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## ORIGINAL RESEARCH

### Absenteeism among In-School Adolescents in South-West, Nigeria using Probit Regression Model

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#### Abstract

**Background:** Adolescents face a lot of social and economic challenges and psychological well-being issues, resulting in absenteeism, leading to poor performance in school. Many studies have identified determinants of absenteeism through logistic regression models. However, other models are suitable to identify factors associated with a binary response variable like absenteeism.

**Objective:** To identify factors associated with absenteeism among in-school adolescents in Sagamu using a probit model.

**Methods:** Secondary data from a descriptive cross-sectional study carried out among a representative sample of adolescents attending public secondary schools in Sagamu Township were used. Logistic and Probit regression models were used to identify the factors associated with absenteeism. The residual deviance (RD), Akaike Information Criterion (AIC), and Bayesian Information Criterion (BIC) were criteria for model comparison.

**Results:** The RD (778, 778), AIC (806, 806) and BIC (876, 876) for both models were the same. There was no difference in the performance of the two models.

Age (17-19yrs;  $\beta=0.413$ ), Marital status ( $\beta=1.840$ ), consuming alcohol ( $\beta=1.015$ ), Poor comprehension ( $\beta=0.305$ ), and loneliness ( $\beta=0.231$ ) had positive significant associations with absenteeism ( $p<0.05$ ). Smoking ( $\beta=-0.548$ ,  $p=0.036$ ) had a negative significant association with absenteeism, while Sex, Mother's education and occupation, and living arrangement were not significantly associated with absenteeism.

**Conclusion:** The logistic regression and probit models performed the same way. Age, marital status, alcohol consumption, poor comprehension, loneliness and smoking were determinants of absenteeism. Parents and school administrators should pay attention to the psychosocial factors identified when designing interventions to significantly reduce absenteeism.

**Keywords:** Absenteeism, Determinants, In-school adolescents, Probit regression. Secondary school, Social

#### Introduction

Adolescents represent a significant proportion of Africa's population. Adolescents and young people aged 10-24

years make up about one-third of Nigeria's population.<sup>[1]</sup> Adolescents today face a lot of social, economic, and health challenges, including those related to their mental and psychological well-being. Adolescents in

sub-Saharan Africa are not exempted from the experiences of their peers all over the world. [2,3]

Absenteeism refers to a situation where a child records prolonged non-attendance in school. The effect of absenteeism on students' performance cannot be over-emphasized. Family involvement and settings, academic difficulties, health-related issues, available safe spaces in schools (friendly school community), and meeting the needs of students are very paramount for solving the problem of absenteeism. [4-6]

Student mental health in schools plays a vital role in students' performance, and this may result in being present or absent from school. About 42% of students in the United States feel hopeless or down often. However, about 29% experienced poor mental health, while not less than 20% of students aged 13-15 years had experienced or would experience severe mental condition. [7] In Spain, illness absences increased from about 12 to 22%, between 2000 and 2015, but remained at 3.5% in 2017- 2019. [8]

Absenteeism is not merely a student disadvantage; it has compounded societal consequences. Adolescents who are absent from school have been reported to be at higher risk of sexually transmitted infections, substance use, violence, unprotected sexual intercourse, having multiple partners, alcohol, and cigarette use. [9] It was also reported that school attendance among children and adolescents is the poorest in sub-Saharan Africa.

Some identified determinants of absenteeism in literature include social factors such as household size, income, educational status of parents or guardians, residential environment, living arrangements, sex, age, grade retention,

parental occupation, household-food-insecurity, breakfast consumption, current drinking, current smoking, depression, size-of-school, lack-of-sanitation-facilities, being obese, students'-performance, lack of parental support, poor peer support, and any form of bullying-involvement. [8,10-13]

In Northern Ghana, cultural restriction, girls from moderate - income parent(s) were significantly associated with odds of menstruation-related school absenteeism. [14]

Different Models have been used to identify the determinants of Absenteeism. A logistic regression model was used in some studies to analyze data on the Global School-based Student Health Survey (GSHS), 2018 of the World Health Organization (WHO) which identified being female amongst others as significantly associated with chronic school absenteeism. [15,16] A study in Scotland, used a linear regression model to show that absenteeism had a negative association with academic achievement. [17] Researchers in Madhya Pradesh, identified lower socioeconomic status, parental illiteracy, rural background, unskilled occupation, assisting the mother in the kitchen, and watching TV to be associated with frequent absenteeism using Chi-square test and logistic regression model. [18]

