A MULTILEVEL LOGISTIC REGRESSION ANALYSIS ON SUICIDE IDEATION AND ASSOCIATED FACTORS AMONG SCHOOL GOING ADOLESCENTS IN NAMIBIA

A MINI-THESIS SUBMITTED IN PARTIAL FULFILMENT FOR THE DEGREE OF

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BY

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Abstract

Suicide accounts for many deaths worldwide making it the second leading cause of death among 15-29 year olds globally. Suicide ideation leads to mental health disorder and has been shown to "spread" suicidal thoughts to others. Consequently, adolescents who reported suicidal ideation at an early age are more likely to later attempt suicide. The objective of the study was to estimate prevalence and risk factors for suicidal ideation among school-going adolescents in Namibia. The study analyzed secondary data from the Namibia Global School-based Health Survey (GSHS) of 2013 (N= 4 531). A multilevel logistic regression, which allows for the incorporation of group-level effects (school and grade) and estimation of interactions, was used to establish risk factors associated with suicidal ideation. 32% of the school-going adolescents indicated they had considered suicide at least once in the previous 12 months. Age ($p = 0.025$), sex ($p = 0.025$), dietary behaviour ($p = 0.035$), violence (p-value < 0.001), mental health ($p = 0.002$), drug use ($p = 0.008$) and tobacco use (p-value < 0.001) were significantly associated with suicide ideation. Results suggest significant school level effects with a VPC of 0.0454 and grade level effects with a VPC of 0.0231. Due to a small number of grades and schools, the maximum likelihood estimation may have produced unstable estimates and therefore, future researchers may use a Bayesian approach. Future researchers can also make use of multilevel multinomial logistic regression modelling instead of the multilevel binary logistic regression modelling that was used in this study.

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List of Abbreviations and/or Acronyms

AIC	Akaike Information Criterion
AOR	Adjusted Odds Ratio
BIC	Bayesian Information Criterion
CDC	Centers for Diseases Control and Prevention
CI	Confidence Interval
Df	Degrees of Freedom
GLM	Generalised Linear Model
GSHS	Global School based Health Survey
HIC	High Income Country
HPA	Hypothalamic-Pituitary-Adrenal
LR	Likelihood Ratio
NFSB	Non-Fatal Suicidal Behaviour
OR	Odds Ratio
PE	Physical Education
RRR	Relative Risk Reduction

SI	Suicide Ideation
UAOR	Unadjusted Odds Ratio
UNAIDS	United Nations Programme on HIV/AIDS
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations Children's Fund
VPC	Variance Partitioning Coefficient
WHO	World Health Organization

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Dedication

To the Sub-Saharan Consortium for Advanced Biostatistics (SSACAB), if it was not for your sponsorship, I would not have completed my Masters of Science in Biostatistics. This thesis is dedicated to my friends Evelina Hasholo and Kefas Leonard whose words of encouragement never stopped ringing in my ears. Special thank you to the Kapenda family who laid a very strong foundation that made me who I am today.

Declarations

I, Sesilia Rauha Ndeutalala Kapenda, hereby declare that this study is my own work and is a true reflection of my research, and that this work, or any part thereof has not been submitted for a degree at any other institution.

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CHAPTER 1: INTRODUCTION

1.1. Introduction

Chapter 1 provides an overview of the study. The background of the study, statement of the problem, significance of the study, limitations and delimitations of the study are also discussed in this chapter.

1.2. Background of the study

Adolescent mental health is a neglected but increasing public health issue in developing countries, including Namibia (Kangootui et al, 2019). Suicide accounts for many deaths worldwide making it the second leading cause of death among 15-29 year olds globally. Suicidal thoughts or suicidal ideation means thinking about or planning suicide (Nordqvist, 2018), which is often under-evaluated or under-appreciated in evaluating children's health. Nordqvist further states that these suicidal thoughts can range from a detailed plan to a fleeting consideration and does not include the final act of suicide. According to the World Health Organization (2016), every single year over 800 000 people die due to suicide and there are more who attempt to do the same.

Suicidal ideation is the most commonly reported form of suicidality, with suicidal death rates of approximately 12% among community adolescents aged 13–18 years (15.3% and 9.1% for females and males respectively (Nock et al, 2013)). Notably, about 41% of adolescent females and 23% of adolescent males with a lifetime history of suicidal ideation ultimately attempt suicide, in most cases within the first year of onset of suicidal ideation (Nock et al, 2013).

In United States, suicide contributed to unintentional injury deaths among adolescents, having been reported of 4.5/100 000 adolescents (10 to 19 years) between 1999 and 2002 (Muula et al, 2007). According to the article produced by *The Namibian*'s investigative unit, Namibian Police statistics

provided to *The Namibian* show that 36 children killed themselves from 2017 to 2019, a number described by the education ministry as "tragic and devastating". Fourteen teenagers committed suicide in Namibia in 2013 (Whittaker, 2014). Between 2014 and 2015, 28 teenagers committed suicide, 19 in 2015 and 9 in 2014 (Kangootui et al, 2019). The authors further reported that nationwide, 18 children committed suicide between 1 April 2018 and 31 March 2019, while a similar number died between 1 April 2017 and 31 March 2018. Furthermore, 15 boys and 3 girls were among cases of suicide recorded by the police from 1 April 2017 to 31 March 2018. Of the 458 suicides recorded by the police between 2018 and 2019, 10 were young boys and eight were young girls. In this study, an adolescent is defined to be a young person aged 13-17 years in grades 7-12 (WHO, 2013).

Recent studies, for example, show that there is a significant increase in adolescents with diagnosable behavioral health disorders such as depression, substance use, anxiety and other stress-related conditions. Furthermore, although not all suicidal ideation materializes into suicide attempt or suicide, it is the first step on the path to suicide. One of the most serious consequences of mental health problems is non-fatal suicidal behavior.

1.3. Statement of the problem

Suicide is a major worldwide public health concern, especially among adolescents. Suicide among adolescents has been a major issue and the statistics are considerably alarming. Research on factors associated with suicidal ideation and suicide attempts has been conducted largely in developed countries. However, to my knowledge, related studies in Namibia are limited.

An early study revealed evidence that adolescents who reported suicidal ideation at an early age were much more likely than their counterparts who denied suicidal ideation to later attempt suicide (Bridge

et al, 2006). Therefore, an examination of childhood suicidal ideation is not only warranted but also timely for an early identification and remediation of suicidal ideation in adulthood.

1.4.Objectives of the study

Main Objective

The main objective of the study was to examine the prevalence and factors associated with suicide ideation among school going adolescents in Namibia, while controlling for clustering at grade and school levels.

Specific Objectives

The specific objectives of the study were:

a) to establish the prevalence of suicide ideation,
b) to determine factors associated with suicidal ideation among school going adolescents in Namibia.

1.5. Significance of the study

The study will help decision makers implement school health, adolescent programmes and interventions aiming at educating school-going adolescents on how to cope with stressful situations to avoid risky behavior and offer protection against suicide ideation and behavior. The study also hopes to inform, challenge and/or support policy and actions directed to addressing the psychological needs of school-going adolescents with suicidal ideation.

Moreover, the study will add to the existing knowledge on suicide ideation as it will address issues that might not have been addressed before in Namibia. The study adds to the ongoing understanding of suicidal ideation among school-going adolescents by identifying the most relevant predictors.

Furthermore, the findings of this study will also enable mental health professionals to make practical clinical decisions and plan interventions that will help school-going adolescents troubled by suicidal ideation.

1.6.Organization of the study

The thesis is organized as follows. Chapter 1 provides the introduction. Chapter 2 provides the literature review. Chapter 3 gives the methodology and data analysis. Chapter 4 highlights the data analysis, results and discussions of the results. Conclusions and recommendations are presented in chapter 5.

1.7. Chapter Summary

Chapter 1 discussed the historical and background of suicide ideation of school going adolescents in Namibia. The study is vital as it will help decision makers implement school health and adolescent programmes and interventions aiming at educating school-going adolescents on how to cope with stressful situations to avoid risky behavior and offer protection against suicide ideation and behavior. Moreover, the limitations and delimitations of the study were discussed. The following chapter deals with the comprehensive literature review of the subject matter.

CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

In this chapter, a comprehensive literature review is given. The chapter is divided into 6 subheadings namely; the definition of key concepts, effects of suicidal ideation, factors associated with suicide ideation and statistical models for the determinants of suicide ideation as well as statistical modelling methods used in psychotic studies.

2.2. Definition of key concepts

2.1.1 Suicide ideation

A suicidal ideation (or suicidal thoughts) means thinking about or planning suicide (Nordqvist, 2018), which is often under-evaluated or under-appreciated in evaluating children's health.

The term 'suicidal ideation' refers to thought that life is not worth living, ranging in intensity from fleeting thoughts through to concrete, well thought-out plans for killing oneself, or a complete pre-occupation with self-destruction. These thoughts are not uncommon among young people. It is estimated that between 22% and 38% of adolescents have thought about suicide at some point in their lives, with between 12% and 26% reporting having had such thoughts in the previous year (Nock et al, 2008).

2.1.2. Adolescence

WHO (2016) defined adolescence as a period in human growth and development that occurs after childhood and before adulthood, from ages 10 to 19 years. Adolescence is defined as a period of

transition “between childhood and adulthood that prepares the young person for occupation, marriage and mature social roles” (Muuss, 1996, p.366).

2.3. Effects of suicidal ideation

During the ‘teen years’ the incidence of suicide attempts, suicide ideation and self-harm peak and suicide is a leading cause of death. Suicide ideation leads to mental health disorder which is often linked with poor academic performance (De Luka et al, 2016). Adolescents who have reported suicidal ideation at an early age are more likely to later attempt suicide.

Associating with suicidal people has been shown to “spread” suicidal thoughts to others (Feng et al, 2016). Suicidal ideation is the most commonly reported form of suicidality, with lifetime prevalence rates of approximately 12 % among community adolescents aged 13–18 years (Giletta et al, 2014). According to the Centers for Disease Control and Prevention (CDC, 2014), each year, 157 000 youth between the ages of 10 and 24 receive medical care at emergency departments for self-inflicted injuries.

2.4. Factors associated with suicidal ideation

Previous studies have identified a number of risk factors that could contribute to suicidal ideation in adolescents. These factors range from demographic to socio- economic, psychological and behavioral factors.

Suicide ideation is often associated with gender, age group and the geographical regions (Muula et al, 2007; Randall et al, 2014; Sharma et al, 2015; Turecki and Brent, 2015). Muula et al (2007) found the 12-month prevalence of suicide ideation among in-school adolescents in Zambia to be 32.2%. The prevalence of suicide ideation among males (31.1%) and females (31.4%) was similar and being older

than 14 years (OR=1.21; 95%CI 1.01, 1.03) was also positively associated with suicidal ideation. Muula et al (2007) further stated that male adolescents who reported being worried, reported smoking marijuana or having been drunk, and those whose sadness and hopelessness interfered with functioning, were more likely to have reported suicidal ideation.

Randall et al, 2014 reported there was no significant relationship between age, sex, truancy, and suicidal ideation and suicide planning. However, a multinomial regression analysis, using one suicide attempt and multiple suicide attempts as outcomes, revealed that female, anxiety, loneliness, being physically attacked, and illicit drug use were associated these outcomes (Randall et al, 2014).

Randall et al (2014) further found the rate of suicide attempts during the one-year period of recall was high compared to the prevalence found in other low and middle income countries, such as Nigeria, Thailand, Vietnam, China and the Philippines. Suicide attempt prevalence was also higher in Benin compared to High Income Countries (HICs) such as Canada and the US, where estimated rates are between 4.4% and 9%.

Sex (AOR, 5.12; CI, 3.32 – 7.89) was significantly associated with suicidal ideation (Sharma et al, 2015). Furthermore, 34.0% of suicidal ideation was explained by the all the factors (sex, being in a fight, being insulted, being attacked, perceived unhappiness, smoking and ever having sexual intercourse).

Compared to students aged 18 years or older, students of age 17 years were 25% more likely (AOR=1.25, 95% CI [1.19, 1.31]) to consider committing suicide (Almansour and Siziya, 2017). Additionally, the overall prevalence of suicidal ideation was 17.0% (15.6% among males and 18.3% among females) with male students 17% less likely (AOR=0.83, 95% CI [0.81, 0.85]) to consider committing suicide than females.

In the study conducted by Feng et al, 2016, the null model including only the random intercepts for grade and school, the variation identified among grades within schools was 0.03 ± 0.18 and among schools was 0.24 ± 0.49. The Variance Partitioning Coefficient (VPC) for grade was 0.8% and for school was 6.7%. In the univariate analysis, there was no significant difference in reported suicidal ideation between males and females or among students of different ages, or from rural and urban schools.

Suicide association is reported to be associated with alcohol and drug misuse (Randall et al, 2014; Ziaei et al, 2017). Additionally, poor mental health, history of child abuse, being sexually abused, being bullied, financial difficulties, poor coping skills and school going adolescents being worried that they could get hungry (Martin et al, 2016; Randall et al, 2014; Sharma et al, 2015; Ziaei et al, 2017) are also factors associated with suicide ideation. Other factors associated with suicide ideation are; anxiety, depression, quality of life due to acne, depression symptoms, being worried that they could not sleep at night and feeling sad and hopeless that they could not do usual activities (Wolford-Clevenger et al, 2014; Lukaviciute et al, 2017; Muula et al, 2007; Randall et al, 2014).

Almansour and Siziya (2017) reported the following findings. Students who most of the time or always felt lonely or had been so worried about something that they could not sleep at night (anxiety) were more likely to consider committing suicide compared to those students not lonely or so worried (AOR=1.47, 95% CI [1.42, 1.53] for loneliness and AOR=1.43, 95% CI [1.37, 1.48] for anxiety), students who missed classes or school without permission were 26% (95% CI [1.22, 1.31]) more likely to consider committing suicide compared to students who never missed classes or school. In relation to violence, students who were bullied, attacked or involved in a physical fight were more likely to consider committing suicide compared to students who were not involved in violence (bullied AOR=1.24, 95% CI [1.21, 1.27]), attacked AOR=1.12, 95% CI [1.09, 1.17]) and involvement in a

fight AOR=1.13, 95% CI [1.10, 1.17])). In the same study, drug use was associated with considering committing suicide and students who ever used drugs were 1.27 (95% CI [1.21, 1.34]) times more likely to consider committing suicide than those who never ever used drugs. Similarly, students who ever used marijuana were 27% more likely (AOR=1.27, 95% CI [1.19, 1.35]) to consider committing suicide than those who never ever used marijuana. Compared to students whose parents most of the time or always understood their problems and worries were 15% less likely (AOR=0.85, 95% CI [0.83, 0.87]) to consider committing suicide than those students whose parents never, rarely or sometimes understood their problems or worries.

