LIFE: International Journal of Health and Life-Sciences
ISSN 2454-5872

Omone et al., 2020

Volume 6 Issue 3, pp. 01-22

Date of Publication: 12th November, 2020

DOI- https://dx.doi.org/10.20319/lijhls.2020.63.0122

This paper can be cited as: Omone, O. M., Lucky, K. & Kozlovszky, M. (2020). Effective Prevention of High-Risk Cervical Cancer among Women in Developing Countries: A Case-Study in Nigeria. LIFE: International Journal of Health and Life-Sciences, 6(3), 01-22.

EFFECTIVE PREVENTION OF HIGH-RISK CERVICAL CANCER AMONG WOMEN IN DEVELOPING COUNTRIES: A CASE-STUDY IN NIGERIA

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Abstract

There is a surge of morbidity and mortality among women as a result of untreated cases of Cervical Cancer (CC) which is common among women living in underdeveloped and developing countries. The epidemiology of CC revealed that the application of certain combat and operational risk factors of some germane associated with the formation/development of CC can help avoid being infected by the neoplastic disease or the early discovery at an early stage can help mitigate the spread. Hence, some germane high-risk and low-risk factors of the formation of CC in this study were considered to help differentiate infected women from those that are not infected and to create awareness about HPV for effective prevention of CC formation. This study is aimed at predicting and differentiating the group of women with 'low-risk' CC from 'high-risk' CC among Nigerian

women; identification of 'high-risk' population. Therefore, some germane and prevalent risk factors such as having sexual intercourse at an early age (early age at sexual debut/first coitus) and the number of sex partners had over a lifetime, and other known low-risk germane such as poor diet and inadequate knowledge about Human Papillomavirus (HPV) and CC were considered; wherewith HPV is considered a predominant risk factor for the occurrence/possibility of CC among the population. A risk-score assessment Human Papillomavirus (HPV) Assessment Test (HAT) tool was used for data collection. Hence, this study is the first to develop a risk-score assessment test tool for HPV and CC awareness in Nigeria.

Keywords

Cervical Cancer (CC), First Coitus, Human Papillomavirus (HPV), Knowledge, Poor Diet, Sex Partners

1. Introduction

Cervical Cancer (CC) is known as cancer of the cervix. Biologically, the efficient development of the cell cycles/cell-division cycle plays a vital role in the proper growth of the human body. The cell-division is a process that enhances the development process and progression of both internal and external organs in the body. Types of cell-division are; binary fission, mitosis, and meiosis cell division. Cancerous cell develops in the eukaryotic cells as a result of a mitosis cell-division when normal cells are inhibited for uncontrolled growth, damaged and unchecked (cannot be renewed); resulting to the mutation of genetic cell-division. When there is a damage in the mutation of genes in the cervix area, a cancerous tumor begins to develop in the lower part of the uterus. This process is called *'CC formation'* (Kashyap et al., 2019). It develops around the female reproductive ducts/cervix area and it is the most prevalent kind of malignancies and the fourth most diagnosed cancerous disease among women globally (Riaz et al., 2020). It is defined by ICO/IARC Information Centre as the end-stage of untreated HPV infection (*HPV INFORMATION CENTRE,* n.d.). Globally, the epidemiology of CC revealed that over 500,000 new cases of CC infected women are been reported/recorded yearly (Franco et al., 2003). According to the most recent research in 2018 for the regional reports on the Sub-Saharan Africa by the Catalan Institute of Oncology (ICO) and the International Agency for Research on Cancer (IARC) on HPV and Cancer in Nigeria, statistical analysis reveals that over 50 million women above the age of 15years are at risk of developing CC. Yearly, 14,943 women were recorded to be diagnosed with CC

disease while 10,403 women die as a result of the untreated disease; thus, it is ranked as the second kind of cancer existing among women between the ages of 15 – 44 years (Mboumba Bouassa et al., 2017). This is because Nigeria is a developing country with over 195,874,683 as the entire population and there is no availability of free medical services to accommodate such a huge population. However, the cases of CC are more dominant in developing countries (Kashyap et al., 2019), (Zanin, 2018) than in developed countries. This is because there are no effective interventions to enhance the prevention of the disease. Hence, the women population in developing countries does not know the causes (germane risk factors) of CC which are; inadequate social and medical amenities, poor social awareness, virus infection, way of life/behavior, and poor awareness about CC and HPV. These germane risk factors can be categorized as *'low'* and *'high'* risk factors (Kashyap et al., 2019). In this study, the considered *'high-risk'* factors which are the causes of CC are; the way of life (such as poor diet, first coitus, and several sex partners), persistent virus infection (such as HPV), and poor awareness about CC and HPV (i.e. lack/inadequate knowledge about CC and HPV).

