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KNOWLEDGE OF TERTIARY INSTITUTION STUDENTS ON THE TRANSMISSION DYNAMICS AND CONTROL OF SEXUALLY TRANSMITTED DISEASES AT COVID-19 PANDEMIC AND ITS MATHEMATICAL MODEL

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ABSTRACT

The study investigated knowledge of tertiary institution students on transmission dynamics and control of sexually transmitted diseases at covid-19 pandemic and its mathematical modeling. Three objectives and research questions were used to guide the study. Data were obtained from 123 out of 516 male and female students that formed the population of study. whose

INTRODUCTION

Sexually transmitted diseases (STDs) can be life threatening as most times it increases the risk of morbidity and mortality in human population especially during covid-19 pandemic. Over the past decades, the incidence of STDs among adolescents' age 10-19years has been on the rise making it a public health problem. The rise may not be unconnected with the learning social vices in our society today. Of recent, there has been an upsurge in moral decadence. Accompanied with the quest to get rich quick, is the spate in crime, prostitution, homosexuality and lesbianism, with young

mean age was 17.5years. The instrument for data collection had a total of 16 statements that answered the different research questions. To curb the attitude on transmission dynamics of STDs, a five compartmental mathematical models was developed to represent unaware STDs susceptible individuals S, aware STDs susceptible individuals who modify their sexual behaviours S_1, aware STDs susceptible individuals who remain faithful to their uninfected sexual partners for life S_2, carriers class (I) and recovery or removal class (R). The STDs equilibrium point and reproduction number (R_n <1 and R_n >1) were discussed. The mathematical model solution indicates that STDs is still spreading because R_n >1, showing that the system is unstable. The data obtained were analyzed using mean and standard deviation to answer the research questions. Findings from the study showed that the students have good knowledge of sexually transmitted diseases when they indicated that STDs can be contracted through sexual intercourse at covid-19 pandemic with ($\bar{X}$ =3.96, SD = 0.20). Some have no cure with $\bar{X}$ =3.22, SD = 0.93 and that human papillomavirus can lead to cervical cancer in women with $\bar{X}$ =3.16, SD = 0.74 respectively. The findings also showed that the students' attitude increase the transmission dynamics of STDs at covid-19 with $\bar{X}$ =2.92, SD = 0.37 and that the different age groups differ in their knowledge of transmission dynamics, those of age group 16-18years had the $\bar{X}$ =2.72, SD= 0.10 showing the least knowledge followed by those age group 19 – 21years was $\bar{X}$ =2.99, SD = 0.57 whereas those in the age group of 22 years and above with the $\bar{X}$ = 3.17, SD = 0.41 showed a higher knowledge of the transmission dynamics at covid-19 pandemic. Based on these findings, it was recommended that children should be given health education talk on STDs at early age before they start school, they should be made to understand that there is no immunity against STDs and that self-care and being of responsible behaviour is required to control exposure to these diseases.

Keywords: STDs; covid-19 pandemic; mathematical model; equilibria; reproduction number

adolescents not left out especially at covid-19 pandemic. Some young children have even been introduced to clubbing and cannot do without going to the club on daily

bases. This exposes their young body to infection with STDs and increase transmission of same in their population.

STDs are diseases transmissible from one sexual partner to another. They include chlamydia, gonorrhea, genital herpes, human papillomavirus (HPV), syphilis, and Human Immuno Virus. Many of these STDs do not show symptoms early because of their long incubation period, yet can still be passed on during sex and during skin to skin contact during covid-19. Some of the diseases are curable, while some are not. The effect and incurable nature of some STDs are what make them very harmful to man. In avoidance of the harmful effects of STDs, several practices have been put in place to prevent and control the transmission of the diseases in human population, such as condom use, delaying sex till after marriage, maintaining single partner, etc. However, not all individuals, especially adolescent students are able to practice preventive strategies because of their poor attitude to life. The worrisome part is the fact that most adolescent students have no knowledge of the dangers associated with what they do, hence their poor health seeking behaviour, expressed in non-use of condoms and other preventive measures. Such dangers as crime, unwanted pregnancy and sexually transmitted diseases could lead to school drop-out, congenital malformation in new borne, in the case of females who get pregnant in the process or those of child bearing age who harbour and later transmit same to their children in utero or suffer out right fatality.