Ziaei et al, 2017 reported that suicidal ideation was positively associated with being worried (UAOR = 6.94; 95% Cl [2.97, 16.23], struggling to stay focused on homework (UAOR = 3.07; 95% Cl [1.38, 6.80], current cigarette smoking (UAOR = 4.81; 95% CI [2.85, 8.13], thoughts about using alcohol or other drugs (UAOR = 7.69; 95% CI [4.55, 12.98], being bullied (UAOR = 2.54; 95% CI [1.50, 4.31], and being sexually abused (UAOR = 3.28; 95% CI [1.75, 6.13]). Suicidal ideation was negatively associated with having understanding parents (UAOR = 0.49; 95% CI [0.29, 0.83]). However only being worried (AOR = 4.15; 95% Cl [1.71, 10.07], current cigarette smoking (AOR = 3.00; 95% CI [1.69, 5.30], thoughts about using alcohol or other drugs (AOR = 4.28; 95% CI [2.41, 7.59] and being sexually abused (AOR = 2.63; 95% CI [1.32, 5.24]) remained positively associated with suicidal ideation.

Martin et al, 2016 also reported that approximately 80% of those who attempted suicide had a history of child abuse and poor mental health, financial difficulties, poor coping skills, and reporting a suicide plan were also associated with an increased prevalence of attempting suicide; adjusted for these factors, child abuse was associated with a 1.77-fold increased prevalence (95 % CI 0.93, 3.36) of suicide attempts.

2.5. Statistical Considerations

Study design

Research on suicidal ideation has mostly adopted cohort studies (Darvishi et al, 2015), cross sectional studies (Ziaei et al, 2017; Wolford-Clevenger et al, 2014; Sharma et al, 2015; Randall et al, 2014; Feng et al, 2016; De Luca et al, 2016) and longitudinal studies (Young et al, 2011; Giletta et al, 2014; Stolz et al, 2016).

Cohort studies

Cohort studies are based upon the existence of a common characteristic such as year of birth, graduation or marriage, within a subgroup of a population (Kumar, 2011). People with the common characteristics are studied over a period of time to collect the information of interest to you. Studies could cover fertility behavior of women born in 1986 or career paths of 1990 graduates from a medical school, for instance. Cohort studies look at the trends over a long period of time and collect data from the same group of people.

The cross-sectional study designs

Cross-sectional studies, also known as one-shot or status studies, are best suited to studies aimed at finding out the prevalence of a phenomenon, situation, problem, attitude or issue, by taking a cross-section of the population (Kumar, 2011). They are useful in obtaining an overall ‘picture’ as it stands at the time of the study. Such studies are cross sectional with regard to both the study population and the time of investigation. A cross-sectional study is extremely simple in design. You decide what you want to find out about, identify the study population, select a sample (if you need to) and contact your respondents to find out the required information.

As these studies involve only one contact with the study population, they are comparatively cheap to undertake and easy to analyze. However, their biggest disadvantage is that they cannot measure change. To measure change it is necessary to have at least two data collection points – that is, at least two cross sectional studies, at two points in time, on the same population.

A cross sectional study of three grades, spanning Junior and Senior High, which sampled a total of 2 690 adolescents was conducted in Benin by Randall et al, 2014.

The longitudinal study designs

To determine the pattern of change in relation to time, a longitudinal design is used; for example, when you wish to study the proportion of people adopting a programme over a period. Longitudinal studies are also useful when you need to collect factual information on a continuing basis. You may want to ascertain the trends in the demand for labour, immigration, changes in the incidence of a disease or in the mortality, morbidity and fertility patterns of a population. In longitudinal studies the study population is visited a number of times at regular intervals, usually over a long period, to collect the required information. These intervals are not fixed so their length may vary from study to study. Intervals might be as short as a week or longer than a year. Irrespective of the size of the interval, the type of information gathered each time is identical. Although the data collected is from the same study population, it may or may not be from the same respondents. A longitudinal study can be seen as a series of repetitive cross-sectional studies.

2.6. Statistical Modelling methods

2.6.1. Linear Models

A Linear model is a model that uses linearity to describe the relationship between the mean of the response variable and a set of explanatory variables, assuming normality of the response (Rencher & Schaalje, 2008).

According to Rencher & Schaalje, 2008; The simple linear regression model for n observations can be written as;

$$y_i = \beta_0 + \beta_1 x_i + \varepsilon_i, \quad i = 1,2, \dots, n \tag{2.6.1.1}$$

where; y_i is the dependent or response variable

$\beta_0 \; and \; \beta_1$ are the regression coefficients

x_i is the independent or predictor variable and,

ε_i is the error term

A linear model relating to the response y to several predictors, also referred to as multiple regression, has the form

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k + \varepsilon \tag{2.6.1.2}$$

Assumptions of the linear model

1. $E(\varepsilon_i) = 0$ for all $i = 1, 2, \dots, n$, or equivalently, $E(y_i) = \beta_0 + \beta_1 x_i$

2. $var(\varepsilon_i) = \sigma^2$ for all $i = 1, 2, \dots, n$, or equivalently, $var(y_i) = \sigma^2$
3. $cov(\varepsilon_i, \varepsilon_j) = 0$ for all $i \neq j$, or equivalently, $cov(y_i, y_j) = 0$

Using the three assumptions, the following means and variances of $\widehat{\beta_0}$, $\widehat{\beta_1}$ and σ^2 are obtained:

$$E(\widehat{\beta_1}) = \beta_1 \quad (2.6.1.3)$$

$$E(\widehat{\beta_0}) = \beta_0 \quad (2.6.1.4)$$

$$var(\widehat{\beta_1}) = \frac{\sigma^2}{\sum_{i=1}^{n}(x_i - \bar{x})^2} \quad (2.6.1.5)$$

$$var(\widehat{\beta_0}) = \sigma^2 \left[\frac{1}{n} + \frac{\bar{x}^2}{\sum_{i=1}^{n}(x_i - \bar{x})^2}\right] \quad (2.6.1.6)$$

$$E(s^2) = \sigma^2 \quad (2.6.1.7)$$

2.6.2. Generalised Linear Models

A Generalised Linear Model (GLM) is an extension of the linear model to encompass non-normal response distributions and possibly non-linear functions of the mean (Neema, 2018).

The structure of GLMs

A GLM is a consolidated model of three components, namely:

1. **A Random component** specifying the conditional distribution of the response variable, y and its probability distribution $\{\boldsymbol{y} = (y_1, y_2, \dots, y_n)^T\} \sim independently\ distributed.$

The random component consists of a response variable y with independent observations $(y_1, y_2, \dots, y_n)$ (Neema, 2018). These observations have probability density or mass function for a distribution in the exponential family such as normal, binomial, and Poisson etc. (Neema, 2018).

Parameter estimates are carried out using maximum likelihood (ML) estimators. By restricting GLM to exponential family of distributions, general expressions for the model likelihood equation, asymptotic distributions of estimators for model parameters and algorithm for fitting the model are obtained.

2. A Linear predictor:

For a parameter vector $\beta = (\beta_1, \beta_2, \dots, \beta_p)^T$ and an $n \times p$ model matrix $\boldsymbol{X}$ that contains values of p explanatory variables for the n observations, the linear predictor is $\boldsymbol{X\beta}$ (Neema, 2018).

For observation i, $i = 1,2, \dots, n$, let x_{ij} be explanatory variable x_j, j= $1,2, \dots, p$. Let also $\boldsymbol{x}_i = (x_{i1}, x_{i2}, \dots, x_{ip})$.

Setting $x_{i1} = 1, \ or \ x_{i0} = 1$, to serve as coefficient of an intercept term in the model.

The linear predictor of a GLM relates parameter $\{\eta_i\}$ pertaining to $\{E(y_i)\}$ to the explanatory variables $x_1, x_2, \dots, x_p$ using a linear combination of them:

$$\eta_i = \sum_{j=1}^{p} \beta_j x_{ij}, \qquad i = 1,2, \dots, n \tag{2.6.2.1}$$

The explanatory variables themselves can be non-linear functions of underlying variables e.g. interaction terms $(e.g. \quad x_{i3} = x_{i1}x_{i2})$ or quadratic terms $(e.g. \quad x_{i2} = x_{i1}^2)$.

In matrix form the linear predictor is expressed as;

$$\boldsymbol{\eta = X\beta}, \qquad \boldsymbol{\eta = (\eta_1, \eta_2, \dots, \eta_n)^T}$$

3. A Link function:

This is a function g that is applied to each component of $E(\boldsymbol{y})$ that relates it to the linear predictor $g[E(\boldsymbol{y})] = \boldsymbol{X\beta}$ (Neema, 2018). The link function connects the random component with the linear predictor.

Let $\mu_i = E(y_i), \quad i = 1,2, \dots, n$ (2.6.2.2)

The GLM links η_i to μ_i by $\eta_i = g(\mu_i)$, where the link function $g(.)$ is a monotonic, differentiable function.

Hence g links μ_i to explanatory variables through the formula;

$$g(\mu_i) = \sum_{j=1}^{p} \beta_j x_{ij}, \qquad i = 1,2, \dots, n \qquad (2.6.2.3)$$

In the exponential family representation of a distribution, a certain parameter serves as its natural parameter. This parameter is the mean for a normal distribution, the log of the odds for a binomial distribution and the log of the mean for a Poisson distribution. The link function g that transforms μ_i to the natural parameter is called the *canonical link*. Table 1 shows some important GLMs for statistical analysis.

Logistic Regression

In some situations, the response variable y has only two possible outcomes. In such cases, the outcome y can be coded as 0 or 1 (Rencher & Schaalje, 2008). To illustrate a linear model in which y is binary, consider the model with one x:

$$y_i = \beta_0 + \beta_1 x_i + \varepsilon_i; \quad y_i = 0,1; \; i = 1,2,\dots,n \qquad (2.6.2.3)$$

Since y_i is 0 or 1, the mean $E(y_i)$ for each x_i becomes the proportion of observations at x_i for which $y_i = 1$. This can be expressed as

$$E(y_i) = P(y_i = 1) = p_i, \qquad (2.6.2.4)$$

$$1 - E(y_i) = P(y_i = 0) = 1 - p_i. \qquad (2.6.2.5)$$

The distribution $P(y_i = 0) = 1 - p_i$ and $P(y_i = 1) = p_i$ is known as the *Bernoulli distribution* (Rencher & Schaalje, 2008).

The mean of y_i is $E(y_i) = p_i = \beta_0 + \beta_1 x_i = \frac{e^{\beta_0+\beta_1 x_i}}{1+e^{\beta_0+\beta_1 x_i}} = \frac{1}{1+e^{-\beta_0-\beta_1 x_i}}$ (2.6.2.6)

and the variance of y_i is $var(y_i) = (\beta_0 + \beta_1 x_i)(1 - \beta_0 - \beta_1 x_i)$. (2.6.2.7)

The model $E(y_i) = p_i = \frac{e^{\beta_0+\beta_1 x_i}}{1+e^{\beta_0+\beta_1 x_i}} = \frac{1}{1+e^{-\beta_0-\beta_1 x_i}}$ can be linearized by the simple transformation

$ln\left(\frac{p_i}{1-p_i}\right) = \beta_0 + \beta_1 x_i$, sometimes called the *logit transformation* (Rencher & Schaalje, 2008).

TABLE 1: IMPORTANT GLMS FOR STATISTICAL ANALYSIS (NEEMA, 2018)

Random Component	**Link Function**	**Model**
Normal	Identity	Regression
		ANOVA
Binomial	Logit	Logistic regression
Multinomial	Generalized logits	Multinomial response
Poisson	Log	Log-linear

2.6.3. Hierarchical/multilevel linear models

Multilevel models are statistical models of parameters that vary at more than one level (Bryk & Raudenbush, 2002). These models can be seen as a generalisation of linear models, although they can also extend to non-linear. Multilevel models are appropriate for research designs where data for participants are organized at more than one level (Bryk & Raudenbush, 2002). Multilevel models can be used on data with many levels, although 2-level models are the most common and the rest of this mini-thesis deals only with these. The dependent variable must be examined at the lowest level of analysis (Bryk & Raudenbush, 2002).

When there is a single level 1 independent variable, the level 1 model is;

$$Y_{ij} = \beta_{0j} + \beta_{1j}\boldsymbol{X}_{ij} + e_{ij} \qquad (2.6.3.1)$$

where; $\boldsymbol{X}_{ij}$ refers to the level 1 predictor

β_{0j} refers to the intercept of the dependent variable in group j (level 2)

β_{1j} refers to the slope for the relationship in group j (level 2) between level 1 predictor and the dependent variable

e_{ij} refers to the random errors of prediction for the level 1 equation.

At level 1, both intercepts and slopes in the groups can be either fixed, non-randomly varying or randomly varying (Fidell & Tabachnick, 2007). When there are multiple level 1 independent variables, the model can be expanded by substituting vectors and matrices in the equation.

The dependent variables are the intercepts and the slopes for the independent variables at level 1 in the groups of level 2.

$$\beta_{0j} = \gamma_{00} + \gamma_{01}\boldsymbol{W}_j + u_{0j} \quad (2.6.3.2)$$

$$\beta_{1j} = \gamma_{10} + u_{1j} \quad (2.6.3.3)$$

where;

γ_{00} refers to the overall intercept, which is the grand mean of the scores on the dependent variable across all the groups when all the predictors are equal to 0.

$\boldsymbol{W}_j$ refers to the level 2 predictor.

γ_{01} refers to the overall regression coefficient, or the slope, between the dependent variable and the level 2 predictor.

u_{0j} refers to the random error component for the deviation of the intercept of a group from the overall intercept.

γ_{10} refers to the overall regression coefficient, or the slope, between the dependent variable and the level 1 predictor.

u_{1j} refers to the error component for the deviation of the of the group slopes from the overall slope.

There are three types of multilevel model, namely random intercept model, random slopes model and random intercepts and slopes model.

