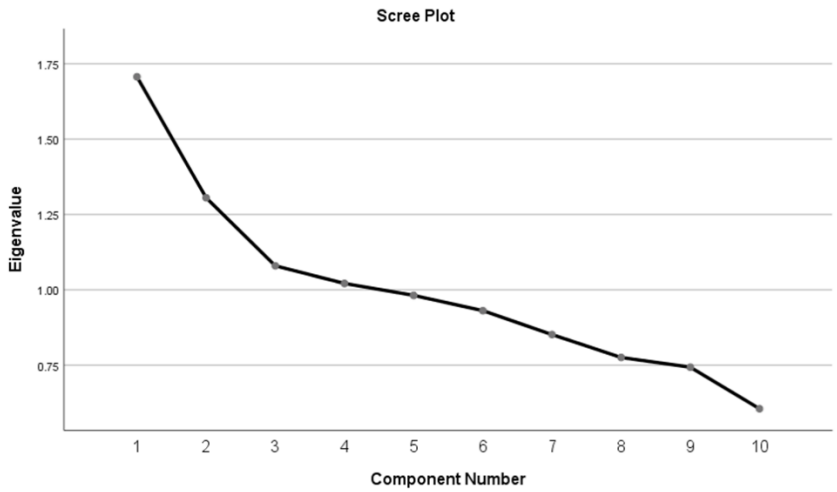
Table 5 Communality Scores for Determinant Factors of Teenage Pregnancy

COMMUNALITIES		
	Initial	Extraction
Age of Teenager	1.000	.673
Peer pressure	1.000	.612
Pre-marital sex/Early sexual debut	1.000	.563
Family Factor (Poverty)	1.000	.532
Lack of Sex Education	1.000	.216
Lack of Contraceptive Awareness and use	1.000	.597
Lack of Communication Between Daughter and Parent	1.000	.525
Lack of Knowledge on Fertile Period	1.000	.490
Drug and Substance Abuse	1.000	.455
Electronic/Media use	1.000	.449

Scree Plot Analysis

The scree plot analysis was performed to identify the optimal number of principal components (PCs) are to be retained in identifying the key determinant factors of teenage pregnancy. The scree plot is a graphical representation of eigenvalues plotted against the number of components, where the point of inflection, is commonly known as the “elbow”, pointing the number of components that adequately explain the variance in the dataset. As demonstrated in this study, the scree plot **Figure 2** shows that the first four eigenvalues decline while the rest remain just above zero, leading to the conclusion that only the first four components capture the most relevant patterns among the samples in the dataset, while the remaining components describe very little variance. This meets Kaiser’s criterion of keeping those components with eigenvalues larger than 1.0.

Figure 2



Number of Extracted principal components

Varimax is used to rotate components after they have been subjected to Principal Component Analysis. Varimax is the most commonly applied rotation technique in factor analysis carried out to extract items by factor loading coefficients that help identify the factor under which each item belongs. Based on the eigenvalue-one rule, as shown in **Table 6** and scree plot in **Figure 2**, we decide to retain the first four principal components (PCs). Taken together, these components account for an overall total of 51.13% of determinant factors’ variability on teenage pregnancy among secondary school girls in Ndhiwa Sub-County. These variables are preferred as such they are therefore taken into consideration when defining determinants of

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teenage pregnancy within this area. The analysis shows that the first factor accounts for around 17.07% of all variations while the second component is responsible for some 13.05% of variances in general and so on. Note that the components 5 through 10 with eigenvalues less than 1 were eliminated, although together they represent over 48.87% of the variance explained. However, any one of the components account for very little variance.

Table 6 Total variance explained by determinant factors of teenage pregnancy among secondary school girls.

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.707	17.070	17.070	1.480	14.796	14.796
2	1.305	13.054	30.123	1.298	12.984	27.780
3	1.080	10.795	40.919	1.177	11.765	39.545
4	1.021	10.210	51.129	1.158	11.584	51.129
5	.981	9.814	60.943			
6	.931	9.307	70.250			
7	.851	8.514	78.764			
8	.775	7.754	86.518			
9	.743	7.430	93.948			
10	.605	6.052	100.000			

Extracted principal components

The component matrix illustrates how each variable in the analysis correlates with the four extracted factors. Both positive and negative correlations are considered equally significant. Factor loadings represent the correlation between each factor and the standardized variable score. Typically, a variable loads strongly onto one factor while showing lower correlations with others. To determine the variables associated with each factor, the highest loading value in each row is selected, ensuring that each variable is assigned to the most relevant factor.