Young adolescent students are at greater risk of STDs. The simple reason is that some young people have more than one sex partner, the female bodies are biologically more prone to STDs during covid-19. Many young people do not want to talk openly and honestly with a doctor or nurse about their sex lives and may do not go for recommended STD tests and treatment. Furthermore, the high risk can be attributable to other factors such as lack of continued sex education, which is a key issue in the rise in sexually transmitted diseases as well as holds a strong grip on preventive practices aimed to control or even eliminate transmission,

The fact that young adolescent students do not take responsibility for their health with regards to sexually transmitted diseases is revealed in the report of (Steinmetz. 2013) who noted 50% sexually active college students do not wear condoms during sexual intercourse and patients under the age of 18 who have been exposed and continued to have sex were the least informed on the subject of sexually transmitted diseases. Again, adolescents are not motivated to practice

safe sex. This is because most cultures do not even expect them to indulge in such act at the age they are expected to abstain, thus contributing to the risk of contracting STDs. Also some individuals assumed that adolescents have knowledge, for the simple reason that they have received information in high school on the subject of sexuality education; whereas large populations of students remain uneducated on STDs transmission and measures to protect self from their harmful effects.

One contributing factor to their negligent of prevention is insufficient knowledge regarding transmission of sexually transmitted diseases. Knowledge in this regard refers to facts, information and skills at ones disposition, acquired mainly through education in form of theoretical or practical experiences (Denning, 2016). Thus one with adequate knowledge is able to navigate his or her world intelligently, having understanding of events in the environment. Limited knowledge in this age cohort has therefore resulted in their being victims in many circumstances. For instance, adolescents have been reported to be responsible for over half of the twenty million new STD cases diagnosed each year and over 16 billion dollars in health care expenditures annually (Centers for Disease Control and Prevention. 2016). This notwithstanding, the (Centers for Disease Control and prevention, 2016) reported 6% increase in the rate of infection with Chlamydia and 13% increase in Gonorrhea infection in 2014. A whooping 26 million new STDs were reported in the United States in 2018. 33,725 cases of chlamydia, gonorrhea and syphilis were reported in 2019 compared to 32,024 cases in 2018, with majority occurring in teenagers (Minnesota Department of Health 2020, Centers for Disease Control and Prevention 2021).

Adolescent sexual behaviour is a phenomenon that often results in health risks such as STDs and pregnancy (Weaver 2015). They are the group with the second highest incidence of certain STDs, and these diseases can leave them vulnerable to other diseases such as HIV/AIDS and can also suffer irreversible damages if not treated immediately. Chlamydia and Gonorrhea are capable of causing pelvic inflammatory disease and fallopian tube infections, both of which are difficult to detect in the majority of cases. The permanent damage caused by scar tissue from pelvic inflammatory disease and other reproductive tract infections can ultimately lead to infertility if not treated early (Centers for Disease Control and Prevention, 2013),

The World Health Organization defined adolescents as persons between 10 and 19 years of age (WHO 1998), who make up about 20% of the world's population, of whom 85% live in developing countries. Yet until now they have not been recognized and treated as a distinct group, both rather generally been subsumed under the heading of child, family or women's health and welfare. This has at least partially been because adolescents were considered to be a relatively healthy age group, one without a heavy "burden of disease", compared to newborn infants or older adults.

This has been debunked by (Weaver 2015), who reported that because adolescents engage in high risk behaviors such as early sexual debut, unprotected sex, and multiple sex partners, they are no longer safe. That both males and females in this age cohort are experiencing diseases and poor health outcomes at significantly greater rates than any other group; thus needing support for positive change that will enable attainment of maximum health.

Judging from Mezieobi and Irikana (2021) point of view, STDs are social problem because it causes harm on a large number of persons. Thus with the declaration of same diseases as public problem there is the need to find lasting solution which lies mostly in its control (Ikeako, Ekwueme, Ezegwui & Okeke 2014; WHO 2015). To achieve control, young adolescents who are the sexually active group and more likely to transmit infection in their group and to other individuals have to be sensitized on preventive measures and supported to practice same. The same requires supportive approach through positive behaviour changes implemented early at this malleable age. Thus assessment of level of knowledge and attitude of young adolescents towards prevention and control of sexually transmitted diseases becomes imperative as this will provide baseline data for any programme aimed at instituting positive change.