A random (varying) intercepts model is a model in which intercepts are allowed to vary, and therefore, the scores on the dependent variable for each individual observation are predicted by the intercept that varies across groups. This model assumes that slopes are fixed.

$$\text{varying-intercept model: } y_i = \alpha_{j[i]} + \beta_{xi} + \epsilon_i \quad (2.6.3.4)$$

A random (varying) slopes model is a model in which slopes are allowed to vary, and therefore, the slopes are different across groups. This model assumes that intercepts are fixed.

$$\text{varying-slope model: } y_i = \alpha + \beta_{j\{i\}xi} + \epsilon_i \qquad (2.6.3.5)$$

A random (varying) intercepts and slopes model is a model that includes both random intercepts and random slopes. In this model, both intercepts are allowed to vary across groups.

$$\text{varying-intercept, varying-slope model: } y_i = \alpha_{j[i]} + \beta_{j[i]xi} + \epsilon_i \qquad (2.6.3.6)$$

Assumptions of multilevel/hierarchical models

Multilevel models have the same assumptions as other major general linear models, but some of the assumptions are modified for the hierarchical nature of the design.

1. Linearity

   The assumption of linearity states that there is a rectilinear relationship between variables (Salkind & Green, 2004). However, the model can be extended to non-linear relationships (Salkind & Green, 2004).

2. Normality

   The assumption of normality states that the error terms at every level of the model are normally distributed (Salkind & Green, 2004). However, the multilevel modelling approach can be used for all forms of generalised linear models (Salkind & Green, 2004).

3. Homoscedasticity

   The assumption of homoscedasticity assumes equality of population variances (Salkind & Green, 2004). However, different correlation matrix can be specified to account for this, and the heterogeneity of variance can itself be modeled (Salkind & Green, 2004).

4. Independence of observations

   Independence is an assumption of general linear models, which states that cases are random samples from the population and that scores on the dependent variable are independent of each other (Salkind & Green, 2004). Multilevel models assume that level 1 and level 2 residuals are uncorrelated, and the errors at the highest level are uncorrelated (Salkind & Green, 2004).

Intraclass Correlation Coefficient

The Intraclass Correlation Coefficient (ICC), ρ is the proportion of variance in the outcome variable that is explained by the grouping structure of the hierarchical model (Gelman & Hill, 2007). It is calculated as a ratio of group-level error variance over the total error variance:

$$\rho = \frac{\sigma_{u_0}^2}{\sigma_{u_0}^2 + \sigma_e^2}, \qquad (2.6.3.7)$$

where $\sigma_{u_0}^2$ is the variance of the level-2 residuals and σ_e^2 is the variance of the level-1 residuals (Gelman & Hill, 2007). In other words, the ICC reports on the amount of variation unexplained by any predictors in the model that can be attributed to the grouping variable, as compared to the overall unexplained variance (within and between variance).

A high ICC close to 1 indicates high similarity between values from the same group. A low ICC close to zero means that values from the same group are not similar.

Akaike Information Criterion and Bayesian Information Criterion

The *Akaike Information Criterion* (AIC), is generally considered the first model selection that should be used in practice (Fabozzi et al, 2014). The AIC is

$$AIC = -2logL(\hat{\theta}) + 2k \quad (2.6.3.8)$$

Where $\theta =$ the set of model parameters

$L(\hat{\theta}) =$ the likelihood of the model given the data when evaluated at the maximum likelihood estimate of θ.

$k =$ the number of estimated parameters in the model.

The AIC in isolation is meaningless. Rather, this value is calculated for every model and the "best" model is the model with the smallest AIC.

The fist component, $-2logL(\hat{\theta})$, is the value of the likelihood function, log $L(\hat{\theta})$, which is the probability of obtaining the data given the model.

The *Bayesian Information Criterion* (BIC), is another model selection criterion based on information theory but set within a Bayesian context (Fabozzi et al, 2014). The difference between the AIC and BIC is the greater penalty imposed for the number of parameters by the former than the latter.

The BIC is computed as follows

$$BIC = -2logL(\hat{\theta}) + k\ log\ n \quad (2.6.3.9)$$

where the terms above are the same as those described in the AIC description. The best model is the one that provides the minimum BIC.

2.6.4. Other Statistical Models

Meta-analysis (Cao et al, 2015), descriptive analysis (Han et al, 2015), multivariate logistic regression (Han et al, 2015; Sharma et al, 2015; Ziaei et al, 2017), multiple linear regression (Wolford-Clevenger et al, 2014), backward logistic regression (Muula et al, 2007) and multilevel logistic regression models (Young et al, 2011; Giletta et al, 2014; Feng et al, 2016; Stolz et al, 2016; De Luca et al, 2016, Jablonska et al, 2014) were some of the statistical methods that have been employed to analyze suicide ideation data.

Feng et al, 2016 used a multilevel logistic regression model to investigate the hierarchical data structure at student, grade and school levels. The author further conducted a Bayesian spatial analysis to examine the spatial disparity in the risk of suicidal ideation among residential neighborhoods. Adopting a multi-level approach, Giletta et al (2014) examined risk factors for adolescent suicidal ideation, with specific attention to (a) hypothalamic-pituitary-adrenal (HPA) axis stress responses and (b) the interplay between HPA-axis and other risk factors from multiple domains (i.e., psychological, interpersonal and biological). To assess the association between school-level characteristics and NFSB, Jablonska et al, 2014 also used a multilevel regression.

Compared to the models highlighted above, multilevel analysis is preferred because it allows the author to study effects that vary by group, estimate interactions to the extent that is supported by the data and to estimate group averages and group-level effects. Multilevel modeling is a direct way to include indicators for clusters at all levels of a design (Finch et al, 2014).

2.7. Multilevel Logistic Regression Model

According to Guo, G., & Zhao, H. (2000), a multilevel model provides a convenient framework for studying multilevel data. Such a framework encourages a systematic analysis of how covariates measured at various levels of a hierarchical structure affect the outcome variable and how the interactions among covariates measured at different levels affect the outcome variable (Guo & Zhao, 2000).

Furthermore, multilevel modeling corrects for the biases in parameter estimates resulting from clustering (Guo & Zhao, 2000). In contrast to the popular belief, ignoring multilevel structure can result in biases in parameter estimates as well as biases in their standard errors. The more highly correlated the observations are within clusters, the more likely that ignoring clustering would result in biases in parameter estimates (Guo & Zhao, 2000). Also, multilevel modeling provides correct standard errors and thus correct confidence intervals and significance tests. When observations are clustered into higher-level units, the observations are no longer independent (Guo & Zhao, 2000). Independence is one of the most basic assumptions underlying traditional linear and binary regression models. When the clustering structure in the data is ignored and the independence assumption is violated, the traditional linear and binary models tend to underestimate the standard errors. The following is an intuitive argument for this statement. The observations in the same cluster tend to be more similar in their outcome measures if clustering matters regarding the outcome measures (Guo & Zhao, 2000). Similarity within a cluster implies that we can, to some extent, predict the outcome of an observation if we know the outcome of another observation in the same cluster. This suggests that not every observation provides an independent piece of information and that the total amount of information contained in a sample with clustering is less than that in a sample without clustering.

Let levels 1, 2, and 3 represent students, grades, and schools. Then starting with the two-level model with a single explanatory variable,

$$Y_{ij} = \beta_0 + \beta_1 x_{ij} + \mu_j + \epsilon_{ij} \qquad (2.7.1)$$

where Y_{ij} denote a binary response variable for the i^{th} student in the j^{th} school, β_0 is the intercept, x_{ij} is the explanatory variable, β_1 is its effect, $\mu_j$is the random effects accounting for the variation at school level and ϵ_{ij} is the student level random effects.

Considering the random effects, their parameters are $E(\mu_i) = E(\epsilon_{ij}) = 0$, $var(\mu_j) = \sigma_\mu^2$, $var(\epsilon_{ij}) = \sigma_\epsilon^2$, $Cov(\mu_j, \epsilon_{ij}) = 0$ for $j \neq j'$. Furthermore, the within schools' correlation can be obtained from $\rho = \frac{\sigma_\mu^2}{(\sigma_\mu^2 + \sigma_\epsilon^2)}$.

From equation (1), the three level model with random coefficients can be given as

$$Y_{ijk} = \beta_0 + \beta_1 x_{ijk} + \mu_{1jk} x_{ijk} + v_{0k} + \mu_{0jk} + \epsilon_{0ijk} \qquad (2.7.2)$$

where k denotes level three, v_{0k} and μ_{0jk} are random intercepts for level three and two respectively, $x_{ijk}$is an observed explanatory variable at level one, and μ_{1jk} is $x_{ijk}{}'s$ random effect at level two (grade).

Again, the random effects model parameters are

$$E[v_{0k}] = E[\mu_{0jk}] = 0, \quad var(v_{0k}) = \sigma_{v0}^2, \quad var(\mu_{0jk}) = \sigma_{\mu 0}^2, \quad var(\mu_{1jk}) = \sigma_{\mu 1}^2, \quad var(\epsilon_{0ijk}) = \sigma_{\epsilon ijk}^2, Cov(\mu_{0jk}, \mu_{1jk}) = 0.$$

The random effects across different levels and random effects across different clusters (schools) in the same level are uncorrelated.

The multilevel logistic regression model incorporates school-specific random effects to account for the within school correlation of the student outcomes. Consider the data set that consist of students (level one) grouped into grades (level two) from different schools (level three). A binary random variable Y_{ijk} is observed for student i in grade j from school k, x_{ijk} an explanatory variable at student level is also observed. The probability of the response variable is given as $\pi_{ijk} = \Pr(Y_{ijk} = 1)$, where π_{ijk} is modelled using logit link function.

Assuming that Y_{ijk} has a Bernoulli distribution function, then the three-level model is given as;

$$logit\left(\pi_{ijk}\right) = \log\left[\frac{\pi_{ijk}}{1-\pi_{ijk}}\right] = \beta_0 + \beta_1 x_{ijk} + \mu_{1jk} x_{ijk} + \nu_{0k} + \mu_{0jk}. \qquad (2.7.3)$$

A general multi-level logistic regression model that will be fitted in this study is as follows:

$$(logit(p_{ijk}) = \gamma_{000} + \sum_{p=1}^{P} \gamma_{p00} x_{pijk} + v_{00k} + u_{ojk} \qquad (2.7.4)$$

where p_{ijk} is the likelihood of suicide ideation for i th student in jth grade of kth school;

γ_{000} is the average intercept across all grades within all school (overall log of odds of suicide ideation when all other variables are set to be zeros);

v_{00k} is a specific-school effect on the overall intercept;

u_{ojk} is grade-school effect on the overall; and

γ_{p00} is the effect of the covariate x_{pijk} on the likelihood of suicide ideation.

Estimation

The model parameters can be estimated using maximum likelihood estimation. Let the conditional density function for schools in model 2 be;

$$f(Y_k|x_k,\mu_j) = \prod_{i=1}^{n_k} \frac{exp(\beta_0+\beta_1 x_{ijk}+\mu_{1jk}x_{ijk}+\nu_{0k}+\mu_{0jk})}{1-exp(\beta_0+\beta_1 x_{ijk}+\mu_{1jk}x_{ijk}+\nu_{0k}+\mu_{0jk})} \quad (2.7.5)$$

where Y_j and x_j, respectively denotes the responses and the explanatory variables in k school.

Assuming that μ_k is normally distributed and to integrate out the unobserved random effects μ_k,

$$f(Y_k|x_k) = \int f(Y_k|x_k,\mu_k)g(\mu_k)d\mu_k \quad (2.7.6)$$

where $g(\mu_k)$ denotes the normal density function.

Random intercept logit model

Building an Empty Model: To what extent do the Log-Odds vary between grades and schools?

The first step is usually to fit a null or empty two-level model, that is a model with only an intercept and grade effects.

This 'null' model may be written:

$$\log\left[\frac{\pi_{ijk}}{1-\pi_{ijk}}\right] = \beta_0 + \beta_1 x_{ij} + \mu_j \quad (2.7.6)$$

Where, $\mu_j \sim N(0,\sigma_\mu^2)$.

β_0 is interpreted as the log-odds that $y = 1$ when $x = 0$ and $\mu = 0$ and is referred to as the overall intercept in the linear relationship between the log-odds and x. If we take the exponential of β_0, $\exp(\beta_0)$, we obtain the odds that $y = 1$ for $x = 0$ and $\mu = 0$.

β_1 is the effect of a 1-unit change in x on the log-odds that $y = 1$, the effect of x after adjusting for (or holding constant) the grade effect μ.

If we are holding μ constant, then we are looking at the effect of x for individuals within the same group so β_1 is usually referred to as a cluster-specific effect.

μ_j is the grade (random) effect, grade residual, or level 2 residual.

The intercept β_0 is shared by all grades while the random effect μ_j is specific to grade j. The random effect is assumed to be to follow a normal distribution with variance σ_μ^2.

The second step was to fit another null or empty two-level model, that is a model with only an intercept and school effects.

This 'null' model may be written:

$$\log\left[\frac{\pi_{ijk}}{1-\pi_{ijk}}\right] = \beta_0 + \mu_{ok} \qquad (2.7.7)$$

The intercept β_0 is shared by all schools while the random effect μ_{oj} is specific to school k. The random effect is assumed to be to follow a normal distribution with variance $\sigma_{\mu 0}^2$.

2.8. Chapter Summary

This chapter has looked at the various aspects of suicide ideation with specific emphasis on the definitions of suicide ideation and adolescents, effects of suicidal ideation, factors associated with suicide ideation as well as models used to model the factors associated with suicide ideation. Statistical models in psychotic studies were also discussed, as well as the AIC and BIC model selection criterion.

The following chapter will outline the research methodology of the current study with an overview of research design, research sample, research instruments, research procedures, and finally the methods of data analysis.

CHAPTER 3: RESEARCH METHODS

3.1. Introduction

In this chapter, the various tools used to gather the relevant information have been listed and the methodology for analyzing data is explained. The chapter is divided into the following sections: research design, population of study, research instruments used as well as the procedures undertaken to collect data. In addition, the analytical techniques the study used to produce the final results are discussed.

3.2. Research Design

The study involved secondary analysis of data from the Namibia Global School-Based Health Survey (GSHS) conducted in 2013. The GSHS was developed by the World Health Organization (WHO) in collaboration with UNICEF, UNESCO and UNAIDS with technical assistance from the Centers of Diseases Control and Prevention, Atlanta, Georgia, United States. The purpose of the survey was to provide data on health and social behaviors among in-school adolescents aged 13 to 15 years (Muula et al, 2007).