Despite the broad understanding of the significant negative effect of absenteeism on performance, the use of data on absenteeism by schools and states has received little guidance. [19] In studies involving two possible outcomes like yes/no, present/absent situations as found in absenteeism studies, regression models that are categorical in nature such as logistic and probit regression models are appropriate. Previous studies carried out in

developing countries including sub-Sahara Africa have utilized logistic regression models for identification of factors associated with absenteeism. [14,20, 21] It is noted that logistic regression model was commonly used to identify factors associated with school absenteeism in the previous studies, especially in Nigeria. The objective of this study was to look at the performance of Probit regression model on the identification of factors associated with absenteeism.

## Methods

This study made use of secondary data from a descriptive cross-sectional study carried out among a representative sample of adolescents attending public secondary schools in Sagamu Township. [22] The study area is an agglomeration of thirteen towns in southwestern Nigeria. It is located in Ogun State along the Ibu River and Eruwuru Stream between Lagos and Ibadan. It was founded in the mid-19th century by members of the Remo branch of the Yoruba people. Sagamu has experienced both population and economic growth since the 1950s, due to its position between the cities of Ibadan and Lagos. Sagamu is in a rainforest region, has a population of about 355,900, and occupies an area of 605.6 km<sup>2</sup>. Sagamu Local Government Area is made of fifteen political wards, which have one public primary school and a secondary school each. The schools are run by the respective heads (principals and head teachers) under the supervision of the zonal education officer.

### *Study variables*

The response or dependent variable (Y) for this study was Absenteeism (Yes or No); whether the student was absent from school for a particular period (1) or not (0). The explanatory or independent variables are: Age (X<sub>1</sub>), Gender (X<sub>2</sub>), Marital status (X<sub>3</sub>), Mother's educational (X<sub>4</sub>), Mother's occupation (X<sub>5</sub>), Living arrangement (X<sub>6</sub>), Consume alcohol (X<sub>7</sub>), Smoking (X<sub>8</sub>), Poor comprehension (X<sub>9</sub>), and felt lonely in the past 4 weeks (X<sub>10</sub>).

### *Data Analysis*

Statistical Package for Social Sciences, (SPSS) version 23 and the R programming package were used for the analysis. Probit and Logistic regression models were used to identify the factors associated with absenteeism. The Akaike Information Criterion (AIC), and Bayesian Information Criterion (BIC) were criteria for model comparison. The model that has the smaller values of the criteria was considered to be a better model.

Models for the study:

Logistic regression model

The outcomes are in log-odds.

$$E(Y|X) = P(Y = 1) = \log\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots \beta_k X_k \quad (1)$$

p represents the probability of occurrence of absenteeism.

Probit regression model

$$E(Y|X) = P(Y = 1) = \Phi(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots \beta_k X_k) \quad (2)$$

$$\pi = \Phi(\alpha + \beta X_i) \quad (3)$$

$\Phi$  = cumulative normal distribution function

Z- score = inverse normal distribution function

The Probit regression model outcomes are z-score units.

$$\Phi^{-1}(P(Y = 1)) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k \quad (4)$$

X's are explanatory variables and  $\beta_1, \beta_2, \beta_3, \dots, \beta_k$  are the regression coefficients for the model. Probit regression analysis estimates the probability of a binary response variable equal to 1 (as opposed to 0), which is dependent on some covariates or independent variables. It assumes that the probability of the dependent variable is a Cumulative distribution function of a normal distribution used to model the probability of the response or dependent variable. [23]

#### *Model Selection Criteria*

Criteria for data selection are:

Akaike Information Criteria (AIC):

Bayesian Information Criteria (BIC)

$$AIC = -2\log(L) + 2p \quad (5)$$

$$BIC = -2\log(L) + \log(n)p \quad (6)$$

Number of parameters in the model =p, total number of observations is n, while L= likelihood function. The model with smaller AIC or BIC gives the better model.

## **Results**

**Table I: Criteria for model comparison**

| Model    | RD     | AIC    | BIC    |
|----------|--------|--------|--------|
| Logistic | 777.91 | 805.91 | 875.91 |
| Probit   | 778.00 | 806.00 | 875.99 |

Table I shows the criteria used to determine better model out of the two. The residual deviance (RD), (778, 778); AIC (806, 806); BIC (876, 876) for logistic and Probit models are the same respectively. Therefore, the two models have performed the same way.