Obio/Akpor is one of the twenty (23) three Local Government Areas that made up Rivers State. It is a semi urban as well as an urban LGA. It is densely populated and houses meaningful number of young adolescence in the age bracket under study, who are mostly found in both public and privately owned secondary schools in the area. The rising cases of sexually transmitted diseases among adolescents globally and Nigeria in particular, has made sexual and reproductive health among this age group a critical issue. Undoubtedly, this group of people with increasing population constitutes one-fifth (1.2 billion) of the world population and one third of Nigeria's total population of 180million, hence any disease in this group will present Nigeria as

a morbid nation as it will spread faster and affect many people being that they are active in every area of life. Sexually transmitted diseases occur in both sexes and when inadequately treated, result in chronic reproductive tract infections, infertility and even death. The deaths which most times result from abortions often by quacks due to unwanted pregnancies have toll on our population and economy. This is because in many instances, young people are not provided with the information and skills to protect themselves against the risk of infection, making them victims of even preventable diseases,

Statement of the Problem

Despite the availability of youth friendly centres, free reproductive health and family planning services, free HIV Counseling and Testing (HCT) services, students in tertiary institutions still engage in unsafe sex and having multiple partners which is one of the unhealthy behavior to acquire sexually transmitted diseases and school drop-out associated with adolescent pregnancy during covid-19 pandemic, adolescent single mothers and death from unsafe abortion and prolonged obstructed labour, HIV/AIDS and other sexually transmitted diseases. Based on the above elucidations, the researchers deemed it necessary to carry out a study titled knowledge of tertiary institution students in Rivers State on the transmission dynamics and control of sexually transmitted diseases at covid-19 pandemic and its mathematical model

Research Questions.

1. What is the knowledge level of tertiary institution students within the ages 16 to 18 years regarding STDs during covid-19 pandemic?
2. How does tertiary institution students' (adolescent's) attitude towards transmission of STDs during covid-19 pandemic?
3. How do the different age brackets differ in their knowledge of STDs transmission during covid-19 pandemic?
4. How can a mathematical model be developed for sexually transmitted diseases (STDs)

Research Methodology

A descriptive cross-sectional and mathematical modelling designs were used for the study. The study was conducted in Akpor Kingdom in Obio/Akpor Local

Government Area of Rivers State with five hundred and sixteen (516) students that made up the population of study. This population was selected from both public and private tertiary institutions in the area out of which one hundred and thirty (130) were chosen as sample for the study. The students were deemed as the most appropriate subjects because they are directly involved and mostly the ones to suffer the effect or any consequences of sexually transmitted disease.

The instrument for data collection was a Likert type questionnaire designed to elicit information from tertiary institution students on their knowledge towards on the transmission dynamics and control of sexually transmitted diseases in their cohort during covid-19. The questionnaire items were subjected to validation by presenting it to a Health expert in Rivers State University Teaching Hospital and an Educational Test and Measurement expert in Ignatius Ajuru University of Education. Port Harcourt. Considering their inputs, some corrections were made and the instrument was deemed valid for the study.

The selected public tertiary institutions for the study were visited and questionnaire was administered to the students using the convenient method of sampling. It is important to indicate here that not all the students that were approached accepted to respond to the questionnaire, while some accepted the questionnaire instruments but never returned them. However, 130 (one hundred and thirty) students were sampled out of which 123 (one hundred and twenty-three) were used for analysis gave 92%. The 7 (seven) unused questionnaire which is about 8% of the total number of questionnaire sampled was due to error in filling the questionnaire and inability of some students to return the questionnaire to the researchers before the analysis was done. The data generated was analyzed using mean and standard deviation. Approval to carry out the study was obtained from the ethical committee of the Rivers State Hospitals Management Board, Port Harcourt. Individual consent was obtained from the study subjects who signed the consent before answering the questionnaires. Confidentiality of the information obtained was maintained since the names of the study subjects were not required.

Results and Discussion

Research question One: What is the knowledge level of tertiary institution students within the ages 16 to 18 years regarding to STDs during covid-19 pandemic?