1.1 Human Papillomavirus (HPV) and Cervical Cancer (CC)

HPV is categorized as a *high-risk* factor for the possibility of CC in women. HPV is an infectious virus (i.e. a viral infection) that is contagious from the male to the female through sexual intercourse. This viral infection causes membrane growth (such as genital warts) and even cancer (mostly in a female if left untreated) around the genital organ of both males and females. There are numerous species of HPV genotypes that can be classified as *'low-risk/high-risk'* types. Several epidemiology studies classified the risk type as *low-risk/high-risk*; the HPV genotypes classified as *low-risk* are 1, 4, 6, 7, 11, 26, 27, 28, 29, 30, 36, 37, 38, 40, 41, 42, 43, 44, 45, 48, 49, 54, 55, 57, 60, 61 62, 63, 65, 70, 72, 73, 74, 75, 76, 77, 81, 84, 90, and 91 genotypes, while the genotypes classified as *high-risk* are 2, 3, 5, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 45, 47, 50, 51, 52, 53, 56, 57, 58, 59, 64, 66, 67, 68a, 68b, 69, 73 and 82 genotypes (Ault, 2006), (Omone & Kozlovszky, 2020). In this study, we focus on certain *high-risk* HPV genotypes that are associated with the *formation of CC* in women. Recently, researchers have discovered that these HPV genotypes (16 and 18) (So et al., 2016), are classified as *'high-risk'* genotypes and are imperatively the etiology of this neoplastic disease (cancer of the cervix).

The development of HPV infection into a cancerous tumor in the cervix area takes a very long time; it takes 15 – 20 years to develop in women with a normal immune system and 5 – 10 years to develop in women with a weak immune system. Mostly, *HPV-16* and *HPV-18* genotypes are the types of *'high-risk'* genotypes and the main types of HPV species that cause 70% of CCs and precancerous cervical lesions among middle-aged women in Nigeria (*Human Papillomavirus (HPV) and Cervical Cancer*, n.d.). When persistent HPV develops into CC, normal cells are transformed and converted into abnormal cells, and then these cells develop precancerous tissues (Balasubramaniam et al., 2019). This first-stage *formation of CC* is called Cervical Intraepithelial Neoplasia (CIN-1: low-grade squamous intraepithelial lesion) but may gradually become severe and then develops into a second-stage (an invasive stage) called Neoplasia and Microinvasive lesions (CIN-2/CIN-3: high-grade squamous intraepithelial lesion) (Cutts et al., 2007). However, in a few cases, the immune system can fight against the development of HPV infection for the *formation of CC*. The immune system can fight against HPV infection if such individual does not have any other kind of infections/diseases, eats a healthy diet, and medically fit.

1.2 First Coitus/Early Age at First Sexual Intercourse

Early age at first coitus is considered one of the epidemiological features, as well as a *'high-risk'* factor associated with CC among women. Research has revealed that first coitus on CC risk is not certain but depends on the age at first coitus with multiple sexual partners (Shepherd, 2000), and an immature cervix development in young women/adolescents (as a Hormone-Dependent Tissue – HDT) which is prone to HPV infection (Plummer et al., 2012). Fundamentally, it is also a *high-risk* factor for HPV infection, other studies revealed that unprotected sex (i.e. poor sexual hygiene) with carriers of HPV (*STD Facts - Human Papillomavirus (HPV)*, n.d.) is also a risk factor of being infected by HPV which is a fundamental risk for *the formation of CC* (Small et al., 2017). It is necessary that young women are taught to practice safe-sex and abstain from it until they are older which is a prevention strategy and a behavior intervention (Kessler, 2017).

An investigation carried out among 362 female students at the University of Lagos, Nigeria revealed that 204(56.3%) responded to HPV and CC knowledge-related questions, whereby 58(28.4%) do not know that early age first coitus increases the risk of the *formation of CC* (Makwe et al., 2012). This could induce that 28.4% could have been involved in early sex practices, infected with HPV, and likely to develop CC in the future. In Nigeria, one of the reasons for early sex is early marriage (Ukwuoma, n.d.). This is mostly recurring in the rural-northern part of Nigeria,

where teenagers (between 13 – 15 years) are given out in marriage (Ahmed et al., 2013). An enforced law by the government to stop child marriage will further contribute to the reduction of CC in Nigeria.