Table II shows the logistic regression results and factors associated with absenteeism. Being in the ages 14-16 increases the log odds of absenteeism by 0.205 (Z=0.60, p=0.546) compared with those with ages 11-13 years; there was no statistically significant association between the age group and absenteeism. Ages 17-19 years increase the log odds of absenteeism by 0.753 (Z=2.01, p=0.044), and was statistically significantly associated with each other. Gender ( $\beta=0.258$ , Z=1.35, p=0.178), marital status-single ( $\beta=0.238$ , Z=0.35, p=0.730), mother's education and occupation (p>0.05), and living arrangement ( $\beta=0.277$ , Z=1.44, p=0.150) were not statistically significantly associated with absenteeism. Marital status (others, but not single) increases the log odds of absenteeism by 3.069 (Z=2.76, p=0.006) compared with married, while alcoholic consumption (Z=4.42, p=0.000), poor comprehension (Z=2.86, p=0.004), and lonely in the past four weeks (Z=2.15, p=0.032) increase the log odds of absenteeism by 1.723, 0.582, and 0.441 respectively. They were all significantly associated with absenteeism. Cigarette smoking decreases the log odds by 0.906 (Z= -2.06, p=0.039).

Table II: Logistic Regression of factors of Absenteeism among in-school Adolescents

|                         | Estimate<br>( $\beta$ ) | Std-Error | Z-<br>value | Confidence<br>interval (95%) |       | p-value |
|-------------------------|-------------------------|-----------|-------------|------------------------------|-------|---------|
| Intercept               | -3.558                  | 0.96      | -3.72       | -5.60                        | -1.81 | 0.000*  |
| Age (yrs)               |                         |           |             |                              |       |         |
| 11- 13                  | ref.                    |           |             |                              |       |         |
| 14-16                   | 0.205                   | 0.34      | 0.60        | -0.43                        | 0.92  | 0.546   |
| 17-19                   | 0.753                   | 0.37      | 2.01        | 0.04                         | 1.52  | 0.044*  |
| Sex                     |                         |           |             |                              |       |         |
| Female                  | ref.                    |           |             |                              |       |         |
| Male                    | 0.258                   | 0.19      | 1.35        | -0.12                        | 0.64  | 0.178   |
| Marital Status          |                         |           |             |                              |       |         |
| Married                 | ref.                    |           |             |                              |       |         |
| Others                  | 3.069                   | 1.11      | 2.76        | 1.00                         | 5.48  | 0.006*  |
| Single                  | 0.238                   | 0.69      | 0.35        | -0.98                        | 1.79  | 0.730   |
| Mother's Education      |                         |           |             |                              |       |         |
| No formal education     | ref.                    |           |             |                              |       |         |
| Not tertiary            | 0.255                   | 0.57      | 0.45        | -0.75                        | 1.52  | 0.653   |
| Tertiary                | -0.164                  | 0.61      | -0.27       | -1.29                        | 1.17  | 0.789   |
| Mother's Occupation     |                         |           |             |                              |       |         |
| House-wife              | ref.                    |           |             |                              |       |         |
| Working                 | 0.048                   | 0.22      | 0.22        | -0.37                        | 0.49  | 0.827   |
| Living arrangement      |                         |           |             |                              |       |         |
| Both parents            | ref.                    |           |             |                              |       |         |
| Others                  | 0.277                   | 0.19      | 1.44        | -0.10                        | 0.65  | 0.150   |
| Consume Alcohol:        |                         |           |             |                              |       |         |
| No                      | ref.                    |           |             |                              |       |         |
| Yes                     | 1.723                   | 0.39      | 4.42        | 0.95                         | 2.49  | 0.000*  |
| Smoke Cigarettes:       |                         |           |             |                              |       |         |
| No                      | ref.                    |           |             |                              |       |         |
| Yes                     | -0.906                  | 0.44      | -2.06       | -1.78                        | -0.05 | 0.039*  |
| Poor comprehension:     |                         |           |             |                              |       |         |
| No                      | ref.                    |           |             |                              |       |         |
| Yes                     | 0.582                   | 0.20      | 2.86        | 0.19                         | 0.99  | 0.004*  |
| Lonely,past four weeks: |                         |           |             |                              |       |         |
| No                      | ref.                    |           |             |                              |       |         |
| Yes                     | 0.441                   | 0.21      | 2.15        | 0.03                         | 0.84  | 0.032*  |