Table 2.1.1: Mean and standard deviation analysis on the knowledge level of tertiary institution students within the ages 16 to 18 years regarding STDs during covid-19 pandemic

N=123

SN	Knowledge of STDs	Mean	SD	95% LB	CI UB
1 2	STDs can be contracted through sexual intercourse. There is cure for all STDs	3.96 1.62	0.20 0.74	3.92 1.49	3.99 1.75
3	Human Papillomavirus can lead to cervical cancer in women	3.16	'0.74	3.03	3.29
4	Some STDs have no cure	3.22	0.93	3.05	3.39
5	Same virus can cause all STDs	1.93	0.96	1.76	2.11
6	STDs can cause pelvic inflammatory disease and infertility if left untreated.	3.22	0.96	3.05	3.39
	Grand mean	**2.85**	**0.33**	**2.79**	**2.91**

Source: Field Survey (2022).

The result from Table 2.1.1 shows the mean and standard deviation analysis on the knowledge level of tertiary institution students within the ages 16 to 18 regarding STDs during covid-19 pandemic. It showed that the mean knowledge of the adolescents regarding to STDs was 2.85, SD=0.33 and the 95 confidence interval moved from 2.79 to 2.91. The result showed that the respondents strongly indicated that STDs can be contracted through sexual intercourse with mean =3. 96 and standard deviation (SD) =0.20. This was followed by the fact that STDs can cause pelvic inflammatory disease and infertility if left untreated with mean =3.22 and SD =0.96. Some STDs have no cure had mean =3.22 and SD=0.93; and Human Papillomavirus can lead to cervical cancer in women had mean =3.16 and SD=0.74 among others.

Research question 2: How does tertiary institution students' (adolescent's) attitude towards transmission of STDs during covid-19 pandemic?

Table 2.1.2: Mean and standard deviation analysis on tertiary institution students' attitude towards transmission of STDs during covid-19 pandemic

N=123

SN	Attitude towards Transmission of STDs	Mean	SD	95% LB	CL UB
7	A person with a cold sore on the mouth can give his or her partner Genital Herpes during oral-genital contact	3.16	0.95	2.99	3.33
8	If both couples have not had a sexually transmitted disease, they can engage in oral-genital or anal sex without fear of getting AIDS.	2.88	1.13	2.68	3.08
9	A person with Genital Herpes is generally not Contagious between active attacks.	2.46	0.94	2.30	2.63
10	Most women do not show symptoms in the early stages of Gonorrhea or Chlamydia.	2.82	1.29	2.59	3.05
11	A person can only have one type of sexually transmitted disease at a time.	3.28	1,06	3.09	3.47
	Grand mean	**2.92**	**0.37**	**2.85**	**2.99**

Source: Field Survey (2022).

The result from Table 2.1.2 shows the mean and standard deviation analysis on adolescents' attitude towards transmission of STDs during covid-19. It shows that the mean rating of the respondents over how adolescents' attitude affect the transmission of STDs was with mean = 2.92 and SD=0.37; and the 95% CI moved from 2.85 to 2.99. The result further showed that the respondents strongly indicated that a person can only have one type of sexually transmitted disease at a time with mean =3.28 and SD=1.06. This was followed by the fact that a person with a cold sore on the mouth can give his or her partner Genital Herpes during oral-genital contact with mean =3.16 and SD=0.95. That if both couples have not had a sexually transmitted

disease, they can engage in oral-genital or anal sex without fear of getting AIDS had mean =2.88 and SD =1.13 among others.

Research question 3: How do the different age brackets differ in their knowledge of STDs transmission during covid-19 pandemic?

Table 2.1.3: Mean and standard deviation analysis on how different age groups differ in their knowledge of STDs Transmission during covid-19 pandemic

N=123

SN	Knowledge of STDs transmission	16-18 years N=29 Mean	SD	19-21 years N=75 Mean	SD	22years &above N=19 Mean	SD
12	Anal sex is a high risk for Hepatitis B	2.41	1.40	2.92	0.49	1.68	0.48
13	A woman who has genital herpes can pass it on to her baby during childbirth.	3.62	0.49	3.44	0.58	2.89	0.88
14	Most adolescents are knowledgeable about how STDs are transmitted	3.41	0.82	3.56	0.50	2.53	0.90
15	Would have loved to receive information about sex sooner in life.	2.10	1.01	3.27	1.14	3.00	0.00
16	Many cases of Gonorrhea and Syphilis are as a result of people using dirty toilet seats in public bathrooms.	3.38	1.24	2.68	1.29	3.47	0,90
	Grand mean	**2.99**	**0.57**	**3.17**	**0.41**	**2.72**	**0.10**

The result from Table 2.1.3 showed the mean and standard deviation analysis on how different age brackets differ in their knowledge of STDs Transmission. It showed that the mean knowledge of STDs Transmission among adolescents in the age group of 16-18 years was mean = 2.99 and SD=0.57 where as that of those in the age bracket of 19-21 years had mean = 3.17 and SD=0.41 and those in the age bracket of 22years and above was with mean = 2.72 and SD =0.10 respectively.