1.3 Poor Diet

The biological scientist has discovered that when the human body is lacking certain minerals, vitamins (especially vitamin C and other vitamins A, B, D, and E) and other nutrients, the cellular Deoxyribonucleic Acid (DNA) can be damaged leading to a weakened immune system. This makes the human body prone to *'low-risk'* of cancers (e.g. cancer of the head and neck, CC, etc.) and other kinds of infection (Whitney & Rolfes, 2018). When the body is infected by HPV, building a strong immune system by consuming a measurable amount of antioxidants from our daily Food Intake (FI) can help reduce the risk of the *formation of CC* and other types of gynecologic cancers (Koshiyama, 2019). This can be achieved by the daily practice of a good diet enhanced by the consumption of food rich in antioxidants; mostly plant-based meals (such as vegetables and fruits, class of phytonutrients food-carotenoids, and vitamins) as this helps the body to attack free radicals that damage the DNA and proper physiological functions (Lobo et al., 2010), supports the DNA methylation, and modulate the immune system functionality (Gombart et al., 2020). A good diet improves body development and fortifies it to fight against attacks that prevent the physiological functionality of the body. Most importantly, daily adequate water intake should be considered as a part of our diet because water as a nutrient is a solvent that helps the body with the elimination and excretion of certain waste products that are toxic to human health (Omone et al., 2020).

Studies have revealed that micronutrients and supplements can help in reducing the level of risk associated with HPV infections, and the progression, persistence, and regression of the *formation of CC* (Harper & Demars, 2014). However, many are not well informed about this subject; as a report shows that poor diet is a cofactor of 20% to 60% formation of CC in both developed and developing countries (Koshiyama, 2019), (McCullough & Giovannucci, 2004). As a result of poverty, Nigeria is reported to be one of the countries where the population lack a good diet, thereby leading to the prevalence of several diseases which includes HPV a risk factor for *the formation of CC* among the women population, thereby leading to high mortality rates (Sowunmi et al., 2015).

1.4 Inadequate Knowledge about HPV and the Formation of CC

In 2018, the Global Cancer Observatory (Globocan) in Nigeria reported that cancer of the cervix uteri is the second kind of cancer Nigeria women suffer from yearly. According to the International Agency for Research on Cancer (IARC), Nigerian women diagnosed with CC has resulted in 10,403 rates of mortality yearly (*Cancer Today*, n.d.). The mortality rate is higher in the rural parts of Nigeria because the rural area is less developed, lack medical services, and less informed than the urban area (WHO | The World Health Report 1998 - Life in the 21st Century: A Vision for All, n.d.). However, the population of urban settlement is more than rural settlement. According to the World Bank in 2018, 97,263,561 (49.66%) of the population consisted of the rural settlement while 98,611,179 (50.34%) consisted of the urban settlement in Nigeria (*Population, Total - Nigeria | Data*, n.d.). Therefore, there is a higher probability of CC disease among women in the rural area than in the urban area in Nigeria due to the lack of adequate health services combined with an overpopulated structure of the rural area (*WHO, 1998*), (Ogunbode & Ayinde, 2005). Thus, there is a need for awareness and knowledge impact about HPV and CC among women in the rural area in order to keep them informed and educated; which is synonymous to developing and developed countries (Rama et al., 2010).

The lack of knowledge about HPV and CC in Nigeria is a vital but *low-risk* factor to be considered in this study because the lack of knowledge stands as a substantial barrier to the prevention of CC. The impact of knowledge about HPV and CC on the population can be promoted if the healthcare system in every state/region in Nigeria organizes seminars/conferences at least twice in a year to educate women; this can prevent/mitigate the outbreak of CC disease among women (Bisi-Onyemaechi et al., 2018). Furthermore, the women should be informed about how to prevent being infected by HPV (a *high-risk* factor associated with CC) by engaging in protected sex, the effects of HPV vaccines, and ingestion at least twice a year (for teenagers, adolescents, and adults), and the willingness to undertake regular PAP (Papanicolaou) smear test (an examination of the cervix to detect abnormal and precancerous/cancerous growth) (Makwe et al., 2012). Apart from HPV infection, increased number of parity (≥5), age at first birth, family history, exposure to Diethylstilbestrol (DES) in utero during pregnancy, frequent use of oral contraceptive (OC) pills, Sexually Transmitted Infections (STIs), lack of free medical services, and smoking (Amini et al., 2017) are a potential risk for the development of CC in women (Cooper et al., 2007), (*Risk Factors for Cervical Cancer - Canadian Cancer Society*, n.d.), (Daling et al., 2004). In a comparison

between developed and developing countries, researchers have revealed that the level of knowledge concerning HPV and CC is more dominant in developed countries (Francis et al., 2010). According to a study conducted among health workers in Cyprus (a developed country), statistical analysis revealed that the population under the investigation had good knowledge about HPV. Thus, 88.5% of 200 women indicated to have good knowledge about HPV (Christodoulou et al., 2019). In contrast, another study conducted in Gondar town, Ethiopia (a developing country), revealed that >80% of 770 women indicated not to have any knowledge about HPV as one of the germane risk factors of CC (Mengesha et al., 2020). Therefore, we would say that the women population in developing countries are more at risk of being infected by CC than the women population in developed countries. Thus, inadequate knowledge about HPV is associated with the fact that the women reside in a developed/developing country and the *formation of CC (Riaz et al., 2020).*