3.3. Population and sampling methods

A total of 5 091 school-going adolescents registered in grades 7-12 were eligible to participate in the Namibia global school-based health survey (GSHS) but only 4 531 eventually participated, giving an overall response rate of 89%.

School-going adolescents self-reported their responses to each question on a computer scan-able sheet. The study participants were encouraged to answer all questions but also told that they were free not to

answer any question they felt uncomfortable with. Additionally, trained research assistants supervised the process. The school response rate was 100%, the adolescent response rate was 89% and the overall response rate was 89%.

A two-stage cluster sample method was used to produce data representative of all school-going adolescents in grade 7-12 in Namibia. In the first stage of sampling, the primary sampling units were schools and these were selected with probability proportional to enrolment size. Only 51 schools were selected. In the second stage of sampling, classes were randomly selected and all adolescents in selected classes were eligible to participate. These classes were within schools. All students in the selected classes were eligible to participate regardless of their age. A self-completed questionnaire was used and study participants completed the questionnaire within one class period. The questionnaire which covered demographic aspects and suicide ideation questions is in Appendix 4.

The study only included school-going adolescents aged 13-17 years in grades 7-12.

3.4. Variables in the study

The outcome (dependent) variable, suicidal ideation, was assessed using the following two questions (see Appendix 4):

- "During the past 12 months, did you ever seriously consider attempting suicide?" (Yes=1, No=0)
- "During the past 12 months, did you make a plan about how you would attempt suicide?" (Yes=1, No=0)

An index score for suicide ideation was constructed based on total index score with 0= Not suicidal, 1-2 = suicidal.

Potential risk factors included socio demographic variables: gender and age (years), as well as psychological factors, including dietary behaviour, violence, mental health, sexual behaviour, and tobacco, alcohol and drug use. All psychological factor (dietary behavior, violence, mental health, sexual behaviour, and tobacco, alcohol and drug use) levels were measured using a 3-item scale. Physical activity and experience at school or at home with parents and friends was also evaluated as potential risk factors in this study based on a set of questions, responses to which were categorized into poor, moderate and good relationship.

The following index scores were constructed (see Appendix 1 for the questions used to indicate these scores)**:**

Dietary behaviour with <12 as poor diet, 12-22 as medium diet and >22 as good diet.

Violence with <14 as little violence, 14-27 as medium violence and >27 as high violence.

Mental health with <6 as low mental health, 6-10 as medium mental health and >10 as high mental health.

Tobacco use with <13 as low tobacco use, 13-24 as medium tobacco use and >24 as high tobacco use.

Alcohol use with <10 as low alcohol use, 11-20 as medium alcohol use and >20 as high alcohol use.

Drug use with <8 as low drug use, 8-14 as medium drug use and >14 as high drug use.

Sexual behaviour with <18 as low sexual behaviour, 18-34 as medium sexual behaviour and >34 as high sexual behaviour.

Physical activity with <10 as little physical activity, 10-18 as medium physical activity and >18 as high physical activity.

Experience at home or at school with <9 as bad experience at school or home, 9-16 as medium experience at school or home and >16 as good experience at school or home.

Other variables included in the multilevel model were;

Grade: only grades 7 to 12 were sampled and included in the study, which are within schools.

School: only 51 schools are included in the study, which were selected with probability proportional to enrolment size.

3.5. Data Analysis: Multilevel Logistic Regression Model

In the first step, a model including only the random effect terms was built, to investigate variation in the prevalence of suicidal ideation at the grade and school levels before considering individual adolescent attributes.

A general multi-level logistic regression model that will be fitted in this study is as follows:

$$(logit(p_{ijk}) = \gamma_{000} + \sum_{p=1}^{P} \gamma_{p00} x_{pijk} + v_{00k} + u_{ojk} \qquad (3.5.1)$$

where p_{ijk} is the likelihood of suicide ideation for i th student in jth grade of kth school;

γ_{000} is the average intercept across all grades within all school (overall log of odds of suicide ideation when all other variables are set to be zeros);

v_{00k} is a specific-school effect on the overall intercept;

u_{ojk} is grade-school effect on the overall; and

γ_{p00} is the effect of the covariate x_{pijk} on the likelihood of suicide ideation.

However, this study only considered three levels, where level 1 (student) is nested in level 2 (grade) and level 2 is nested in level 3 (school).

To screen the covariates, univariable association between each risk factor and the outcomes were examined.

Multilevel analyses were carried out using maximum likelihood estimation in *glmer* from the *lme4* package in the R statistical software (Foundation for Statistical Computing, Vienna, Austria, 2007).

3.6. Research ethics

Ethical approval of this study was obtained from the Research Ethical Committee of the University of Namibia from The Centre of Postgraduate Studies. Extracted Data from the Centers for Disease Control and Prevention website did not include patient's identity and were kept in a locked computer. The privacy of participating schools and school-going adolescents is protected. Informed consents that required parents/guardians' signature were provided during the administration of the data collection.

3.7. Chapter Summary

The purpose of this chapter was to present a transparent sketch of the methodological approach and ethical considerations made in this study. The practical aspects of carrying out this research were also outlined by looking at the research design, population of study, research instruments used as well as the procedures undertaken to collect data. The process of data analysis to obtain the findings of the study was as well presented. Lastly, the researcher presented the ethical issues adhered to in

conducting the current research. The research results and discussion will be portrayed in the ensuing chapter, followed by the conclusions and recommendations in chapter five.

CHAPTER 4: RESULTS AND DISCUSSION

4.1. Introduction

The fourth chapter presents the results obtained from the applied statistical methods or techniques discussed in chapter 3. The results are outlined and interpreted in forms of equations, tables and figures.

4.2. Descriptive statistics

Of the 4 531 grade 7–12 students who completed the survey, 4 349 (96%) from 51 schools responded to the questions regarding suicide ideation; 1448 (32%) of these students indicated they had considered suicide at least once in the previous 12 months.

TABLE 2: PREVALENCE ESTIMATE (PERCENTAGES) AND 95% CONFIDENCE INTERVAL FOR MENTAL HEALTH

Mental Health	Total	Males	Females
Percentage of school-going adolescents who ever seriously considered attempting suicide during the past 12 months	[20.5(18.6-22.5)]	[20.8(17.7-24.3)]	[20.3(18.4-22.3)]
Percentage of school-going adolescents who actually attempted suicide one or more times during the past 12 months	[25.9(22.2-29.9)]	[27.7(23.1-32.8)]	[24.1(20.6-27.9)]

Table 2 shows that the percentage of school-going adolescents who ever seriously considered attempting suicide during the past 12 months is 20.5 and the percentage of school-going adolescents who actually attempted suicide one or more times during the past 12 months is 25.9.

TABLE 3: DESCRIPTIVE STATISTICS OF MAIN STUDY VARIABLES USED IN BUILDING THE MODEL

Variable	Chi squared statistic, p-value
Age	12.889, p = 0.075
Sex	2.009, p = 0.156
Grade	**78.970, p < 0.001**
School ID	**23.265, p < 0.001**
Dietary Behavior	**19.801, p < 0.001**
Violence	**208.362, p < 0.001**
Mental Health	**13.829, p < 0.001**
Tobacco Use	**48.491, p < 0.001**
Alcohol Use	**14.975, p < 0.001**
Drug Use	**65.806, p < 0.001**
Sexual Behavior	0.006, p = 0.936
Physical activity	1.014, p = 0.602
Experience at school or home	3.724, p = 0.155

In the univariate analysis (Table3), there was no significant association in reported suicidal ideation between gender or among students of different ages, or from sexual behavior, physical activity and experience at school or home. Table 13 provides socio-demographic characteristics of school-going adolescents in Namibia and Table 14 gives information on the bivariate association with suicide ideation indicators.

4.3. Multilevel analysis

4.3.1. Specifying and estimating a three-level model

Random intercept logit model

Building an Empty Model: To what extent do the Log-Odds of suicidal ideation vary between grades and schools?

The first step was to fit a null or empty two-level model, that is a model with only an intercept and grade effects.

Table 3 shows the results from fitting a multilevel logit model for the probability of being suicidal with grade effects but no explanatory variables. This null model is sometimes referred to as a variance components model.

TABLE 4: MULTILEVEL LOGIT MODEL FOR SUICIDE IDEATION, WITH GRADE EFFECTS

Parameter	**Estimate**	**Standard error**
β_0	-0.7605	0.2063
σ_μ^2	0.2602	0.1032

The log-likelihood is evaluated using the Laplacian approximation. From the model estimates in Table 4, (using Laplace Approximation), it can be said that the log-odds of having suicidal thoughts in an average grade (one with $\mu_{oj} = 0$) is estimated as $\hat{\beta}_0 = -0.7605$. The intercept for grade j is -0.7605 + μ_{oj}, where the variance of μ_{oj} is estimated as $\widehat{\sigma_{\mu 0}^2}$= 0.2602.

The likelihood ratio statistic for testing the null hypothesis, that $\widehat{\sigma_{\mu 0}^2} = 0$, was calculated by comparing the two-level model, with the corresponding single-level model without level two random effects.

The test statistic is 208.2962 (-2×-104.1481) with 1 degree of freedom, so there is strong evidence that the between-grade variance is non-zero.

The following graph shows grade effects shown in rank order together with 95% confidence intervals.

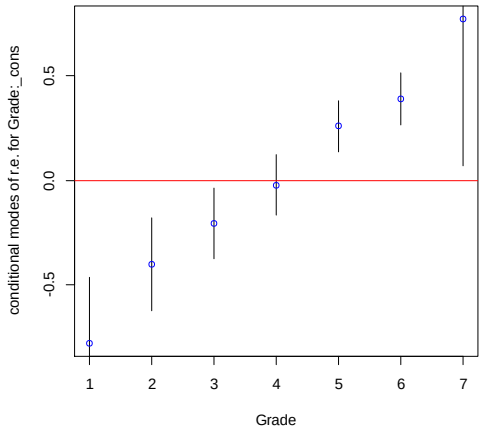

FIGURE 1: GRADE RESIDUALS WITH 95% CONFIDENCE INTERVALS FOR LOG ODDS OF SUICIDE IDEATION

Figure 1 shows the estimated residuals for all 7 grades (Grade 7-12) in the sample. The 95% confidence interval does not overlap the horizontal line at zero, indicating that suicidal ideation in these grades is significantly above average (above the zero line) or below average (below the zero line). It can be observed that the confidence intervals are quite wide.

The inter-grade suicide ideation variation was significant with inter-correlation coefficient of 7.33%.

The second step was to fit another null or empty two-level model (with school as second level), that is a model with only an intercept and school effects.

TABLE 5: MULTILEVEL LOGIT MODEL FOR SUICIDE IDEATION, WITH SCHOOL EFFECTS

Parameter	**Estimate**	**Standard error**
β_0	-0.71705	0.0818
σ_μ^2	0.2802	0.0409

It can be said that the log-odds of having suicidal thoughts in an average school (one with $\mu_{oj} = 0$) is estimated as $\hat{\beta}_0 = -0.71705$ (Table 5). The intercept for grade j is -0.71705 + μ_{oj}, where the variance of μ_{oj} is estimated as $\widehat{\sigma_{\mu 0}^2}$= 0.2802.

The likelihood ratio statistic for testing the null hypothesis, that $\widehat{\sigma_{\mu 0}^2} = 0$, was calculated by comparing the two-level model, with the corresponding single-level model without level two random effects.

The test statistic is 169.53006 (-2×-84.76503) with 1 degree of freedom, so there is strong evidence that the between-grade variance is non-zero.

To examine the estimates of grade effects or residuals, $\widehat{\mu_{oj}}$,obtained from the null model. The following graph shows grade effects shown in rank order together with 95% confidence intervals.

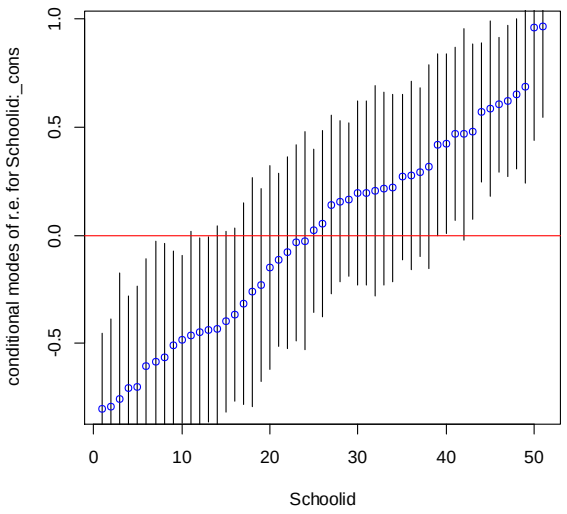

FIGURE 2: SCHOOL RESIDUALS WITH 95% CONFIDENCE INTERVALS FOR LOG ODDS OF SUICIDE IDEATION

Figure 2 shows the estimated residuals for all 51 schools in the sample. The 95% confidence interval does not overlap the horizontal line at zero, indicating that suicidal ideation in these schools is significantly above average (above the zero line) or below average (below the zero line).

The inter-school suicide ideation variation was significant with inter-correlation coefficient of 7.85%.

TABLE 6: MULTILEVEL LOGIT MODEL FOR SUICIDE IDEATION, WITH GRADE AND SCHOOL EFFECTS

Parameter	**Estimate**	**Standard error**
β_0	-0.7608	0.2017
σ_μ^2(Grade)	0.2107	0.1052
σ_μ^2(School)	0.2539	0.1270

Table 6 shows the estimate and standard errors in the multilevel logit model for suicide ideation, with school and grade effects.

TABLE 7: NULL MODEL SELECTION

	logLik	AIC	BIC	Deviance	Df.residual
Grade (model0)	-2662.9	5329.8	5342.5	5325.8	4248
School (model00)	-2682.3	5368.6	5381.3	5364.6	4347
Grade and school (model000)	**-2599.4**	**5204.7**	**5223.8**	**5198.7**	**4247**

Table 7 shows the AIC, BIC, log likelihood, deviance and df.residual for the null models fitted earlier as model0, model00 and model000 respectively. The null model that best fits the data is model000, that is the model for grade and schools. The selection is done because the AIC and BIC are slightly smaller than those of model0 and model00.