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The Mathematical Model Formulation

We develop a deterministic sex-structured mathematical model of Susceptible, Infected, and Recovered- an SIR-type model that incorporates STDs knowledge during covid-19 as the intervention strategy that helps to change the sexual behaviours of some individuals in the susceptible class. Here, by "knowledge", we mean unaware STDs susceptible individuals who have received proper or effective STDs public health education/counselling against risky sexual behaviours that may result in STDs diseases. This change in behavior leads to subdividing the susceptible individuals into three subclasses, namely unaware STDs susceptible individuals S, aware STDs susceptible individuals who modify their sexual behaviours S_1, and aware STDs susceptible individuals who remain faithful to their uninfected sexual partners for life S_2. Individuals only enter the general unaware STDs susceptible class S.

The recruitment into the S class is at a rate of Λ and natural death rate for all subclasses is μ. As a result of awareness (through STDs counselling and testing) a proportion of the susceptible leave the general unaware susceptible class S at the rate ρ $0 < \rho < 1$ out of which a fraction λ $(0 < \lambda < 1)$ reduce their sexual behaviours sufficiently by remaining faithful to their uninfected sexual partners for the rest of their lives (they are literally immune to STDs infection by sexual contact) and so move to the S_2 subclass while the complementary $(\overline{1}, \emptyset)$ reduce their sexual activities and so move to the S_1 subclass. The expected reduction in risky sexual behaviours by the S_1 as a result of awareness is counted for by the parameter $0 < \tau < 1$. It is pertinent to note that the inclusion of the S_2 subclass is very significant because an appreciable number of people have now changed their sexual behaviours sufficiently due to the awareness of the widespread nature of STDs in the society. The monumental deaths resulting from the disease increasing knowledge of the agony and psychological trauma experienced by the infected individuals and better enlightenment due to intense STDs educational campaigns, (Yusuf and Benyah 2012). The significance of the S_2 subclass is that it emphasizes the importance of prevention for a disease such as STDs and HIV that has no cure. Increasing the members of this subclass is one of the keys to control the spread of the disease. Since it is assumed in this study that the S_2 subclass is not involved in extra-marital activities and hence transmission, the infection with STDs is with S and S_1 subclasses only, with effective infection contact rate β_1 and β_2 respectively, due to their interaction with the Infected class I. thus, the disease spreads due to

the direct contact between the S and S_1 subclasses with the infected class (I). individuals in the I class, with a disease-induced death rate α, receive treatment with ARVs at a rate δ and hence move to the Removed class R of individuals who are assumed in this study not to be involved in transmission as a result of efficacy of ART. The R class has an additional disease-induced death rate of ν.

Thus, the total population size N(t) at time t, is given by

$$N(t) = S(t) + S_1(t) + S_2(t) + I(t) + R(t) \quad (1)$$

Based on the fact that the infectious period of STDs is very long ($\geq 10 years$), we regard the population size as varying and not constant. From the model assumptions above, the model takes the form of the following deterministic system of nonlinear ordinary differential equations that describes the interaction of STDs public awareness with unaware STDs susceptible individuals as:

$$\dot{S} = \Lambda - \lambda S - \rho S - \mu S \quad (2)$$

$$\dot{S}_1 = (1 - \emptyset)\rho S - \tau\lambda_1 S_1 - \mu S_1 \quad (3)$$

$$\dot{S}_2 = \emptyset\rho S - \mu S_2 \quad (4)$$

$$\dot{I} = \lambda S + \tau\lambda_1 S_1 - (\delta + \alpha + \mu)I \quad (5)$$

$$\dot{R} = \delta I - (\nu + \mu)R \quad (6)$$

with initial conditions S(0)>0, $S_1(0)$ >0, $S_2(0)$ >0, $I(0) \geq 0$, $R(0) \geq 0$. The rate of change of the total populations is obtained by adding the equations of model system equations (2-6) to give $\dot{N} = \Lambda - \mu\dot{N} - \alpha I - \nu R$ (7)

in equations (2-6), the forces of infection for the S and S_1 subclasses are $\boldsymbol{\lambda}$ and λ_1 respectively, where $\lambda = \beta_1 I$ and $\lambda_1 = \beta_2 I$. Since the model equations (2-6) monitors human populations and STDs public knowledge with treatment, it is assumed that all the state variables are non-negative for all time $t \geq 0$. All parameters in the model are assumed to be non-negative and one can show that the solutions of the system of equations are non-negative, given non-negative initial conditions.