Table7 Rotated Component Matrix for the Determinant Factors of Teenage Pregnancy Among Secondary School Girls

Determinant Factor	PC1	PC2	PC3	PC 4
Peer pressure	0.756	-0.010	-0.073	0.187
Pre-marital sex/Early sexual debut	0.742	-0.074	0.080	0.033
Drug and Substance Abuse	0.556	0.195	0.247	-0.217
Lack of Communication Between Daughter and Parent	-0.101	0.707	0.003	0.121
Electronic/Media use	0.071	0.650	-0.079	-0.125
Lack of Sex Education	0.049	0.406	0.125	0.182
Lack of Contraceptive Awareness and use	0.010	-0.214	0.740	0.064
Family Factor (Poverty)	0.155	0.284	0.654	-0.008
Age of Teenager	0.080	-0.008	-0.135	0.805
Lack of Knowledge on Fertile Period	-0.010	0.204	0.298	0.599

In the results of the PCA as shown in the **Table 7** we see teenage pregnancy influenced by four key components, namely social and behavioural factors, parental and media factors, contraceptive awareness, biological and cognitive factors. **PC1** which accounts for the highest variance, consists of peer pressure (0.756), pre-marital sex/early sexual debut (0.742), and drug and substance abuse (0.556). These findings suggest that social interactions are crucial in shaping adolescent behavior, with peer influence playing a significant role in risky sexual practices. Additionally, the presence of drug and substance abuse suggest that impaired judgment from intoxication may increase the chances of engaging in unprotected sex.

PC2 emphasizes the importance of communication between parents and their daughters as well as the impact of media exposure. A lack of communication between parents and daughters (0.707) and electronic/media use (0.650) are identified as significant factors. This implies that families where parental guidance is limited, teenagers may turn to media for information, which can sometimes be misleading or promote risky sexual behaviours. Furthermore, the moderate loading for lack of sex education (0.406) suggests that while formal education on reproductive health plays a role, it is not the only factor at play, reinforcing the need for holistic learning that includes both parental guidance and structured educational programs in schools. **PC3** addresses knowledge gaps and economic factors, highlighting the significant impact of a lack of contraceptive awareness and poverty with loading factor 0.704 and 0.654 respectively. This indicates that teenagers from low-income families encounter dual challenge: limited access to reproductive health education and face financial barriers that hinder their ability to obtain contraceptives. The strong link between poverty and teenage pregnancy points to the socioeconomic aspects of the problem, suggesting that economic interventions may be essential to reduce its occurrence.

PC4 includes both biological and cognitive elements, with the age of teenagers (0.805) and lack of knowledge about the fertile period (0.599) being the most prominent factors. The high loading for age indicates that as teenagers matures, they are more inclined become more inclined to participate in sexual activities, increasing their risk of experiencing pregnancy. Moreover, the lack of understanding regarding the fertile period underscores the knowledge gap in reproductive health, potentially resulting in unintended pregnancies due to miscalculations or misconceptions about fertility.

CONCLUSIONS

The study empirically examined the key determinant factor of teenage pregnancy among secondary school girls. The subsequent findings stem from the analysis conducted using descriptive statistics, correlation analysis and PCA. This study demonstrates that teenage pregnancy in Ndhiwa Sub-County is influenced by multiple factors, which can be categorized into social and behavioural influences, parental and media influence, knowledge and contraceptive awareness, and biological and cognitive factors. The application of PCA has been instrumental in identifying the most critical determinants, allowing for a more focused approach to addressing the issue. The findings highlight peer pressure, pre-marital sex (early sex debut), drug and substance abuse and Lack of communication between daughter and parent as the key determinant factors of teenage pregnancy among secondary school girls in Ndhiwa Sub-County. Understanding these factors provides a foundation for developing targeted interventions that can effectively reduce teenage pregnancy rates among secondary school girls in Ndhiwa.

RECOMMENDATIONS

In this study much emphasis was given to identify the key determinant factors of teenage pregnancy among secondary school girls and by using principal components analysis approach; however, some areas and approaches remain uncovered. For future research studies, it is essential to broaden the analysis to a larger sample size including using teacher to provide information on pregnancy status of students that would be accurate if students were biased in their responses and consider additional factors that influence teenage pregnancy like culture, not explored in this study but documented in existing literature sources or use any other approach like exploratory factor analysis or confirmatory analysis approach to confirm consistent with this finding.

REFERENCES

1. Alice Constance Mensah, Joseph Dadzie (2020). Application of Principal Component Analysis on Perceived Barriers to Youth Entrepreneurship, American Journal of Theoretical and Applied Statistics. Volume 9, Issue 5, September 2020, pp. 201-209. doi: 10.11648/j.ajtas.20200905.13.
2. ASRH (2021). Adolescent Sexual and Reproductive Health Factsheet, Homa-bay County.
3. Ayele BG, Gebregzabher TG, Hailu TT, Assefa BA. Determinants of teenage pregnancy in Degua Tembien District, Tigray, Northern Ethiopia: A community-based case-control. PLoS One. 2018 Jul 25;13(7): e0200898. doi: 10.1371/journal.pone.0200898. PMID: PMCID: PMC605945