1.5 Number of Sex Partners

A sexually active woman with an increase in multiple sex partners is considered a '*high-risk'* factor for HPV infection and the *formation of CC*. Previous epidemiological research has also revealed that having sex with a male-partner who have had multiple sex partner over a lifetime can put the woman at risk of developing CC because the man is known to be the etiological carrier of HPV (Omone & Kozlovszky, 2020). Apart from being infected by HPV as a result of multiple sex partners, there are other kinds of Sexually Transmitted Infections (STIs) that are transmitted during sexual intercourse (Jesus & Martinez, 2019); these STIs (such as Human Immunodeficiency Virus (HIV), Herpes-Simplex Virus type 2 (HSV-2), chlamydia trachomatis, ureaplasma, trichomoniasis, cytomegalovirus (CMV), syphilis, granuloma inguinale, Neisseria gonorrhea, mycoplasma genitalicum, and Hepatitis B and C) are a cofactor of HPV infection and increases the risk of the *formation of CC* (Cooper et al., 2007). However, HSV-2 has the highest risk factor among all other STIs (Kim et al., 2016). When a woman is infected with any kind of STI, the virus attacks the cell-cycle in the woman's body, thereby manipulating the cell-cycle to reproduce the virus as normal cells (Cairns et al., 2011). Hence, certain abnormal cell-cycles begin to grow into abnormal cells (precancerous tumors) i.e. the cytological vicissitudes of the cervical epithelial cells propelled by STIs (Kim et al., 2016). The only preventive measure against STIs is to consistently engage in protected sexual intercourse (e.g. the use of condoms by both male and female) which will also decrease the risk of CC and other HPV-related cancers (Shepherd, 2000), (Parkin & Bray, 2006). On getting infected with one/more STI(s) or not, to further prevent the *formation of CC*, it is

important to enforce STI evaluations for women as soon as they start sexual activities in Nigeria. Studies have shown that there is a possibility that a woman could be infected with more than one STIs at a time, which may stipulate an increase/rise in the *formation of CC* in such a woman (Kim et al., 2016) alongside with HPV infection.

2. Materials and Method

Descriptive statistics was mainly used for simply analyzing the collected data; thus, representing the data using tables and correlation coefficient. Factors which were described using tables are the population's socio-demographic factors, age at first coitus, poor diet, number of sex partners, HPV history, Knowledge, Attitude, and Perception (KAP) about HPV and CC in Nigeria. To find the association/correlation between the population's risk score and age at first coitus Product Moment Correlation Coefficient (PMCC) was used.

2.1 Human Papillomavirus (HPV) Assessment Test (HAT) and the Study Design

In this study, a risk-score sheet was developed as a data collection method. The risk-score sheet, known as Human Papillomavirus (HPV) Assessment Test (HAT) is a standardized and anonymous questionnaire which was administered to Nigerian women during an online conference organized by a group of gynecologists. Yearly, over 500,000 Nigerian women usually join the conference online. The questionnaire was administered to all participants who joined the conference. However, about 2,000 participants responded to the questionnaire. The questionnaire included questions that are capable of collecting information about the participant's sociodemographic factors, age at first sexual experience, sexual behavior and sexual hygiene practices, records/history of STIs, dietary behavior/habit, knowledge about HPV and CC. Data distribution was carried out on the day of the conference during the online meeting but data collection was between January 2020 – June 2020.

2.2 Study Population

The study population of this study involved only women in Nigeria to conduct a cross-sectional study. Among 2,500 women who responded to the questionnaire, only 1,638 were qualified to meet the selection criteria for this study investigation. These criteria are highlighted below;

2.2.1 Inclusion Criteria

The women who passed the selection criteria in this research and were included are only Nigerian women living in Nigeria, women who have had sexual intercourse in their lifetime, and women between the age of 12 – 65 years.

2.2.2 Exclusion Criteria

The women who did not pass the selection criteria in this research and were excluded are women who are not Nigerians, women who have never had sexual intercourse, women below the age of 12 years and above 65 years.