Equilibrium Points and Stability Analysis

The model equations (2-6) has two non-negative equilibria: disease free equilibrium (DFE) point and endemic equilibrium (EE) point.

DFE and Basic Reproduction Number(R_0)

The model has DFE by setting the left-hand sides of equations (2-6) to zero, giving the result

$$E_0 = (S^0, S_1^0, S_2^0, I^0, R^0) = \left(\frac{\wedge}{\rho+\mu}, \frac{(I-\emptyset)\rho\wedge}{\mu(\rho+\mu)}, \frac{\emptyset\rho\wedge}{\mu(\rho+\mu)}, 0, 0\right) \quad (8)$$

The local stability of E_0 can be established using the next-generation operator method on the model equations 2-6. We take I as our infected compartment, then using the notation in (Driesche and Watmough2002), the Jacobian Matrices F and V for the new infection terms and the remaining transfer terms are respectively given by

$F = [\beta_1 S^0 + \tau\beta_2 S_1^0]$ and $V = [\delta + \alpha + \mu]$.

Taking the inverse of V, we have

$$V^{-1} = \left[\frac{1}{\delta+\alpha+\mu}\right], \text{ so that } FV^{-1} = \left[\frac{\beta_1 S^0 + \varepsilon\beta_2 S_1^0}{\delta+\alpha+\mu}\right]. \quad (9)$$

It follows that the basic reproduction number of the model denoted by R_0 is given by

$$R_0 = \rho FV^{-1} = \frac{\beta_1 S^0 + \tau\beta_2 S_1^0}{(\delta+\alpha+\mu)} = \frac{\beta_1\wedge}{(\rho+\mu)(\delta+\alpha+\mu)} + \frac{\tau\rho\wedge\beta_2(1-\emptyset)}{\mu(\rho+\mu)(\delta+\alpha+\mu)} \quad (10)$$

where ρ is the spectral radius, that is the dominant eigen-value of $|FV^{-1} - \lambda I| = 0$.

Furthermore, using theorem 2 in (Driesche and Watmough2002), we obtained the above result.

Disease Free Equilibrium of the Model

Theorem *The disease-free equilibrium of the model equations (2-6) given by E_0 is locally asymptotically stable (LAS) if $R_0 < 1$ and unstable if $R_0 > 1$.*

Thus, R_0 can be written as:

$$R_0 = \frac{\beta_1\wedge}{(\rho+\mu)(\delta+\alpha+\mu)} + \frac{\tau\rho\wedge\beta_2(1-\emptyset)}{\mu(\rho+\mu)(\delta+\alpha+\mu)} \quad (11)$$

$$= R_S + R_{S_1}$$

where,

$$R_S = \frac{\beta_1 \wedge}{(\rho+\mu)(\delta+\alpha+\mu)}, \qquad R_{S_1} = \frac{\tau\rho \wedge \beta_2(1-\emptyset)}{\mu(\rho+\mu)(\delta+\alpha+\mu)}$$

R_S represents the contribution of unaware STDs susceptible individual (S) to secondary infections, while R_{S_1} is the contribution of aware susceptible individuals (S_1) to the secondary infections. The threshold parameter R_0 measures the average number of new STDs infections generated by a single STDs infected individual throughout his/her infectious period in a completely susceptible population, Anderson and Mary (1991); Dickmann, Heesterbeek and Metz (1990); Hethcote (2000); Driesche and Watmough (2002) in which a proportion of aware susceptible (S_2) are not involved in the dynamics of the disease in the presence of ART. Thus, theorem 3.1 implies that the infection can be eliminated from the population if the initial sizes of the sub-populations are in the basin of attraction of the DFEE_0. Hence, the global stability of DFE,E_0 shows that it is globally asymptotically stable (GAS) because $R_0 < 1$.