4. Beaumont, R. (2012). "An introduction to Principal Component Analysis & Factor Analysis" Using SPSS 19 and R.
5. Dede, B. N. (2019). Factors associated with teenage pregnancy in Riana division, Ndhiwa sub-county, Kenya (Doctoral dissertation).
6. Deshpande, A. (2004)." Data Dimension Reduction Techniques." Ohio: TechSolve, Inc[http://www.amitdeshpande.com/2008/04/introduction- toprincipalcomponent.html].
7. Diamantopoulos, A., & Siguaw, J. A. (2006). Formative Versus Reflective Indicators in Organizational Measure Development: A Comparison and Empirical Illustration. British Journal of Management, 17(4), 263–282. https://doi.org/10.1111/j.1467-8551.2006.00500.
8. Dinno, A. (2012). Gently Clarifying the Application of Horns, Parallel Analysis to Principal ComponentAnalysisVersusFactorAnalysis.Unpublished[doyenne.com/Software/files/PA_for_PCA_vs_FA.pdf].
9. Dogbegah, R, Owusu-Manu, D., and Omoteso, K. (2011). "A Principal Component Analysis of Project Management Competencies for the Ghanaian Construction Industry". Australasian Journal of Construction Economics and Building, 11 (1) pp.26-40.
10. Envulada, E., Agbo, H., and Ohize, V.A. (2014). Determinants and outcomes of teenage pregnancy in a rural community in Jos plateau state, Nigeria. Vol 1; 48 – 52.
11. Goicolea I, Wulff M, Öhman A and Sebastian M. (2009). Risk factors for pregnancy among adolescent girls in Ecuador's Amazon basin: Pan Am Journal Public Health; [PubMed] [Google Scholar]
12. H. Hotelling. (1933). Analysis of a complex of statistical attributes into principal components. Journal of Educational Psychology, 24, 417–441, and 498–520.
13. Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2006). Multivariate data analysis (6th ed.). Upper Saddle River, NJ: Pearson University Press.
14. Harris, R.J. (2001). A primer of multivariate statistics (3rd ed). Lawrence Erlbaum Associates, Inc, publishers (pdf)
15. Holand, S.M. (2008). "Principal Components Analysis (PCA)." Athens: Department of Geology, University of Georgia, Athens, GA 30602-2501 [strata.uga.edu/software/pdf/pca Tutorial.pdf].
16. Iezzoni, A. F., & Pritts, M. P. (1991). Applications of Principal Component Analysis to Horticultural Research, HortScienceHortSci, 26(4), 334-338. Retrieved Mar 22, 2023, from https://doi.org/10.21273/HORTSCI.26.4.334.
17. Ionita, I. and Schiopu, D. (2010). "Using Principal Component Analysis in Loan Granting." Romania: Petroleum - Gas University of Ploiesti[bmif.unde.ro/docs/pdf_final_10%20IIonita%20-%20final%202.pdf].
18. Karl Pearson. (1901). LIII. On lines and planes of closest fit to systems of points in space. Philosophical Magazine Series 1, 2, 559-572.
19. Kenya Demographics and Health Survey (2014), Teenage pregnancy in Kenya.
20. Kenya Demographic and Health Survey (2022). Key indicator survey. https://dhsprogram.com/pubs/pdf/PR143/PR143.pdf.
21. Kenya Demographic and Health Survey (KDHS) 2022:
22. Kenya National Bureau of Statistics. (2022). Kenya Demographic and Health Survey 2022. KNBS.
23. Kibwage, P., Njoroge, R., & Mutua, J. (2022). The influence of media exposure on adolescent sexual behavior in Kenya: A case study of secondary school students. African Journal of Social Sciences, 10(2), 45-63.
24. Kirby, D. (2001). Emerging answers: Research findings on programs to reduce teen pregnancy. Washington, DC: National Campaign to Prevent Teen Pregnancy.
25. Kothari, C.R. (2006). Research methodology: methods & techniques. (2nd ed.). New Delhi: New Age International (P) Limited Publishers.
26. Langat, E.C., Mohiddin, A., Kidere, F. et al. (2024). Challenges and opportunities for improving access to adolescent and youth sexual and reproductive health services and information in the coastal counties of Kenya: a qualitative study. BMC Public Health 24, 484. https://doi.org/10.1186/s12889-024-17999-9
27. Ljubicic Marie Lindhardt, Madsen Andre, Juul Anders, Almstrup Kristian and Johannsen Trine Holm (2021). The Application of Principal Component Analysis on Clinical and Biochemical Parameters

Exemplified in Children with Congenital Adrenal Hyperplasia. Frontiers in Endocrinology journal. Volume 12, dOI:10.3389/fendo.2021.652888.