4.3.2. Adding explanatory variables

Multilevel logistic regression model with level 1 explanatory variables (student characteristics)

The following explanatory variables were added to the model:

Age, Sex, Dietary Behaviour, Experience at home/school, Physical activities, Violence, Dietary behaviour, Mental health, Sexual behaviour, Tobacco use, Alcohol use and Drug use.

TABLE 8 : MULTILEVEL LOGIT MODEL WITH STUDENT CHARACTERISTICS, MODEL 1

Fixed Effects	**Estimate**	**St. Error**	**Z value**	**Pr(>|z|)**
Intercept	-3.86774	0.45057	-8.584	< 2e-16***
Age	0.15625	0.03978	3.928	8.58e-05***
Sex	0.15284	0.09187	1.664	0.096156
Dietary Behaviour	0.19519	0.07743	2.521	0.011713*
Violence	0.61030	0.9222	6.618	3.64e-11***
Mental Health	0.35997	0.09487	3.794	0.000148***
Sexual Behaviour	0.03043	0.19363	0.157	0.875141
Physical Activity	0.01598	0.06865	0.233	0.815917

From the above table 8, we observe that the estimates for the age, dietary behaviour, violence and mental health fixed slopes are significant, and therefore it is said that the student suicide ideation scores do vary by grade.

TABLE 9: MULTILEVEL LOGIT MODEL WITH SCHOOL CHARACTERISTICS, MODEL 2

Fixed Effects	Estimate	St. Error	Z value	Pr(>|z|)
Intercept	-2.22545	0.24956	-8.918	< 2e-16***
Experience at school and home	0.10879	0.07687	1.415	0.15699
Tobacco use	0.30853	0.10043	3.072	0.00213**
Alcohol use	0.09241	0.09152	1.010	0.31261
Drug use	0.50818	0.12808	3.968	7.26e-05***

From the above table (Table 9), we observe that the estimates for the Tobacco use and Drug use fixed slopes are significant, and therefore it is said that the student suicide ideation scores do vary by school.

Next, a full model with all explanatory variables was fitted.

TABLE 10: MULTILEVEL LOGIT MODEL WITH STUDENT AND SCHOOL CHARACTERISTICS, MODEL 3

Fixed Effects	Estimate	St. Error	Z value	Pr(>|z|)
Intercept	-4.71998	0.60237	-7.836	4.67e-15***
Age	0.13484	0.05360	2.515	0.01189*
Sex	0.20064	0.11256	1.782	0.07467·
Dietary Behaviour	0.16998	0.09672	1.757	0.07885·
Violence	0.49095	0.12039	4.078	4.54e-05***
Mental Health	0.31813	0.11559	2.752	0.00592**
Sexual Behaviour	0.13208	0.23709	0.557	0.57748
Physical Activity	0.03222	0.08309	0.388	0.69821
Experience at home and school	0.06594	0.09846	0.670	0.50302
Tobacco use	0.25846	0.12789	2.021	0.04329*

Alcohol use	0.08074	0.11705	0.690	0.49033
Drug use	0.41418	0.17385	2.382	0.01720*

From the above table (Table 10), we observe that the estimates for the age, violence, mental health and tobacco use and drug use fixed slopes are significant, and therefore it is said that the student suicide ideation scores do vary by grade and school.

Next, a full multilevel model, with all explanatory variables that were significant in model 1 and model 2 was fitted.

TABLE 11 : MULTILEVEL LOGIT MODEL WITH SIGNIFICANT STUDENT AND SCHOOL CHARACTERISTICS, MODEL 4

Fixed Effects	**Estimate**	**St. Error**	**Z value**	**Pr(>|z|)**
Intercept	-4.13306	0.43688	-9.460	< 2e-16***
Age	0.10061	0.04497	2.237	0.025269*
Sex	0.21496	0.09573	2.245	0.024740*
Dietary Behaviour	0.17132	0.08105	2.114	0.034537*
Violence	0.52827	0.09895	5.358	8.41e-08***
Mental Health	0.30259	0.09988	3.029	0.002450**
Tobacco use	0.36034	0.10762	3.348	0.000813***
Drug use	0.37474	0.14122	2.654	0.007963**

From the above table 11, we observe that the estimates for all explanatory variables that were significant in models 1 and 2 are still significant, and therefore it is said that the student suicide ideation scores do vary by grade and school. All the variables in the study were positively associated with the likelihood of suicide ideation.

TABLE 12: MODEL SELECTION

	logLik	AIC	BIC	Deviance	Df.residual	ICC
Grade (model1)	-1492.9	3003.8	3056.6	2985.8	2599	7.20%
School (model2)	-1661.0	3333.9	3369.7	3321.9	2852	6.79%
Grade and school (model3)	**-1074.4**	**2176.8**	**2254.7**	**2148.8**	**1923**	**4.24%**
Grade* and school* (model4)	-1436.4	2892.8	2951.3	2872.8	2548	4.94%

Table 12 shows the model selection criteria. It can be observed that the model that best fits the data is model 3. The AIC for model 3 is 2176.8 and the BIC is 2254.7. These measures are smaller than those of models 1, 2 and 4. It was observed earlier in model 3, that the estimates for the age, violence, mental health and tobacco use and drug use fixed slopes are significant, and therefore it is said that the student suicide ideation scores do vary by grade and school.

Note: these models are just looking at random components only and not at the covariates.

Partitioning variance

The between-school (level 2) variance School (Intercept) in grade is estimated as $\sigma^2_{\mu 0}$ = 0.0049, and the within-school between-student (level 1) variance Residual is estimated as σ^2_e = 0.1031. Thus, the total variance is 0.0049 + 0.1031 = 0.108. The variance partition coefficient (VPC) is 0.0049/0.108 = 0.0454, which indicates that 5% of the variance in suicide ideation can be attributed to differences between schools. The variance partition coefficient for grade (VPC) is 0.0025/0.1082 = 0.0231, which indicates that 2% of the variance in suicide ideation can be attributed to differences between grades.

4.4.Limitations of the study

This study was based on data collected in a cross-sectional survey and relied on recall of information over a period of 12 months. There may be misreporting due to inability to recall, or deliberate or intentional misreporting. Since a cross sectional study design was used, it is deemed difficult to make causal inferences and the situation may provide different results if another time-frame had been chosen.

Additionally, the adolescents who participated in the survey were the ones attending school, leaving the drop-outs. Thus, caution will be taken in generalizing the findings to the general population of adolescents in Namibia.

4.5.Delimitation of the study

The study only included school-going adolescents aged 13-17 years in grades 7-12.

4.6.Chapter Summary

Chapter 4 presented, analyzed and interpreted data collected in the study. Figures and tables were used to summarize the data. The overall mean suicide ideation (across schools) is estimated as 2.13 (Pr(>|t|) < 0.001***) and the overall mean suicide ideation (across grades) is estimated as 2.12 (Pr(>|t|) = 0.001***). In the null model including only the random intercepts for grade and school, the VPC for grade was 2% and for school was 5%. In the univariate analysis (Table 3), there was no significant difference in reported suicidal ideation between age, sex, sexual behavior, physical activity and experience at school or home. Fitting the two random effect models yielded that the model that best fits the data is the random slope model of suicide ideation with linear grade and school effects with AIC of 2176.8. From the final multilevel output in Table 11, it was observed that the estimates for the

age, sex, dietary behaviour, violence, tobacco use, drug use and mental health `fixed slopes are significant, and therefore student suicide ideation scores do vary by grade and school.

The next chapter outlines the conclusions and recommendations of the study.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1. Introduction

The chapter is dedicated to the conclusions and the recommendations drawn from the results of the study, in relation to the research objectives.

5.2. Conclusions

The main objective of the study was to examine/ assess the prevalence and factors associated with suicide ideation among school going adolescents in Namibia, while controlling for clustering at grade and school levels. The specific objectives of the study were to establish the prevalence of suicide ideation and to determine factors associated with suicidal ideation among school going adolescents in Namibia.

In the first step, a model including only the random effect terms was built, to investigate variation in the likelihood of suicidal ideation at the grade and school levels before considering individual adolescent attributes. To screen the covariates, univariable association between each risk factor and the outcome (suicide ideation) was examined. Multilevel analyses were carried out using maximum likelihood estimation in *glmer* from the *lme4* package in the R Statistical Software.

Various models with all explanatory variables were fitted to determine which one fits the data best. From the final multilevel output in Table 10, it was observed that model 3 fits the data best and estimates for the age, tobacco use, drug use and mental health fixed slopes are significant, and therefore student suicide ideation scores do vary by grade and school.

5.3. Recommendations

The study expands the research area on suicidal ideation in adolescence in Namibia.

The cross-sectional design used in the study makes it difficult to establish causality. It is therefore recommended that future researchers look into other study designs. Future researchers can also use multilevel multinomial logistic regression modelling instead of multilevel binary logistic regression modelling that was used in this study.

Future researchers are encouraged to look into cross level interactions to the model and backward level analysis as the current study did not consider that.

Due to a small number of grades (i.e 7-12), the maximum likelihood estimation may have produced unstable estimates and therefore, future researchers may use a Bayesian approach.

This study was based on data collected in a cross-sectional survey and relied on recall of information over a period of 12 months. There may be misreporting due to inability to recall, or deliberate or intentional misreporting. Since a cross sectional study design was used, it is deemed difficult to make causal inferences and the situation may provide different results if another time-frame had been chosen. Additionally, the adolescents who participated in the survey were the ones attending school, leaving the drop-outs and out-of-school adolescents. Further, the study only included school-going adolescents aged 13-17 years in grades 7-12 and hence out-of-school adolescents should be considered by future studies.

Future research examining risk factors from multiple-level analysis is necessary to better understand youth suicidal behaviors and elucidate the cognitive, physiological and behavioral pathways leading to the development of suicidal behaviors during adolescence.

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APPENDICES

Appendix 1

TABLE 13: SOCIO-DEMOGRAPHIC CHARACTERISTICS OF SCHOOL-GOING ADOLESCENTS IN NAMIBIA

	Unweighted frequency	Unweighted percentage
Demographic variables		
1. How old are you?		
11 years old or younger	32	0.7
12 years old	64	1.4
13 years old	519	11.5
14 years old	602	13.3
15 years old	751	16.6
16 years old	719	15.9
17 years old	692	15.3
18 years old or older	1107	24.4
Missing	45	1
2. Sex		
Male	2114	46.7
Female	2356	52.0
Missing	61	1.3
3. Grade		
Grade 6	17	0.4
Grade 7	1067	23.5
Grade 8	1145	25.3
Grade 9	850	18.8
Grade 10	685	15.1
Grade 11	414	9.1
Grade 12	249	5.5
Missing	104	2.3
Dietary Behavior		
4. Went hungry past 30 days		
Never	2054	45.3
Rarely	233	5.1
Sometimes	1714	37.8
Most of the time	307	.8
Always	141	3.1
Missing	82	1.8
5. Eat fruit per day past 30 days		
Did not eat fruit	916	20.2
Less than one time per day	1055	23.3
time per day	1165	25.7
times per day	498	11.0
times per day	284	6.3
times per day	113	2.5

or more times per day	451	10.0
Missing	48	1.1
6. Eat vegetables past 30 days		
Did not eat vegetables	949	20.9
Less than one time per day	890	19.6
1 time per day	1277	38.2
2 times per day	556	12.3
3 times per day	26	5.9
4 times per day	11	2.4
5 or more times per day	430	9.5
Missing	53	1.2
7. Drink soft drinks past 30 days		
Did not drink soft drinks	1228	27.4
Less than one time per day	1139	25.1
1 time per day	988	21.8
2 times per day	427	9.4
3 times per day	228	5.0
4 times per day	140	3.1
5 or more times per day	330	7.3
Missing	51	1.1
8. Ate fast food past 7 days		
0 days	2252	49.7
1 day	976	21.5
2 days	475	10.5
3 days	260	5.7
4 days	187	4.1
5 days	102	2.3
6 days	76	1.7
7 days	194	4.3
Missing	9	0.2
Hygiene		
9. How many times per day brush teeth		
Did not brush my teeth	165	3.
Less than 1 time per day	311	6.9
1 time per day	1048	23.1
2 times per day	1286	28.4
3 times per day	912	20.1
4 or more times per day	789	17.4
Missing	20	0.4
10. Wash hands before eating past 30 days		
Never	120	2.6
Rarely	81	1.8
Sometimes	644	14.2
Most of the time	1006	22.2
Always	2649	58.5
Missing	31	0.7
11. Wash hands after toilet past 30 day		
Never	164	3.6
Rarely	102	2.3
Sometimes	1008	22.2
Most of the time	1011	22.3
Always	2204	48.6
Missing	42	0.9
12. Use soap on hands past 30 days		

Never	308	6.8
Rarely	165	3.6
Sometimes	1683	37.1
Most of the time	898	19.8
Always	1400	30.9
Missing	77	1.7
Violence and Unintentional injury		
13. Times attacked past 12 mo.		
0 times	2694	59.5
1 time	676	14.9
2 or 3 times	441	9.7
4 or 5 times	159	3.5
6 or 7 times	93	2.1
8 or 9 times	56	1.2
10 or 11 times	59	1.3
12 or more times	269	5.9
Missing	84	1.9
14. how many times in fight 12 mos		
0 times	3017	66.6
1 time	708	15.6
2 or 3 times	366	8.1
4 or 5 times	131	2.9
6 or 7 times	60	1.3
8 or 9 times	48	1.1
10 or 11 times	40	0.9
12 or more times	140	3.1
Missing	21	0.5
15. How many times injured past 12 months		
0 times	1776	39.2
1 time	1067	23.5
2 or 3 times	600	13.2
4 or 5 times	181	4.0
6 or 7 times	98	2.2
8 or 9 times	48	1.1
10 or 11 times	45	1.0
12 or more times	155	3.4
Missing	561	12.4
16. what was serious injury past 12 mo.		
Not seriously injured	2292	50.6
Broken bone/dislocated joint	313	6.9
I had a cut or stab wound	492	10.9
Concussion/ head injury	136	3.0
I had a gunshot wound	30	0.7
I had a bad burn	104	2.3
I was poisoned	42	0.9
Something else happened to me	671	14.8
Missing	451	10.0
17. Cause of injury past 12 mo.		
Not seriously injured	2301	50.8
Motor vehicle accident	154	3.4
I fell	425	9.4
Something fell on me or hit me	320	7.1
I was attacked	165	3.6
Was in fire	86	1.9