\*Significant at 5%

The results of the Probit regression and factors associated with absenteeism are shown in Table III. Being in the ages 14-16 increases the z-score of absenteeism by 0.110 ( $Z=0.62$ ,  $p=0.537$ ) compared with those with ages 11-13 years. There was no statistically significant association between the age group and absenteeism; age group 17-19 years increases the z-score of

absenteeism by 0.413 ( $Z=2.07$ ,  $p=0.039$ ). There was a statistically significant association between the age group and absenteeism. Gender ( $\beta=0.145$ ,  $Z=1.41$ ,  $p=0.158$ ), marital status-single ( $\beta=0.144$ ,  $Z=0.38$ ,  $p=0.705$ ), mother's education and occupation ( $\beta=0.042$ ,  $Z=0.35$ ,  $p=0.726$ ), and living arrangement ( $\beta=0.143$ ,  $Z=1.40$ ,  $p=0.163$ ) were not statistically

significantly associated with absenteeism. Marital status (others, but not single) increases the z-score of absenteeism by 1.840 ( $Z=2.85$ ,  $p=0.004$ ) compared with married, while alcoholic consumption ( $Z=4.33$ ,  $p=0.000$ ), poor comprehension ( $Z=2.87$ ,  $p=0.004$ ), and lonely in the past four weeks ( $Z=2.04$ ,  $p=0.041$ ) increase the

z-score of absenteeism by 1.015, 0.305, and 0.231 respectively. They were all significantly associated with absenteeism. Cigarette smoking decreases the z-score by 0.548 ( $Z= -2.10$ ,  $p=0.036$ ), and had statistically significant association with absenteeism.

**Table III: Probit Regression of factors of absenteeism among in-school Adolescent**

|                          | Estimate<br>( $\beta$ ) | Std-Error | Z-<br>value | Confidence<br>interval (95%) |       | p-value |
|--------------------------|-------------------------|-----------|-------------|------------------------------|-------|---------|
| Intercept                | -2.058                  | 0.52      | -3.97       | -3.14                        | -1.07 | 0.000*  |
| Age (yrs)                |                         |           |             |                              |       |         |
| 11- 13                   | ref.                    |           |             |                              |       |         |
| 14-16                    | 0.110                   | 0.18      | 0.62        | -0.23                        | 0.47  | 0.537   |
| 17-19                    | 0.413                   | 0.20      | 2.07        | 0.03                         | 0.81  | 0.039*  |
| Sex                      |                         |           |             |                              |       |         |
| Female                   | ref.                    |           |             |                              |       |         |
| Male                     | 0.145                   | 0.10      | 1.41        | -0.06                        | 0.35  | 0.158   |
| Marital Status           |                         |           |             |                              |       |         |
| Married                  | ref.                    |           |             |                              |       |         |
| Others                   | 1.840                   | 0.65      | 2.85        | 0.59                         | 3.19  | 0.004*  |
| Single                   | 0.144                   | 0.38      | 0.38        | -0.56                        | 0.95  | 0.705   |
| Mother's Education       |                         |           |             |                              |       |         |
| No formal education      | ref.                    |           |             |                              |       |         |
| Not tertiary             | 0.170                   | 0.31      | 0.55        | -0.40                        | 0.82  | 0.580   |
| Tertiary                 | -0.065                  | 0.33      | -0.20       | -0.69                        | 0.62  | 0.844   |
| Mother's Occupation      |                         |           |             |                              |       |         |
| House-wife               | ref.                    |           |             |                              |       |         |
| Working                  | 0.042                   | 0.12      | 0.35        | -0.19                        | 0.28  | 0.726   |
| Living arrangement       |                         |           |             |                              |       |         |
| Both parents             | ref.                    |           |             |                              |       |         |
| Others                   | 0.143                   | 0.10      | 1.40        | -0.06                        | 0.34  | 0.163   |
| Consume Alcohol:         |                         |           |             |                              |       |         |
| No                       | ref.                    |           |             |                              |       |         |
| Yes                      | 1.015                   | 0.23      | 4.33        | 0.55                         | 1.48  | 0.000*  |
| Smoke Cigarettes:        |                         |           |             |                              |       |         |
| No                       | ref.                    |           |             |                              |       |         |
| Yes                      | -0.548                  | 0.26      | -2.10       | -1.07                        | -0.04 | 0.036*  |
| Poor comprehension:      |                         |           |             |                              |       |         |
| No                       | ref.                    |           |             |                              |       |         |
| Yes                      | 0.305                   | 0.11      | 2.87        | 0.10                         | 0.52  | 0.004*  |
| Lonely, past four weeks: |                         |           |             |                              |       |         |
| No                       | ref.                    |           |             |                              |       |         |
| Yes                      | 0.231                   | 0.11      | 2.04        | 0.01                         | 0.45  | 0.041*  |