28. Mang'atu, M., B. & Kisimbii, J. (2019). Factors Influencing Teenage Pregnancies in Kenyan Public Primary Schools: A Case of Kitui County Kenya, Journal of Entrepreneurship & Project Management, 3(4), 11-26
29. Massart, D. L., B.G.M. Vandeginste, S. N. Deming, Y. Michotte, and L. Kaufman. (1988) Chemometrics: A Textbook. Amsterdam. Elsevier.
30. Mathewos, S., & Mekuria, A. (2018). Teenage pregnancy and its associated factors among school adolescents of Arba Minch town, southern Ethiopia. Ethiopian journal of health sciences, 28(3), 287-298.
31. Mburu, C., Otieno, L., & Akinyi, P. (2021). Parental communication and adolescent sexual behavior in rural Kenya. Journal of Family Studies, 27(3), 212-230. https://doi.org/10.1080/13229400.2021.1875634
32. Muangthong, Somphinith & Yamoat, Nirat. (2018). Application of Principal Component Analysis Technique to the Socio-economic Factors in Quality of the Lower Songkhram Wetland, Thailand. Journal of Industrial Technology. 13.
33. Mugenda, O. & Mugenda, A. (2003). Research methods: quantitative and qualitative approaches. (1st ed.). Nairobi: African Centre for Technology Studies (ACTS)
34. Mutua et al. (2020) on Teenage Pregnancy in Kenya:
35. Mutua, M. M., Wawire, S., & Kabiru, C. W. (2020). Adolescent pregnancy and associated factors in Kenya: A systematic review. BMC Public Health, 20(1), 1-12.
36. Njogu, J. (2021). The effectiveness of comprehensive sex education in reducing teenage pregnancies in Kenyan schools. East African Journal of Education Studies, 19(4), 78-95.
37. Njogu, R. W. (2019). The Prevalence and Factors Associated with Teenage Pregnancy in Kenya; A Cross-Sectional Survey (Doctoral dissertation, University of Nairobi).
38. Ofori, R. and Dampson, D.G. (2011). Research Methods and Statistics using SPSS. Kumasi: Payless Publications Ltd, pp247-272.
39. Omondi, J., & Ochieng, W. (2020). The role of parental communication in preventing teenage pregnancies in Kenya. Journal of African Family Studies, 8(2), 33-50.
40. Reiswich, D. and Robert Tompkins, R. (2010). Potential PCA Interpretation Problems for the Dynamics of Financial Market Data [http://papers.ssrn.com/sol3/ papers. cfm? abstract_ id=1757221].
41. Rencher, A.C. (2003). Methods of Multivariate Analysis (2ed). New York: John Wiley and Sons Inc [tx.shu.edu.tw/~Purples Wool/Literature.pdf], pp380-407.
42. Shaw, D. (2009). Access to sexual and reproductive health for young people: Bridging the disconnect between rights and reality. International Journal of Gynecology and Obstetrics, 106: 132-136.
43. Stephens D. (1996). Hearing rehabilitation in a psychosocial framework. Scandinavian audiology. Supplementums, 43, 57–66.
44. UNICEF 2021 Global Teenage Pregnancy Report:
45. United Nations Children's Fund. (2021). Global status report on adolescent pregnancy and reproductive health. UNICEF.
46. United Nations Children's Fund (UNICEF). (2022). The impact of peer pressure on adolescent reproductive health choices. UNICEF Research Report. https://www.unicef.org/research/peer-pressure-2022
47. United Nations Population Fund (UNFPA). (2023). Poverty and teenage pregnancy: Breaking the cycle through education and economic empowerment. UNFPA Policy Brief. https://www.unfpa.org/poverty-teenage-pregnancy.
48. Were, M. (2007). Determinants of teenage pregnancies: The case of Busia District in Kenya. Economics & Human Biology, 5(2), 322-339.
49. Worku, M.G., Tessema, Z.T., Teshale, A.B. et al (2021). Prevalence and associated factors of adolescent pregnancy (15–19 years) in East Africa: a multilevel analysis. BMC Pregnancy Childbirth 21, 253.https://doi.org/10.1186/s12884-021-03713-9.
50. World Health Organization (WHO). (2023). Comprehensive sexuality education: A global review of best practices and policy recommendations. WHO Publications. https://www.who.int/sexuality-education-2023

ISSN No. 2454-6194 | DOI: 10.51584/IJRIAS |Volume X Issue VII July 2025

51. Yamane, T. (1967) Statistics: An Introductory Analysis. 2nd Edition, Harper and Row, New York.
52. Yan, X. (2009). Sofia tanagra Bartletts, sphericity test and the KMO index (Kaiser-Mayer-Olkin). Tanagra 7 Javier 2013: Didacticiel – Études de cas http://eric.univlyon2.fr/~ricco/tanagra/fichiers/en_Tanagra_KMO_Bartlett.pdf12.