Discussion of Findings.

This study undertook the assessment of 123 tertiary institution students' knowledge on the transmission dynamics and control of sexually transmitted diseases at covid-19 pandemic. The mean age of the respondents is 17.5 years. This study tried to establish the knowledge base of tertiary institution students of age 16 to 18 regarding STDs. Result on Table 2.1.3 showed the knowledge level of young adolescents (ages 16 to 19) regarding STDs had Mean = 2.99 with SD=0.33). With the respondents strongly indicating that STDs can be contracted through sexual intercourse had Mean=3.96 and SD=0.20, that it can cause pelvic inflammatory disease and infertility if left untreated with Mean =3.22 and SD=0.96. They also have the knowledge that some of the diseases have no cure (M=3.22, SD=0.93) and that Human Papillomavirus can lead to cervical cancer in women (M=3.16. SD=0.74) among others. Overall, the lower band of their knowledge stood at 2. 79 while the upper band was 2.91 respectively. Showing all the respondents have similar knowledge on STDs as there is no wide margin in their knowledge of STDs.

On how students' attitude affects transmission of STDs. the result on Table 2.1.2 showed a mean rating of 2.92, SD= 0.37. The result further showed that the

respondents strongly indicated that a person can only have one type of sexually transmitted disease at a time (M=3.28, SD=1.06). This was followed by the fact that a person with a cold sore on the mouth can give his or her partner Genital Herpes during oral-genital contact (M=3.16, SD=0.95) and If both couples have not had a sexually transmitted disease, they can engage in oral-genital or anal sex without tear of getting AIDS (M=2.88, SD=I.13) among others. The high mean on all the areas concerning their attitude to practices that can aid transmission indicates that they do not take precaution to control the spread of STDs. This finding is in agreement with the report of (Steinmetz, 2013) who opined that 50% sexually active college students do not wear condoms during sexual intercourse; and that patients under the age of 18 who have been exposed and continued to have sex were the least informed on the subject of sexually transmitted diseases. Also, adolescent students are not motivated to practice safe sex.

Finally, the result Table 2.1.3 showed the summary of descriptive statistic on how different age groups differ in their knowledge of STDs Transmission. It shows that the mean knowledge of STDs Transmission among adolescents in the age bracket of 16-18 years was M = 2.99, SD=0.57) whereas that of those in the age bracket of 19-21 years was M =3.17, SD =0.41 and those in the age bracket of 16-19 years was M = 2.72, SD =0.10. This showed that those in the age bracket of 19-21 had good knowledge of how individual attitude can contribute to the transmission of STDs as compared to the age cohorts in the study. The best knowledge showed by those 19-21years may not be unconnected with the fact that this age cohort in the class currently receiving lessons on sexuality education as indicated in the syllabus from secondary education in Nigeria. This finding is contrary to a study conducted by Amu & Adegun 2015 in Edo-Ekiti, Nigeria, which reported that only 6.9% of the respondents have good knowledge of STDs and its transmission.

These findings also uphold that the reproduction number of STDs is greater than 1, which implies that the diseases are still spread from generation to generation.

Conclusion

Knowledge of STDs among tertiary institution students has not been extensively researched and so many people may not know that these children do not have adequate knowledge on STDs and their transmission pathway among human population. Again adolescents have not been very truthful about the sexual habit, especially age at first exposure even at covid-19. This has also made it

difficult for them to take responsibility for their sexual health and to practice safe sex. Knowledge deficit is worst among the younger age groups (16-18). It is important therefore that these children be properly schooled right from the home before they are up to school age, especially on the different STDs, their spread and control in human population. This will help us achieve lower rates of contracting diseases and make the young adults live healthier lives as well as develop lifelong habits taking responsibility for their health.

Recommendations

Based on the findings, it was recommended that the children be given information on STDs at earlier ages before starting school. This will help them recognize symptoms and either flee from fellows with such symptoms or report to more knowledgeable others.

They should be made to understand that no one is immune to contract STDs. That sexual activity with infected person will mean contracting an STD or STDs; and that self-care and responsible behaviour is required to limit exposures.

That STDs as the name implies can be contracted through sexual activities with infected persons, if they must have sex, they should make it safe by using measures that prevent contact with body fluids of partners. However, abstinence is the best for their age cohort.

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