Breathed something bad	50	1.1
Something else	563	12.4
Missing	467	10.3
Mental health		
18. how many days bullied past 30 days		
0 days	2244	49.5
1 or 2 days	995	22.0
3 to 5 days	381	8.4
6 to 9 days	182	4.0
10 to 19 days	100	2.2
20 to 29 days	59	1.3
All 30 days	175	3.9
Missing	395	8.7
19. How bullied past 30 days		
Not bullied	2494	55.0
Kicked, pushed, or shoved	321	7.1
Made fun of race	203	4.5
Made fun because of religion	105	2.3
Made fun of about sex	148	3.3
Left out of activities	84	1.9
Made fun of about body	294	6.5
Some other way	475	10.5
Missing	407	9.0
20. times felt lonely past 12 mo.		
Never	1429	31.5
Rarely	277	6.1
Sometimes	2088	46.1
Most of the time	449	9.9
Always	239	5.3
Missing	49	1.1
21. times could not sleep past 12 mo.		
Never	1624	35.8
Rarely	369	8.1
Sometimes	1804	39.8
Most of the time	476	10.5
Always	213	4.7
Missing	45	1.0
22. ever considered suicide past 12 mos		
Yes	868	19.2
No	3519	77.7
Missing	144	3.2
23. ever make suicide plan past 12 mos		
Yes	1181	26.1
No	3270	72.2
Missing	80	1.8
24. times attempted suicide past 12 mos		
0 times	3257	71.9
1 time	696	15.4
2 or 3 times	300	6.6
4 or 5 times	89	2.0
6 or more times	118	2.6
Missing	71	1.6
25. number of close friends		
0	569	12.6

1	1169	25.8
2	970	21.4
3 or more	1728	38.1
Missing	95	2.1
Tobacco use		
26. age first smoked		
I have never smoked cigarettes	3110	68.6
7 years old or younger	160	3.5
8 or 9 years old	115	2.5
10 or 11 years old	122	2.7
12 or 13 years old	182	4.0
14 or 15 years old	209	4.6
16 or17 years old	161	3.6
18 years old or older	48	1.1
Missing	424	9.4
27. how many days smoked past 30 days		
0 days	4052	89.4
1 or 2 days	198	4.4
3 to 5 days	62	1.4
6 to 9 days	32	0.7
10 to 19 days	27	0.6
20 to 29 days	24	0.5
All 30 days	81	1.8
Missing	55	1.2
28. other tobacco past 30 days		
0 days	4180	92.3
1 or 2 days	163	3.6
3 to 5 days	36	0.8
6 to 9 days	33	0.7
10 to 19 days	36	0.8
20 to 29 days	20	0.4
All 30 days	35	0.8
Missing	28	0.6
29. try stop smoking past 12 mo		
I have never smoked cigarettes	3401	75.1
Did not smoke cigarettes	300	6.6
Yes	314	6.9
No	121	2.7
Missing	395	8.7
30. others present smoking past 7 days		
0 days	2016	44.5
1 or 2 days	973	21.5
3 or 4 days	364	8.0
5 or 6 days	199	4.4
All 7 days	944	20.8
Missing	35	0.8
31. parents who use tobacco		
Neither	2226	49.1
my father or male guardian	469	10.4
My mother or female guardian	157	3.5
Both	104	2.3
I do not know	1521	33.6
Missing	54	1.2
Alcohol use		

32. age first alcohol		
Never drank alcohol	1610	35.5
7 years old or younger	354	7.8
8 or 9 years old	157	3.5
10 or 11 years old	239	5.3
12 or 13 years old	415	9.2
14 or 15 years old	499	11.0
16 or17 years old	324	7.2
18 years old or older	152	3.4
Missing	781	17.2
33. days one drink or more past 30 days		
0 days	2880	63.6
1 or 2 days	864	19.1
3 to 5 days	256	5.6
6 to 9 days	109	2.4
10 to 19 days	84	1.9
20 to 29 days	33	0.7
All 30 days	58	1.3
Missing	247	5.5
34. number of drinks past 30 days		
Did not drink in past 30 days	2792	61.6
Less than one drink	614	13.6
1 drink	453	10.0
2 drinks	200	4.4
3 drinks	98	2.2
4 drinks	62	1.4
5 or more drinks	148	3.3
Missing	164	3.6
35. how got drinks past 30 days		
Did not drink in past 30 days	2780	61.4
I bought in store	342	7.5
I gave someone money to buy	116	2.6
I got it from my friends	476	10.5
I got it from my family	289	6.4
I stole it	63	1.4
Some other way	167	3.7
Missing	298	6.6
36. times drunk during life		
0 times	3022	66.7
1 or 2 times	907	20.0
3 to 9 times	198	4.4
10 or more times	159	3.5
Missing	245	5.4
37. number of troubles as result of drinking		
0 times	3632	80.2
1 or 2 times	379	8.4
3 to 9 times	111	2.4
10 or more times	94	2.1
Missing	315	7.0
Drug use		
38. age first drugs		
I have never used drugs	3321	73.3
7 years old or younger	145	3.2
8 or 9 years old	59	1.3

10 or 11 years old	62	1.4
12 or 13 years old	97	2.1
14 or 15 years old	180	4.0
16 or17 years old	129	2.8
18 years old or older	75	1.7
Missing	463	10.2
39. times used marijuana lifetime		
0 times	4032	89.0
1 or 2 times	130	2.9
3 to 9 times	63	1.4
10 to 19 times	29	0.6
20 0r more times	71	1.6
Missing	206	4.5
40. times used marijuana past 30 days		
0 times	4142	91.4
1 or 2 times	112	2.5
3 to 9 times	41	0.9
10 to 19 times	31	0.7
20 0r more times	40	0.9
Missing	165	3.6
41. times used amphetamines lifetime		
0 times	3973	87.7
1 or 2 times	123	2.7
3 to 9 times	45	1.0
10 to 19 times	33	0.7
20 0r more times	34	0.8
Missing	323	7.1
Sexual behavior		
42. ever had sex		
Yes	2021	44.6
No	1814	40.0
Missing	696	15.4
43. age first sexual intercourse		
Never had sex	2396	52.9
11 years old or younger	430	9.5
12 years old	163	3.6
13 years old	133	2.9
14 years old	163	3.6
15 years old	291	6.4
16 or17 years old	417	9.2
18 years old or older	142	3.1
Missing	396	8.7
44. how many sex partners		
Never had sex	2430	53.6
1 person	691	15.3
2 people	297	6.6
3 people	185	4.1
4 people	106	2.3
5 people	71	1.6
6 or more people	354	7.8
Missing	397	8.8
45. Used condom at last intercourse		
Never had sex	2424	53.5
Yes	1272	28.1

No	410	9.0
Missing	425	9.4
46. used birth control last intercourse		
Never had sex	2252	49.7
Yes	733	16.2
No	638	14.1
I do not know	382	8.4
Missing	526	11.6
Physical activity		
47. days active 60 min plus past 7 days		
0 days	1714	37.8
1 day	753	16.6
2 days	477	10.5
3 days	362	8.0
4 days	207	4.6
5 days	240	5.3
6 days	86	1.9
7 days	643	14.2
Missing	49	1.1
48. walk or bike to school past 7 days		
0 days	2280	50.3
1 day	342	7.5
2 days	190	4.2
3 days	143	3.2
4 days	102	2.3
5 days	412	9.1
6 days	55	1.2
7 days	956	21.1
Missing	51	1.1
49. days went to PE each week		
0 days	1024	22.6
1 day	1678	37.0
2 days	375	8.3
3 days	157	3.5
4 days	158	3.5
5 or more days	1095	24.2
Missing	44	1.0
50. time spent sitting on usual day		
Less than 1 hour per day	1624	35.8
1 to 2 hours per day	1237	27.3
3 to 4 hours per day	706	15.6
5 to 6 hours per day	245	5.4
7 to 8 hours per day	126	2.8
More than 8 hours per day	527	11.6
Missing	66	1.5
51. miss school no permission past 30 days		
0 days	3276	72.3
1 or 2 days	732	16.2
3 to 5 days	240	5.3
6 to 9 days	72	1.6
10 or more days	131	2.9
Missing	80	1.8
Experience at school/home		
52. others helpful in school past 30 days		

Never	988	21.8
Rarely	419	9.2
Sometimes	1808	39.9
Most of the time	650	14.3
Always	622	13.7
Missing	44	1.0
53. parents check homework past 30 days		
Never	1185	26.2
Rarely	267	5.9
Sometimes	1182	26.1
Most of the time	644	14.2
Always	1197	26.4
Missing	56	1.2
54. parent understand troubles past 30 days		
Never	974	21.5
Rarely	283	6.2
Sometimes	1350	29.8
Most of the time	744	16.4
Always	1072	23.7
Missing	108	2.4
55. parent know what you do past 30 days		
Never	1149	25.4
Rarely	334	7.4
Sometimes	1545	34.1
Most of the time	672	14.8
Always	783	17.3
Missing	48	1.1
56. parent go through things past 30 days		
1	2160	47.7
2	386	8.5
3	1142	25.2
4	427	9.4
5	369	8.1
Missing	47	1.0

Appendix 2

TABLE 14: BI-VARIATE ASSOCIATIONS WITH SUICIDE IDEATION INDICATORS

Variables	**Ever considered suicide in the past 12 months**	**Ever made suicide plan in the past 12 months**	**Times attempted suicide in the past 12 months**
Demographic variables	Chi squared statistic, pvalue	Chi squared statistic, pvalue	Chi squared statistic, pvalue
Age group	**16.152, p= 0.024**	10.123, p= 0.182	26.480, p= 0.547
Sex	1.257, p= 0.262	0.177, p= 0.674	5.878, p= 0.208
Grade	**23.292, p= 0.001**	**73.489, p= 0.000**	**141.472, p= 0.00**
Dietary behavior			
Went hungry past 30 days	**48.721, p= 0.000**	**33.228, p= 0.000**	**125.245, p= 0.000**
Eat fruit per day past 30 days	**17.386, p= 0.008**	**26.742, p= 0.000**	**57.593, p= 0.000**
Eat vegetables past 30 days	6.969, p= 0.324	**18.122, p= 0.006**	**55.250, p= 0.000**
Drink soft drinks past 30 days	4.934, p= 0.552	**12.812, p= 0.046**	**76.140, p= 0.000**
Ate fast food past 7 days	**18.292, p= 0.011**	**60.934, p= 0.000**	**182.818, p= 0.000**
Hygiene			
How many times per day brush teeth	**32.224, p= 0.000**	**56.617, p= 0.000**	**143.868, p= 0.000**
Wash hands before eating past 30 days	6.065, p= 0.194	6.646, p= 0.156	**60.108, p= 0.000**
Wash hands after toilet past 30 day	**13.366, p= 0.010**	5.776, p= 0.217	**36.090, p= 0.003**
Use soap on hands past 30 days	8.292, p= 0.081	**10.980, p= 0.027**	19.361, p= 0.250
Violence and Unintentional injury			
Times attacked past 12 mo.	**71.342, p= 0.000**	**150.446, p= 0.000**	**525.219, p= 0.000**
how many times in fight 12 mos	**58.444, p= 0.000**	**140.162, p= 0.000**	**495.447, p= 0.000**
How many times injured past 12 months	**62.424, p= 0.000**	**153.249, p= 0.000**	**471.395, p= 0.000**
What was serious injury past 12 mo.	**35.973, p = 0.000**	**83.728, p= 0.000**	**226.447, p= 0.000**
Cause of injury past 12 mo.	**42. 680, p= 0.000**	**97.543, p= 0.000**	**223.153, p= 0.000**
how many days bullied past 30 days	**57.228, p= 0.000**	**78.079, p= 0.000**	**364.056, p= 0.000**
How bullied past 30 days	**43.609, p = 0.000**	**54.315, p= 0.000**	**194.565, p= 0.000**
Mental Health			
Times felt lonely past 12 mo.	**55.994, p= 0.000**	**59.999, p= 0.000**	**105.346, p= 0.000**
Times could not sleep past 12 mo.	**80.411, p= 0.000**	**76.229, p= 0.000**	**145.139, p= 0.000**

number of close friends	5.195, p = 0.158	7.263, p= 0.064	**27.201, p=0.007**
Tobacco Use			
age first smoked	**27.379, p = 0.000**	**24.424, p= 0.001**	**78.668, p= 0.000**
how many days smoked past 30 days	**55.184, p= 0.000**	**41.748, p= 0.000**	**252.369, p= 0.000**
other tobacco past 30 days	**58.434, p= 0.000**	**73.190, p= 0.000**	**242.030, p= 0.000**
try stop smoking past 12 mo	**29.967, p= 0.000**	**28.670, p= 0.000**	**59.055, p= 0.000**
others present smoking past 7 days	**24.632, p= 0.000**	**31.925, p= 0.000**	**60.391, p= 0.000**
parents who use tobacco	**24.267, p= 0.000**	**43.844, p= 0.000**	**132.363, p= 0.000**
Alcohol Use			
age first alcohol	7.722, p= 0.358	**16.894, p=0.018**	**52.686, p= 0.003**
days one drink or more past 30 days	**26.783, p= 0.000**	**12.976, p= 0.043**	**210.807, p= 0.000**
number of drinks past 30 days	**15.092, p= 0.020**	9.345, p=0.155	**53.382, p= 0.001**
how got drinks past 30 days	**15.296, p= 0.018**	8.829, p= 0.183	**67.382, p= 0.000**
times drunk during life	**28.354, p= 0.000**	**22.034, p= 0.000**	**99.851, p= 0.000**
number of troubles as result of drinking	**37.498, p= 0.000**	**43.015, p= 0.000**	**190.086, p= 0.000**
Drug Use			
age first drugs	**31.848, p= 0.000**	**39.418, p= 0.000**	**149.245, p= 0.000**
times used marijuana lifetime	**48.593, p= 0.000**	**44.531, p= 0.000**	**215.120, p= 0.000**
times used marijuana past 30 days	**48.007, p= 0.00**	**35.954, p= 0.000**	**293.539, p= 0.000**
times used amphetamines lifetime	**57.695, p= 0.000**	**78.223, p= 0.000**	**331.324, p= 0.000**
Sexual Behavior			
ever had sex	**27.651, p= 0.000**	**26.525, p= 0.000**	**35.434, p= 0.000**
age first sexual intercourse	10.096, p=0.183	11.624, p= 0.114	**41.425, p= 0.049**
how many sex partners	**17.491, p= 0.008**	**14.361, p= 0.026**	**70.899, p= 0.000**
Used condom at last intercourse	**6.700, p= 0.035**	2.703, p= 0.259	**17.466, p= 0.026**
used birth control last intercourse	**15.952, p= 0.001**	**9.026, p= 0.029**	**28.555, p= 0.005**
Physical activity			
days active 60 min plus past 7 days	2.746, p= 0.907	5.628, p= 0.584	**54.055, p= 0.002**
walk or bike to school past 7 days	**14.231, p= 0.047**	**21.667, p= 0.003**	**74.472, p= 0.000**
days went to PE each week	5.649, p= 0.342	7.570, p= 0.182	**52.448, p= 0.000**
time spent sitting on usual day	**14.692, p= 0.012**	**19.428, p= 0.002**	**68.217, p= 0.000**
miss school no permission past 30 days	**26.175, p= 0.000**	**50.697, p= 0.000**	**208.272, p= 0.000**
Experience at School/home			
others helpful in school past 30 days	**13.522, p= 0.009**	3.878, p=0.423	**54.340, p= 0.000**

parents check homework past 30 days	6.670, p= 0.154	**43.650, p= 0.000**	**39.533, p= 0.001**
parent understand troubles past 30 days	**9.683, p= 0.046**	6.180, p=0.186	22.628, p= 0.124
parent know what you do past 30 days	2.173, p= 0.704	**4.878, p= 0.300**	15.130, p= 0.515
parent go through things past 30 days	**18.157, p= 0.001**	**42.122, p= 0.000**	**82.258, p= 0.000**