\*Significant at 5%

## **Discussion**

This study has examined the performance of two models, namely, Logistic and Probit models. Adolescents aged 17–19 years demonstrated significantly higher levels of absenteeism compared to those aged 11–13 years. This disparity may be attributed to the greater independence often granted to older adolescents. The younger adolescents are often closely monitored by parents and guardians, which may enhance their school attendance. This is similar to previous studies where absenteeism increased for older children. [8,18,20,24]

Contrary to findings from studies conducted in some low and middle income countries, where being male was significantly associated with absenteeism, there was no association between gender and absenteeism in this study. [15-17] This however, is in conformity with a study from Saudi Arabia. [10] Researchers in the United States and Finland reported a significant increase in absenteeism among female participants. [8, 19] The observed difference between findings in this study and previously documented association between gender and absenteeism may be due to socio-cultural peculiarities. In Sagamu, there is no discrimination in child care practices based on gender. Male and female children have essentially equal opportunity.

Marital status, especially those who did not identify as single and were not officially married, was significantly associated with increase in absenteeism. Possibly, they co-habit with their partners,

which may eventually affect their life goals and commitment to academic pursuit.

They could have a false sense of freedom believing there is little or no need for regular school attendance.

There was no significant association between mother's education and absenteeism in this study. This finding contrasts with a study conducted in India, which reported that parental illiteracy was significantly associated with increased absenteeism. [19] Similarly, no significant association was found between mother's occupation and absenteeism, differing from findings in studies from Ethiopia and India, where parental occupation was reported to have a significant association with absenteeism. [11, 19] Living arrangement (whether with both parents or others) did not have a significant association with absenteeism, whereas previous studies from Spain and low to high income countries have shown that a significant association occurred between absenteeism and living arrangement. Absenteeism increased with a single parent than when the child had both parents, and also, when there was a lack of parental support. [17] Alcohol consumption and substance use are known to be detrimental to the wellbeing of adolescents and young person. In this study there was significant association between alcohol consumption and absenteeism, similar to the findings from previous study from Korea. [15] Contrary to previous studies cigarette smoking had negative association with absenteeism. [15,16] This seems to have a protective effect among participants. While this study does not report a causal

relationship, the reported association may be due to the existence of an enabling environment for cigarette smoking around the school. This may be an indication for a thorough assessment of the environment in public secondary schools.

Poor comprehension was another significant predictor of absenteeism in this study as was documented by other studies. A student who misses class activities, involving teacher-student interaction which would assist students to understand what is being taught, would automatically have poor understanding. Poor comprehension will make the student struggle with academics; hence, the student won't enjoy going to school. <sup>[10, 11, 15]</sup> It was also shown in this study that loneliness was a predictor of absenteeism. This corroborates previous findings on psychological predictors of absenteeism. <sup>[16,20,25,26]</sup>

The criteria for model selection have the same values for both models. This indicates that both models have performed equally in identifying factors associated with absenteeism. However, either of the two models could be used to identify predicting factors of absenteeism, or in any other situations where binary response variables occur.

*Strengths and Limitations:* The cross-sectional design utilized for this research makes it impossible to assess temporality and causation. Nevertheless, necessary inferential statistics have been calculated with appropriate interpretation of findings that contribute to existing body of evidence on absenteeism.

## Conclusion

Age, marital status, alcohol consumption, poor comprehension, loneliness and smoking were determinants of absenteeism

among respondents. The two models identified the same variables as predictors of absenteeism. This study has shown that logistic and Probit regression models have performed the same way. In order to reduce the problem of absenteeism in our schools, parents and school administrators should pay attention to the demographic and behavioural predictors of absenteeism. The government should consciously ensure the maintenance of a healthy psychosocial and physical school environment.

**Ethical Approval:** Approval for this research was obtained from the Ogun State Health Research Ethics Committee (HPRS/381/405).

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**Authors' Contributions:** KSO conceptualized the study, OOS and AAG collected data. KSO and OOS analysed the data. KSO, OOS and AAG drafted the manuscript. AAE and GJM read the manuscript for intellectual content. All authors approved the manuscript.

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