3. Statistical Analysis

The collected data was evaluated and examined with the use of an IBM statistical software tool; SPSS version 27.0. Socio-demographic factors, CC and related risk factors, the association between number of sex partners and CC, and the level of knowledge, attitude, and perception of Nigerian women towards HPV and CC are presented as percentages using descriptive statistics. To find the association between age at first sex and the population score, Product Moment Correlation Coefficient (PMCC) was used, where $r\ (1638) = -0.233,\ p<0.001$ and $r^2 = 0.054$ which indicates that age is a contributing factor with 5.4% to score of each woman who have used the HAT tool.

4. Results

In this paper, results are presented using descriptive statistics. These includes tables and correlation coefficient.

4.1 Socio-Demographic Factors

As shown in Table 1 below, statistics to show the sociodemographic factors revealed that most of the women who responded to the questionnaire were middle-aged women. Wherefore, the group which contained teenagers and young adult women are between the age of 12 – 25 years with a total of 153 (9.3%), the group which contained the middle-age women are between the age of 26 – 40 years with a total of 1320 (80.6%), and the group which contained older adult women are between the age of 41 – 64 years with a total of 165 (10.1%). Significantly, as related to civil status, the largest group were married women; there were 424 (25.9%) single women, 1188 (72.5%) married women, and 26 (1.6%) divorced women. The women's level of education was above average. However, only 2 (0.1%) had no formal education while 4 (0.2%) attended primary school,

136 (8.3%) secondary school, 1,179 (72.0%) had a bachelor's degree, 288 (17.6%) had a master's degree, and 29(1.8%) had a doctorate. There was a high rate of poverty among the women, wherefore 632(38.6%) earned below 100usd, 447(27.3%) earned between 100 – 200 USD, 295(18.0%) earned between 200 – 500 USD, 152(9.3%) earned between 500 – 1000 USD, and only 112(6.8%) earned above 1000 USD per month respectively. Mostly, the women resided in the urban settlements in Nigeria. Therefore, 641(39.1%) resided in a rural settlement while 997(60.9%) resided in an urban settlement.

Table 1: *Socio-Demographic Factors*

Social & Demographic Factors	**N = 1638**	
	Frequency	**%**
Age Groups (years)		
12 – 25	153	9.3
26 – 40	1320	80.6
41 – 64	165	10.1
Civil Status		
Single	424	25.9
Married	1188	72.5
Divorce	26	1.6
Level of Education		
Elementary/Primary School	4	0.2
High School/Secondary School	136	8.3
Bachelor's Degree	1179	72.0
Master's Degree	288	17.6
Doctorate Degree	29	1.8
No Formal Education	2	0.1
Level of Income – Monthly (USD)		
≤ 100	632	38.6
100 – 200	447	27.3
200 – 500	295	18.0
500 – 1000	152	9.3
≥ 1000	112	6.8
Residing Settlement		
Rural Settlement	641	39.1
Urban Settlement	997	60.9

4.2 Formation of CC with Age at First Coitus, Poor Diet, Number of Sex Partners, and HPV History

Among the entire population, statistics show that a few among the women had their first sex at an early age, many indicated to practice poor diet, women who have had 2 – 4 number of sex

partners in their lifetime were of the largest group, and many women haven't had the medical record for HPV 16/18 infection. However, the women who indicated not to have been tested for HPV 16/18 are likely not to have access to free medical facilities/services or have no knowledge about HPV genotypes.

Table 2: *CC Formation and Certain Risk Factors*

N = 1638		
Risk Factors	**Frequency**	**%**
Age at First Coitus (years)		
10 – 15	115	7.0
16 – 20	733	44.7
21 – 25	504	30.8
26 – 30	243	14.8
31 – 35	33	2.0
36 – 42	10	0.6
Poor Diet		
No	532	32.5
Yes	1106	67.5
Number of Sex Partners		
1	487	29.7
2 – 4	591	36.1
5 – 10	405	24.7
11 – 15	66	4.0
16 – 20	30	1.8
≥ 20	59	3.6
HPV 16/18 Record		
No	1626	99.3
Yes	12	0.7

Statistically, among the group of women who indicated when they had their first coitus, Table 2 above shows that 115 (7.0%) who experienced their first coitus between the age of 10 – 15 years are at a *higher risk* of HPV infection due to sex as very young adults/teenagers than other women who had the experience at a later age (16 – 42 years). Considering a poor diet practice is a *low-risk* factor but many women are no practitioners of a good diet. Our investigation shows that 532(32.5%) who responded "No" to poor diet means that they practice a good diet, while those 1,106(67.5%) who responded "Yes" to poor diet means they practice poor diet. This shows that over 50% of the population is at '*low-risk'* of the formation of CC due to poor diet. Multiple numbers of sex partners weren't a dominate factor among Nigeria women, this could be as a result of the level of a religious dedication in the country. Only 560(34.1%) have had between ≥5 to ≥20

number of sex partners in their lifetime while 1,078(%) indicated to have had between 1 – 4 number of sex partners in their lifetime. However, just a few women are considered to be at '*high-risk*', wherefore 155(9.5%) have had between ≥11 to ≥20 number of sex partners in their lifetime. Largely, 1,626(99.3%) indicated having no record of HPV 16/18 which could be a result of inadequate knowledge and lack of free medical services.