Appendix 3

R codes

Null Multilevel Logistic Regression Model

GRADE

```
library(foreign)
mydata=read.spss("F:\\Sesilia2019\\SI22Oct2020_1.sav")
library(lme4)
model0<-glmer(ideationbinary ~ (1|Grade), data = mydata, family = binomial("logit"))
summary(model0)


model00<-glm(ideationbinary ~ (1|Grade), data = mydata, family = binomial("logit"))
logLik(model00)-logLik(model0)
icc<-model00@theta[1]^2/(model00@theta[1]^2 + (3.14159^2/3))
icc

u0 <- ranef(model0, condVar = TRUE)
u0se <- sqrt(attr(u0[[1]], "postVar")[1, , ])
Grade <- as.numeric(rownames(u0[[1]]))
u0tab <- cbind("Grade"=Grade,"u0"=u0[[1]], "u0se"=u0se)
colnames(u0tab) [2]<- "u0"
u0tab <- u0tab[order(u0tab$u0), ]
u0tab <- cbind(u0tab, c(1:dim(u0tab)[1]))
u0tab <- u0tab[order(u0tab$Grade), ]
colnames(u0tab)[4] <- "u0rank"
u0tab[1:10, ]
plot(u0tab$u0rank, u0tab$u0, type = "n", xlab = "Grade", ylab = "conditional modes of r.e. for Grade:_cons")
segments(u0tab$u0rank, u0tab$u0 - 1.96*u0tab$u0se, u0tab$u0rank, u0tab$u0 + 1.96*u0tab$u0se)
points(u0tab$u0rank, u0tab$u0, col="blue")
abline(h=0, col="red")
```

SCHOOL

```
library(foreign)
mydata=read.spss("F:\\Sesilia2019\\SI22Oct2020_1.sav")
library(lme4)
model0<-glmer(ideationbinary ~ (1|Schoolid), data = mydata, family = binomial("logit"))
summary(model0)


model00<-glm(ideationbinary ~ (1|Schoolid), data = mydata, family = binomial("logit"))
logLik(model00)-logLik(model0)
icc<-model00@theta[1]^2/(model00@theta[1]^2 + (3.14159^2/3))
icc
u0 <- ranef(model0, condVar = TRUE)
u0se <- sqrt(attr(u0[[1]], "postVar")[1, , ])
Schoolid <- as.numeric(rownames(u0[[1]]))
u0tab <- cbind("Schoolid"=Schoolid,"u0"=u0[[1]], "u0se"=u0se)
colnames(u0tab) [2]<- "u0"
u0tab <- u0tab[order(u0tab$u0), ]
u0tab <- cbind(u0tab, c(1:dim(u0tab)[1]))
```

```
u0tab <- u0tab[order(u0tab$Schoolid), ]
colnames(u0tab)[4] <- "u0rank"
u0tab[1:10, ]
plot(u0tab$u0rank, u0tab$u0, type = "n", xlab = "Schoolid", ylab = "conditional modes of r.e. for Schoolid:_cons")
segments(u0tab$u0rank, u0tab$u0 - 1.96*u0tab$u0se, u0tab$u0rank, u0tab$u0 + 1.96*u0tab$u0se)
points(u0tab$u0rank, u0tab$u0, col="blue")
abline(h=0, col="red")
```

GRADE and SCHOOL

```
library(foreign)
mydata=read.spss("F:\\Sesilia2019\\SI22Oct2020_1.sav")
library(lme4)
model0<-glmer(ideationbinary ~ (1|Grade)+(1|Schoolid), data = mydata, family = binomial("logit"))
summary(model0)
icc<-model0@theta[1]^2/(model0@theta[1]^2 + (3.14159^2/3))
icc
```

STUDENT CHARACTERISTICS

```
library(foreign)
mydata=read.spss("F:\\Sesilia2019\\SI22Oct2020_1.sav")
library(lme4)
model1 <-glmer(ideationbinary ~ Age + Sex + DB + V + MH + SB + PA + (1|Grade),data = mydata, family =
binomial("logit"))
summary(model1)
icc<-model1@theta[1]^2/(model1@theta[1]^2 + (3.14159^2/3))
icc
```

SCHOOL CHARACTERISTICS

```
library(foreign)
mydata=read.spss("F:\\Sesilia2019\\SI22Oct2020_1.sav")
library(lme4)
model2 <-glmer(ideationbinary ~ ESH + TU + AU + DU + (1|Schoolid),data = mydata, family = binomial("logit"))
summary(model2)
icc<-model2@theta[1]^2/(model2@theta[1]^2 + (3.14159^2/3))
icc
```

STUDENT AND SCHOOL CHARACTERISTICS

```
library(foreign)
mydata=read.spss("F:\\Sesilia2019\\SI22Oct2020_1.sav")
library(lme4)
model3 <-glmer(ideationbinary ~ Age + Sex + DB + V + MH + SB + PA +ESH +TU + AU + DU +
(1|Grade)+(1|Schoolid),data = mydata, family = binomial("logit"))
summary(model3)
icc<-model3@theta[1]^2/(model3@theta[1]^2 + (3.14159^2/3))
icc
```

FULL MODEL

```
library(foreign)
mydata=read.spss("F:\\Sesilia2019\\SI22Oct2020_1.sav")
library(lme4)
model4 <-glmer(ideationbinary ~ Age + Sex + DB + V + MH + TU + DU + (1|Grade)+(1|Schoolid),data = mydata,
family = binomial("logit"))
```

```
summary(model4)
icc<-model4@theta[1]^2/(model4@theta[1]^2 + (3.14159^2/3))
icc
```

Appendix 4

Global School-based Student Health Survey (GSHS)

2013 Namibia
GSHS Questionnaire

For more inform
www.cdc.gov/gshs
www.who.int/chp/gshs/en/

-

2013 NAMIBIA GLOBAL SCHOOL-BASED STUDENT HEALTH SURVEY

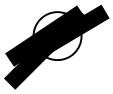
This survey is about your health and the things you do that may affect your health. Students like you all over your country are doing this survey. Students in many other countries around the world also are doing this survey. The information you give will be used to develop better health programs for young people like yourself.

DO NOT write your name on this survey or the answer sheet. The answers you give will be kept private. No one will know how you answer. Answer the questions based on what you really know or do. There are no right or wrong answers.

Completing the survey is voluntary. Your grade or mark in this class will not be affected whether or not you answer the questions. If you do not want to answer a question, just leave it blank.

Make sure to read every question. Fill in the circles on your answer sheet that match your answer. Use only the pencil you are given. When you are done, do what the person who is giving you the survey says to do.

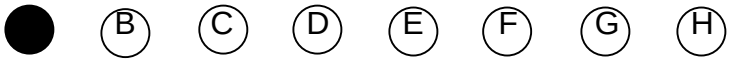
Here is an example of how to fill in the circles:

Fill in the circles like this  Not like this  or 

Survey

1. Do fish live in water?
   A. Yes
   B. No

Answer sheet

1. 

Thank you very much for your help.

1. How old are you?

   A. 11 years old or younger
   B. 12 years old
   C. 13 years old
   D. 14 years old
   E. 15 years old
   F. 16 years old
   G. 17 years old
   H. 18 years old or older

2. What is your sex?

   A. Male
   B. Female

3. In what grade are you?

   A. Grade 6
   B. Grade7
   C. Grade 8
   D. Grade 9
   E. Grade10
   F. Grade 11
   G. Grade 12

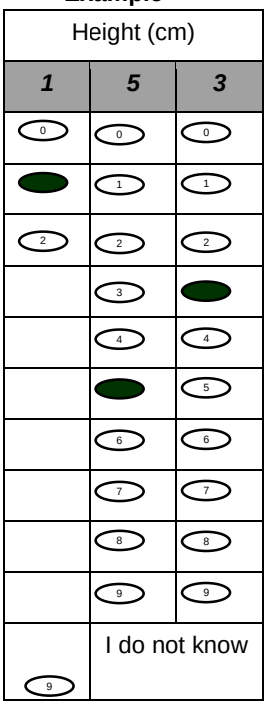
4. Who do you live with?

   A. Both parents
   B. Only your father
   C. Only your mother
   D. Your grandparents
   E. Extended family(not your parents or grandparents)
   F. Siblings
   G. Guardians
   H. Someone else

The next 4 questions ask about your height, weight, and going hungry.

5. How tall are you without your shoes on? ON THE ANSWER SHEET, WRITE YOUR HEIGHT IN THE SHADED BOXES AT THE TOP OF THE GRID. THEN FILL IN THE OVAL BELOW EACH NUMBER.

Example



6. How much do you weigh without your shoes on?

ON THE ANSWER SHEET, WRITE YOUR WEIGHT IN THE SHADED BOXES AT THE TOP OF THE GRID. THEN FILL IN THE OVAL BELOW EACH NUMBER.

Weight (kg)		
0	***5***	***2***
●	0	0
1	1	1
2	2	●
	3	3
	4	4
	●	5
	6	6
	7	7
	8	8
	9	9
9	I do not know	

Example

7. How do you describe your weight?

A. Very underweight B. Slightly underweight
C. About the right weight
D. Slightly overweight
E. Very overweight

8. During the past 30 days, how often did you go hungry because there was not enough food in your home?

A. Never
B. Hardly ever
C. Sometimes
D. Most of the time
E. Always

The next 6 questions ask about what you might eat or drink and what you were taught.

9. During the past 30 days, how many times per day did you **usually** eat fruit, such as marulu, eenyandi, palm fruits, dates, apples, or bananas?

A. I did not eat fruit during the past 30 days
B. Less than one time per day
C. 1 time per day
D. 2 times per day E. 3 times per day
F. 4 times per day
G. 5 or more times per day

10. During the past 30 days, how many times per day did you **usually** eat vegetables, such as spinach, cabbage, pumpkin, or carrots?

A. I did not eat vegetables during the past 30 days
B. Less than one time per day
C. 1 time per day
D. 2 times per day E. 3 times per day
F. 4 times per day
G. 5 or more times per day

11. During the past 30 days, how many times per day did you **usually** drink carbonated soft drinks, such as Coke, Fanta, Twiza, or Vigo? (Do **not** include diet soft drinks, such as Coke Zero or Diet Coke.)

A. I did not drink carbonated soft drinks during the past 30 days
B. Less than one time per day
C. 1 time per day
D. 2 times per day E. 3 times per day
F. 4 times per day
G. 5 or more times per day

12. During the past 7 days, on how many days did you eat food from a fast food restaurant, such as

Kentucky Fried Chicken, Wimpy, and Hungry Lion?

A. 0 days
B. 1 day
C. 2 days
D. 3 days
E. 4 days
F. 5 days
G. 6 days
H. 7 days

13. During the past 30 days, how often did you eat breakfast?

A. Never B. Hardly ever
C. Sometimes
D. Most of the time
E. Always

14. During this school year, were you taught in any of your classes the benefits of healthy eating?

A. Yes
B. No
C. I do not know

The next 11 questions ask about cleaning your teeth, washing your hands, and general hygiene.

15. During the past 30 days, how often did you wash your hands before eating?

A. Never
B. Hardly ever
C. Sometimes
D. Most of the time
E. Always

16. During the past 30 days, how often did you wash your hands after using the toilet or latrine?

A. Never
B. Hardly ever
C. Sometimes
D. Most of the time
E. Always

17. During the past 30 days, how often did you use soap when washing your hands?

A. Never
B. Hardly ever
C. Sometimes
D. Most of the time
E. Always

18. During the past 30 days, how many times per day did you **usually** clean or brush your teeth?

A. I did not clean or brush my teeth during the past 30 days
B. Less than 1 time per day
C. 1 time per day
D. 2 times per day
E. 3 times per day
F. 4 or more times per day

19. Is there a source of clean water for drinking **at school**?

A. Yes
B. No

20. How often do you drink water from the tap or water source **at school**?

a. There is not a tap or water source at school
b. Never
c. Hardly ever
d. Sometimes
e. Most of the time
f. Always

21. Are there separate toilets or latrines for boys and girls **at school**?

a. There are no toilets or latrines at school
b. Yes

c. No

22. Do the toilets or latrines **at school** work properly?
    a. There are no toilets or latrines at school
    b. Yes
    c. No

23. Are the toilets or latrines clean **at school**?
    a. There are no toilets or latrines at school
    b. Yes
    c. No

24. How do you **usually** dry your hands after washing them at school? SELECT ONLY ONE RESPONSE.

    A. I do not wash my hands at school
    B. I drip or air dry my hands
    C. I use a towel
    D. I use paper
    E. I use an air dryer F. I dry them some other way.