4.3 Number of Sex Partners (High-risk) and Low-risk Factors Increases the Risk CC

In this research, 115(7.0%) women who indicated that they started having sex at an early age (between the age of 10 – 15 years) a high-risk factor, are considered as early sex starters. Other risk factors (poor diet, unprotected sex practices, no HPV vaccine taken, and level of income per month) were also considered to help us predict the level of the *formation of CC* among them.

Table 3: *Association Between Number of Sex Partners and Behavior; High-Risk CC Formation*

Risk Factors	**Number of Sex Partners, N = 115**						
	1	**2 – 4**	**5 – 10**	**11 – 15**	**16 – 20**	**≥20**	**%**
High-risk Factor							
Age at First Coitus(years)							
10 – 11	3	3	6	0	1	0	11.3
12 – 13	3	12	11	5	3	3	32.2
14 – 15	3	15	25	5	6	11	56.5
Low-risk Factors							
Poor Diet							
No	5	11	16	6	2	6	40
Yes	4	19	26	4	8	8	60
Engage in Protected Sex							
No	5	17	30	7	9	11	68.7
Yes	4	13	12	3	1	3	31.3
HPV Vaccine History							
No	9	29	40	9	9	13	94.8
Yes	0	1	2	1	1	1	5.2
Level of Income – Monthly (USD)							
≤ 100	4	15	18	4	2	8	44.3
100 – 200	1	8	15	5	0	1	26.1
200 – 500	3	3	4	0	7	3	17.4
500 – 1000	0	2	3	0	1	0	5.2
≥ 1000	1	2	2	1	0	2	7.0

According to Table 3 above, we carried an investigation among 115(7.0%) women who indicated having had their first coitus between the age of 10 – 15 years to determine their lifestyle/behavior. Result shows the impact of behavior as a possible risk factor for the *formation of*

CC. Among 115 women, we recorded a *high-risk of CC*, wherefore 11.3% had first coitus between age 10 – 11 years, 60% indicated to practice poor diet, 68.7% were involved in unprotected sex, 94.8% had never received HPV vaccine, and 44.3% had a low income per month (≤100usd ≡ 30,000ngn). Therefore, considering the percentages ((11.3/100) * (60/100) * (68.7/100) * (94.8/100) * (44.3/100)) of their behavior in association with multiple number of sex partners, hence, only 2.0% among 115 women are at a high-risk of the *formation of CC*.

4.4 Knowledge, Attitude, and Perception (KAP) Towards HPV and CC in Nigeria

The level of knowledge, attitude, and perception of Nigerian women towards HPV and CC is crucial to help reduce mortality rate. However, our investigation shows that these women are not well informed about HPV infection and CC as a neoplastic disease. Despite the high level of education among the women under study, where 1179(72.0%) were BSc holders, 288(17.6%) were MSc holders, and 29(1.8%) were Ph.D. holders as shown in Table 1 above, we recorded a poor level of HPV and CC education among the women. Using descriptive statistics as shown in Table 4 below, we observed that over 60% of the population does not have adequate knowledge about HPV and CC. Hence, 1,141(69.7%) women indicated that they have never attended any HPV related seminar not read about it, 1,232(75.2%) do not know that HPV 16 and 17 are the leading cause of 70% CC in the world, 1,501(91.6%) do not know that there are other HPV genotypes (e.g. 1, 4, 6, 7, 11, 2, 3, 5, 8, 9, etc.) in existence, 1,403(85.7%) do not know that it takes between 15 – 20 years for HPV 16 and 18 to develop into CC in women with the normal immune system while 1,275(77.8%) do not know it takes 5 – 10 years in women with the weak immune system, 1582(96.6%) have never been to the hospital to check if they are HPV status (+ve/-ve), 1538(93.9%) have never taken HPV vaccine in their lifetime, 1581(96.5%) claimed not to have heard about HPV-related warts, 1373(83.8%) do not know that early sex increases the risk of HPV infection, 1350(82.4%) do not know that persistent/untreated HPV can progress in the *formation of CC*, and 1153(70.4%) have never attended a PAP smear screening before.

Table 4: *KAP For HPV and CC Among Nigerian Women*

N = 1638		
KAP-related Questions	**Frequency**	**%**
Have you attended HPV Seminar/read about it?		
No	1141	69.7
Yes	497	30.3
Do you know that HPV 16 % 18 are the leading causes of 70% Cervical Cancer?		

No	1232	75.2
Yes	406	24.8
Apart from HPV 16 & 18, do you know that there are other several HPV genotypes?		
No	1501	91.6
Yes	137	8.4
How long does HPV 16 & 18 take to develop in women with normal immune system		
1 - 5 years	646	39.4
5 - 10 years	441	26.9
10 - 15 years	316	19.3
15 - 20 years	235	14.3
How long does HPV 16 & 18 take to develop in women with weak immune system		
1 - 5 years	949	57.9
5 - 10 years	363	22.2
10 - 15 years	190	11.6
15 - 20 years	136	8.3
Have you ever been to the hospital for HPV test?		
No	1582	96.6
Yes	56	3.4
Have you taken HPV vaccine before?		
No	1538	93.9
Yes	100	6.1
Have you ever heard about HPV-related warts?		
No	1581	96.5
Yes	57	3.5
Do you know that early sex increases the risk of HPV?		
No	1373	83.8
Yes	265	16.2
Do you know that persistent HPV increases the risk for Cervical Cancer progression?		
No	1350	82.4
Yes	288	17.6
Have you ever gone for the Papanicolaou-stained (Pap) test?		
No	1153	70.4
Yes	485	29.6

4.5 Association between Risk Score and Age at first Coitus

Data collected with the HAT tool generated risk-scores for every woman who responded to the questionnaire. As shown in Figure 1 below, using Pearson correlation, there was a negative linear correlation of $r = –0.233$ between the age when each woman had their first coitus and the score generated by the tool. This implies that the resulting Product Moment Correlation Coefficient

(PMCC) is a weak negative/weak downhill linear relationship between age at first coitus and score i.e. as the score (independent value) increases, the age at first coitus (dependent value) decreases. In other words, we say that that the score of each woman increases when the age at first coitus is between 10 – 15 years, which indicates that such a woman is at a high-risk of CC. Therefore, a bivariate correlation of the Pearson correlation examined, showed that there is a weak negative significant association (i.e. statistically significant) for a two-tailed (2-tailed) test between scores and age at first coitus, where r (1638) = –0.233, p<0.001 and the effect size for age at first coitus, where r2 = 0.054 is a contributing factor at 5.4% for each woman's total score.

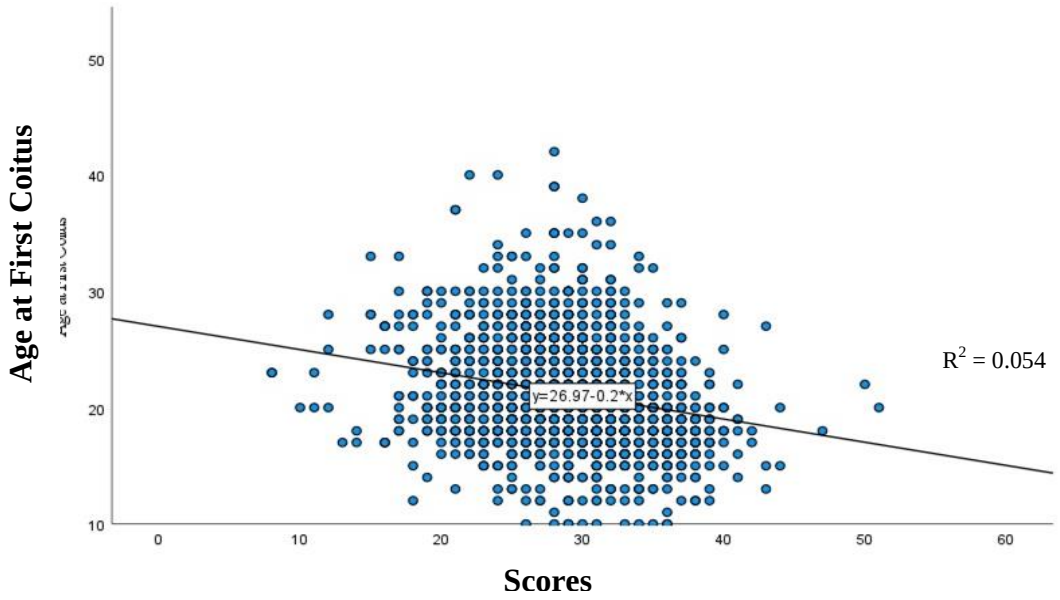

Figure 1: *Association between Scores and Age at First Coitus*

5. Discussion

As recorded by the U.S. Census Bureau Current Population in July 2020, Nigeria as a developing country is the sixth largest population in the world (*Current Population*, n.d.) with low living standards which is affected by the country's low per capita gross domestic product (GDP). Poverty has long lingered in Nigeria and has affected the population (including children, young, and old people) in diverse ways (such as health, career development, etc.) (Ojagbemi et al., 2017). Evidently, our research proves that 38.6% of the women included in this study are living in extreme poverty as they indicated to earn below 100usd (i.e. 30,000ngn) per month which is below the current Nigeria National Minimum Wage (NNMW) (*Nigeria National Minimum Wage | 2018-2020*