25. During this school year or the last school year, were you taught in any of your classes about the importance of hand washing?

    A. Yes
    B. No
    C. I do not know

The next question asks about physical attacks. A physical attack occurs when one or more people hit or strike someone, or when one or more people hurt another person with a weapon (such as a stick, knife, or gun). It is not a physical attack when two students of about the same strength or power choose to fight each other.

26. During the past 12 months, how many times were you physically attacked?

    A. 0 times
    B. 1 time
    C. 2 or 3 times D. 4 or 5 times E. 6 or 7 times
    F. 8 or 9 times
    G. 10 or 11 times
    H. 12 or more times

The next question asks about physical fights. A physical fight occurs when two students of about the same strength or power choose to fight each other.

27. During the past 12 months, how many times were you in a physical fight?

    A. 0 times
    B. 1 time
    C. 2 or 3 times D. 4 or 5 times E. 6 or 7 times
    F. 8 or 9 times
    G. 10 or 11 times
    H. 12 or more times

The next 3 questions ask about <u>serious injuries</u> that happened to you. An injury is serious when it makes you miss at least one full day of usual activities (such as school, sports, or a job) or requires treatment by a doctor or nurse.

28. During the past 12 months, how many times were you seriously injured?

    A. 0 times
    B. 1 time
    C. 2 or 3 times D. 4 or 5 times E. 6 or 7 times
    F. 8 or 9 times
    G. 10 or 11 times
    H. 12 or more times

29. During the past 12 months, what was the most serious injury that happened to you?

A. I was not seriously injured during the past 12 months
B. I had a broken bone or a dislocated joint C. I had a cut or stab wound
D. I had a concussion or other head or neck injury, was knocked out, or could not breathe
E. I had a gunshot wound
F. I had a bad burn
G. I was poisoned or took too much of a drug
H. Something else happened to me

30. During the past 12 months, **what was the major cause** of the most serious injury that happened to you?

A. I was not seriously injured during the past 12 months
B. I was in a motor vehicle accident or hit by a motor vehicle
C. I fell
D. Something fell on me or hit me
E. I was attacked or abused or was fighting with someone
F. I was in a fire or too near a flame or something hot
G. I inhaled or swallowed something bad for me
H. Something else caused my injury

The next 2 questions ask about bullying. Bullying occurs when a student or group of students say or do bad and unpleasant things to another student. It is also bullying when a student is teased a lot in an unpleasant way or when a student is left out of things on purpose. It is not bullying when two students of about the same strength or power argue or fight or when teasing is done in a friendly and fun way.

31. During the past 30 days, on how many days were you bullied?

A. 0 days
B. 1 or 2 days
C. 3 to 5 days
D. 6 to 9 days
E. 10 to 19 days
F. 20 to 29 days
G. All 30 days

32. During the past 30 days, how were you bullied **most often**?

A. I was not bullied during the past 30 days
B. I was hit, kicked, pushed, shoved around, or locked indoors
C. I was made fun of because of my race, nationality, or color
D. I was made fun of because of my religion
E. I was made fun of with sexual jokes, comments, or gestures
F. I was left out of activities on purpose or completely ignored
G. I was made fun of because of how my body or face looks
H. I was bullied in some other way

The next 8 questions ask about your feelings and friendships.

33. During the past 12 months, how often have you felt lonely?

A. Never
B. Hardly ever
C. Sometimes
D. Most of the time
E. Always

34. During the past 12 months, how often have you been so worried about something that you could not sleep at night?

A. Never B. Hardly ever
C. Sometimes

D. Most of the time
E. Always

35. During the past 12 months, did you ever **seriously** consider attempting suicide?

A. Yes
B. No

36. During the past 12 months, did you make a plan about how you would attempt suicide?

A. Yes
B. No

37. During the past 12 months, how many times did you actually attempt suicide?

A. 0 times
B. 1 time
C. 2 or 3 times
D. 4 or 5 times
E. 6 or more times

38. How many close friends do you have?

A. 0
B. 1
C. 2
D. 3 or more

39. During the past 12 months, how often have you been so worried about something that you wanted to use alcohol or other drugs to feel better?

A. Never
B. Hardly ever
C. Sometimes
D. Most of the time
E. Always

40. During this school year, were you taught in any of your classes how to handle stress in healthy ways?

A. Yes
B. No
C. I do not know

The next 6 questions ask about cigarette and other tobacco use.

41. How old were you when you first tried a cigarette?

A. I have never smoked cigarettes
B. 7 years old or younger
C. 8 or 9 years old
D. 10 or 11 years old E. 12 or 13 years old F. 14 or 15 years old
G. 16 or 17 years old
H. 18 years old or older

42. During the past 30 days, on how many days did you smoke cigarettes?

A. 0 days
B. 1 or 2 days
C. 3 to 5 days
D. 6 to 9 days
E. 10 to 19 days
F. 20 to 29 days
G. All 30 days

43. During the past 30 days, on how many days did you use any tobacco products other than cigarettes, such as flavoured tobacco, tobacco leaves or Snuff?

A. 0 days
B. 1 or 2 days
C. 3 to 5 days
D. 6 to 9 days
E. 10 to 19 days
F. 20 to 29 days
G. All 30 days

44. During the past 12 months, have you ever tried to stop smoking cigarettes?

A. I have never smoked cigarettes
B. I did not smoke cigarettes during the past 12 months
C. Yes
D. No

45. During the past 7 days, on how many days have people smoked when you were there?

A. 0 days
B. 1 or 2 days C. 3 or 4 days
D. 5 or 6 days
E. All 7 days

46. Which of your parents or guardians use any form of tobacco?

A. Neither
B. My father or male guardian
C. My mother or female guardian
D. Both
E. I do not know

The next 6 questions ask about drinking alcohol. This includes drinking tombo or home brew, ciders, Obike, Wit Blitz, whisky, brandy and hot stuff. Drinking alcohol does not include drinking a few sips of wine for religious purposes. A "drink" is a glass of wine, a bottle of beer, a small glass of liquor, or a mixed drink.

47. How old were you when you had your first drink of alcohol other than a few sips?

A. I have never had a drink of alcohol other than a few sips
B. 7 years old or younger
C. 8 or 9 years old
D. 10 or 11 years old E. 12 or 13 years old F. 14 or 15 years old
G. 16 or 17 years old
H. 18 years old or older

48. During the past 30 days, on how many days did you have at least one drink containing alcohol?

A. 0 days
B. 1 or 2 days
C. 3 to 5 days
D. 6 to 9 days
E. 10 to 19 days
F. 20 to 29 days
G. All 30 days

49. During the past 30 days, on the days you drank alcohol, how many drinks did you **usually** drink per day?

A. I did not drink alcohol during the past 30 days
B. Less than one drink
C. 1 drink
D. 2 drinks E. 3 drinks
F. 4 drinks
G. 5 or more drinks

50. During the past 30 days, how did you **usually** get the alcohol you drank? SELECT ONLY ONE RESPONSE.

A. I did not drink alcohol during the past 30 days
B. I bought it in a store, shop, or from a street vendor
C. I gave someone else money to buy it for me
D. I got it from my friends
E. I got it from my family
F. I stole it or got it without permission
G. I got it some other way

Staggering when walking, not being able to speak right, and throwing up are some signs of being really drunk.

51. During your life, how many times did you drink so much alcohol that you were really drunk?

A. 0 times
B. 1 or 2 times
C. 3 to 9 times
D. 10 or more times

52. During your life, how many times have you got into trouble with your family or friends, missed school, or got into fights, as a result of drinking alcohol?

A. 0 times
B. 1 or 2 times
C. 3 to 9 times
D. 10 or more times

The next question asks about how often you see alcohol advertisements on videos, magazines, or the internet or at movie theaters, sports events, or music concerts.

53. During the past 30 days, how often did you see any alcohol advertisements?

A. Never
B. Hardly ever
C. Sometimes
D. Almost daily
E. Daily

The next question asks about the type of alcohol you usually drink.

54. What type of alcohol do you **usually** drink?
SELECT ONLY ONE RESPONSE.

A. I do not drink alcohol
B. Beer, lager, or stout
C. Wine
D. Spirits, such as Obike, WitBlitz, whisky, brandy, and hot stuff
E. Tombo or home brew
F. Ciders
G. Some other type

The next 6 questions ask about drug use. This includes using marijuana, amphetamines, cocaine, inhalants speed, escstacy, LSD, benzine, glue, and dagga.

55. How old were you when you first used drugs?

A. I have never used drugs
B. 7 years old or younger
C. 8 or 9 years old
D. 10 or 11 years old E. 12 or 13 years old F. 14 or 15 years old
G. 16 or 17 years old
H. 18 years old or older

56. During your life, how many times have you used marijuana (also called Dagga, weed, boom, cannibus, stop, grass, pipt, stop, and joint)?

A. 0 times
B. 1 or 2 times
C. 3 to 9 times
D. 10 to 19 times
E. 20 or more times

57. During the past 30 days, how many times have you used marijuana (also called dagga, weed, boom, cannibus, stop, grass, pipt, stop, and joint)?

A. 0 times
B. 1 or 2 times
C. 3 to 9 times
D. 10 to 19 times
E. 20 or more times

58. During your life, how many times have you used amphetamines or methamphetamines (also calledtik, speed, bennies, uppers, black beauties, mollies, or splash)?

A. 0 times
B. 1 or 2 times
C. 3 to 9 times
D. 10 to 19 times
E. 20 or more times

59. How difficult do you think it would be for you to get drugs such as **marijuana, amphetamines, cocaine, inhalants speed, escstacy, LSD, benzine, glue, and dagga**?

A. Impossible
B. Very difficult
C. Fairly difficult
D. Fairly easy
E. Very easy
F. I do not know

60. During this school year, were you taught in any of your classes the problems associated with using drugs, such as dagga, inhalants, or amphetamines?

A. Yes
B. No
C. I do not know

The next 7 questions ask about sexual intercourse.

61. Have you ever had sexual intercourse?

A. Yes
B. No

62. How old were you when you had sexual intercourse for the first time?

A. I have never had sexual intercourse
B. 11 years old or younger
C. 12 years old
D. 13 years old E. 14 years old F. 15 years old
G. 16 or 17 years old
H. 18 year old or older

63. During your life, with how many people have you had sexual intercourse?

A. I have never had sexual intercourse
B. 1 person
C. 2 people D. 3 people E. 4 people
F. 5 people
G. 6 or more people

64. The **last time** you had sexual intercourse, did you or your partner use a condom.

A. I have never had sexual intercourse
B. Yes
C. No

65. The **last time** you had sexual intercourse, did you or your partner use any <u>other</u> method of birth control, such as withdrawal, rhythm (safe time), birth control pills, or any other method to prevent pregnancy?

A. I have never had sexual intercourse
B. Yes
C. No
D. I do not know

66. Did you drink alcohol or use other drugs before you had sexual intercourse the **last time**?

A. I have never had sexual intercourse
B. Yes
C. No

67. With whom have you had sexual intercourse?

A. I have never had sexual intercourse
B. Females only
C. Males only
D. Both females and males

The next 2 questions ask about HIV infection or AIDS.

68. Have you ever been tested for HIV infection or AIDS?

A. Yes
B. No

69. During this school year, were you taught in any of your classes how to avoid HIV infection or AIDS?

A. Yes
B. No
C. I do not know

The next 3 questions ask about physical activity. Physical activity is any activity that increases your heart rate and makes you get out of breath some of the time. Physical activity can be done in sports, playing with friends, or walking to school. Some examples of physical activity are running, fast walking, biking, dancing, football, swimming, gymming, skiding, and skipping rope.

70. During thepast **7 days**, on how many days were you physically active for a total of at least 60 minutes per day? ADD UP ALL THE TIME YOU SPENT IN ANY KIND OF PHYSICAL ACTIVITY EACH DAY.

A. 0 days
B. 1 day
C. 2 days
D. 3 days
E. 4 days
F. 5 days
G. 6 days
H. 7 days

71. During the past 7 days, on how many days did you walk or ride a bicycle to or from school?

A. 0 days B. 1 day
C. 2 days
D. 3 days
E. 4 days
F. 5 days
G. 6 days
H. 7 days

72. During this school year, on how many days did you go to physical education (PE) class each week?

A. 0 days B. 1 day
C. 2 days D. 3 days
E. 4 days
F. 5 or more days

The next question asks about the time you spend mostly sitting when you are not in school or doing homework.

73. How much time do you spend during a **typical or usual** day sitting and watching television, playing computer games, talking with friends, or doing other sitting activities, such as playing cards, dominos, chess, and scrabble.

A. Less than 1 hour per day
B. 1 to 2 hours per day C. 3 to 4 hours per day D. 5 to 6 hours per day
E. 7 to 8 hours per day
F. More than 8 hours per day

The next 7 questions ask about your experiences at school and at home.

74. During the past 30 days, on how many days did you miss classes or school without permission?

A. 0 days
B. 1 or 2 days

C. 3 to 5 days
D. 6 to 9 days
E. 10 or more days

75. During the past 30 days, how often were most of the students in your school kind and helpful?

A. Never B. Hardly ever
C. Sometimes
D. Most of the time
E. Always

76. During the past 30 days, how often did your parents or guardians check to see if your homework was done?

A. Never B. Hardly ever
C. Sometimes
D. Most of the time
E. Always

77. During the past 30 days, how often did your parents or guardians understand your problems and worries?

A. Never B. Hardly ever
C. Sometimes
D. Most of the time
E. Always

78. During the past 30 days, how often did your parents or guardians **really** know what you were doing with your free time?

A. Never
B. Hardly ever
C. Sometimes
D. Most of the time
E. Always

79. During the past 30 days, how often did your parents or guardians go through your things without your approval?

A. Never
B. Hardly ever
C. Sometimes
D. Most of the time
E. Always

80. During the past 30 days, how often did your parents or guardians spend time with you?

A. Never
B. Hardly ever
C. Sometimes
D. Most of the time
E. Always

The next 4 questions ask about ear and eye health.

81. Have you ever had a hearing test?

A. Yes
B. No
C. Not sure

82. During the past 12 months, have you had an ear infection that made your ears hurt or caused pus to run out of your ears?

A. Yes
B. No
C. Not sure

83. Do you have difficulties with your eye sight or being able to see?

A. Yes
B. No

84. Are you currently using glasses, spectacles, lenses, or anything else to help you see better?

A. Yes
B. No