Data | 2021-2022 Forecast | Historical, n.d.), (Sinding, 2009). As a result, such women are unable to pay their medical bills and are likely to the dead of CC disease.

In this study, only 115(7.0%) of the women had experienced their first coitus at an early age. Women who started having sex between the age of 10 – 15 years are considered young teenagers in this research (Louie et al., 2009). Scientists have revealed that HPV 16/18 can persist and progress to the *formation of CC* in women with the normal immune system between 15 – 20 years while it takes 5 – 10 years in women with the weakened immune system (*Human Papillomavirus (HPV) and Cervical Cancer*, n.d.), (Cervical Cancer: Risk Factors | Cancer.Net, n.d.). Hence, women who do not practice good diet have no chance of developing a normal immune system which is capable of preventing the *formation of CC* (McCullough & Giovannucci, 2004). Therefore, women who had first coitus at early age, have between ≥11 to ≥20 number of sex partners, and practice poor diet are likely to develop are at a *high-risk* of CC or are likely to be in the first-stage of CC development (i.e. CIN-1: low-grade squamous intraepithelial lesion).

Sexual lifestyle/behavior (early sex and multiple number of sex partners) as a way of life is a *'high-risk'* factor, while low income, poor diet is a *'low-risk'* factor which has impacted 2.0% among 115 women in this study. Several researchers have also discovered an association between sexual behavior and *high-risk* CC. There is a likelihood that a women who started having sex at a young teen age would also have multiple sex partners (Shepherd, 2000), (Louie et al., 2009), except women who are victims of early/child marriage.

In this study, descriptive analysis has revealed that over 60% among 1,638 women are not well informed about the causes of HPV, the physiological harm of HPV to women's health, and HPV vaccines that can be used to prevent HPV infection. These same women are not even aware that HPV 16 and 18 are the leading cause of 70% of CC in women, globally. Corresponding to other statistically related research about HPV and CC, our study have proved that awareness about HPV and CC should be ultimately projected and sustained between teenage girls, adult women and old women (Bisi-Onyemaechi et al., 2018). This will help prevent the HPV pandemic among younger women and the formation of CC in adult women.

We examined the association between the scores (which was generated by the Human Papillomavirus (HPV) Assessment Test (HAT) tool) obtained by the women and age at first coitus. The result shows that age at first coitus (having sex at a younger age between 10 – 15 years) accounted for a portion of 5.4% of the variability of each woman's total score. The higher the score,

the higher the risk of CC. Therefore, age at first coitus is a *high-risk* factor for persistent HPV infection and the *formation of CC* (Plummer et al., 2012).

6. Conclusion

This study has revealed that women residing in both rural and urban settlement in Nigeria are at *high-risk* of the *formation of CC*, whether now/future. Even though Nigeria is a developing country and has women who have high levels of education, statistics shows that they are not well informed about HPV and CC which makes them vulnerable to high mortality rate of cervical cancer disease. It also shows a *high-risk* impact of early sex among women who indicated to have had first coitus between the age of 10 – 15 years. Hence, early sex should be abolished by the government among both male and female teenagers in Nigeria. Parents should also pay close attention to their teenage wards in order to prevent them from engaging in early sex. Sex education which includes the risk of HPV infections should be taught both in high-schools and tertiary institutions. Most importantly, HPV vaccine should be freely administered in both rural and urban settlements in Nigeria. The study population used for statistical analysis was insufficient to make a concrete conclusion regarding the increase of CC and high mortality rate among Nigerian women. Hence, the Human Papillomavirus (HPV) Assessment Test (HAT) tool shall be redistributed in Nigeria in order to collect a large-scale response which will be suitable for a concrete conclusion.

ACKNOWLEDGMENT

The authors thank the EFOP-3.6.1-16-2016-00010 project and the GINOP-2.2.1-15-2017-00073 named “Telemedicina alapú ellátási formák fenntartható megvalósítását támogató keretrendszer kialakítása és tesztelése, Hungary for their financial support.

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