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Genotypes and Associated Risk Levels of Human Papilloma Virus among Female Patients Attending Rabuor Sub County Hospital, Kisumu

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ABSTRACT

Background: Human papillomavirus is the main factor in the etiology of cervical cancer, with over 99.7% of cases being associated with high-risk human papillomavirus infection. Although the majority of HPV infections are asymptomatic and self-limiting, persistent HPV infection can result in genital warts, oropharyngeal cancer, and cervical cancer in women, in addition to various anogenital malignancies and other genital warts in both men and women.

Method: This was a cross-sectional descriptive study which employed a convenience sampling technique where both qualitative and quantitative methods were used for data collection. A total of 374 participants were enrolled in the study and a semi structured questionnaire was administered to collect socio-demographic, reproductive and sexual history data. Laboratory analysis involved detection of HPV DNA hybrids with a chemiluminescent substrate, Digene Hybrid Capture 2 technology. Descriptive and inferential (logistic regression) analyses at level of significant (α=0.05) were used to summarize the data, and results illustrated using charts and tables.

Results: The study findings reported a significant risk level of human papillomavirus among female of age group 40-49 years (AOR; 0.15, 95% CI: 0.03-0.79; p = 0.026). Furthermore, in bivariate logistic regression the circulating HPV genotypes among the respondents was significantly characterized among women of the same age group (95% CI; 0.09-0.7; p = 0.008) as well as in the multivariate regression (AOR = 0.13; 95% CI: 0.02-0.72; p = 0.019).

Conclusion: The study thus concluded that there is 23/94 (25.67%) risk of developing cervical cancer due to high risk level HPV (with the presence of low risk level HPV 71/94 (74.33%) known for causing various forms of warts. Therefore, there is need for combined efforts from the Ministry of health and stakeholders to avail and train health care workers on the usage of HPV DNA kits to ensure timely detection of low and high-risk levels HPV. This will ensure timely identification of women at increased risk for the development of cervical cancer, thereby reducing mortality rate.

Keywords: *Persistent HPV infection; Chemiluminescent substrate; Digene Hybrid Capture 2 technology; Cervical cancer precursors, Circulating HPV genotypes.*

1. Introduction

Small DNA viruses known as human papillomaviruses (HPV) can cause both benign and malignant disorders in the cervix, penis, vulva, vagina, anus, and oropharynx [1]. Since these viruses are widespread, it is suspected that majority of women worldwide have undoubtedly contracted at least one kind of HPV during their sexual activity [2,3,4,5,6]. Globally, there are differences in the population attributable proportion of HPV-associated cancer: 14.2% in sub-Saharan Africa, 15.5% in India, 1.6% in Northern America, and 1.2% in Australia/New Zealand [7,1]. [8] argued that, the most prevalent sexually transmitted infection worldwide is human papilloma virus infection, noting that High-risk HPV is the primary risk factor for cervical cancer with types 16 and 18 being responsible for up to 70% of cervical cancer cases globally. On the other hand, [9] posited that, host hormones, genetics, immunological reaction, the viral genotype, numerous infections, viral load and integration, high parity as well as long-term oral contraceptive usage are among the risk factors for acquiring HPV. Additionally, [10] listed other factors such as tobacco smoking and co-infection with other sexually transmitted diseases. However, the main risk factor for exposure to HPV is sexual behavior, particularly the age at first sexual contact and the number of partners throughout a lifetime [11].

According to [12] there is a worldwide consensus that "high-risk" genotypes, such as genotypes 16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, and 66, are linked to cervical cancer and are associated with some other mucosal anogenital malignancies as well as head and neck cancers. Furthermore, genital warts or growths on the cervix, vagina, vulva, and anus in women, and the penis, scrotum, or anus in men, can result from infections with different genotypes, or "low-risk" infections. Subsequently, they can also result in surgically treatable epithelial growths (recurrent respiratory papillomatosis or juvenile respiratory papillomatosis) on both children and adults' vocal cords [13]. Therefore, risk factors for HPV infection include new and frequent sexual partners as well as irregular condom use. [14] reiterated that, there are more than 100 types of genital HPV; about 13 are considered oncogenic otherwise referred to as “high-risk”. As such, persistent high-risk HPV infection is thus the most important risk factor for cervical cancer precursors and cervical cancer. Generally, women who have HIV are more likely to contract HPV and have a 2–8-times higher risk of cervical cancer than women without the virus [15]. Studies have revealed that HIV-positive women experience an earlier onset of serious precancerous lesions than women without the virus [16]. Subsequently, majority of women typically contract HPV infection shortly after starting to engage in sexual activity in their teens or early 20s. Furthermore, more than 90% of cervix-related HPV infections are asymptomatic and resolve in two to three years, but women who have chronic infection are at significant risk of later developing high-grade cervical intraepithelial neoplasia and invasive malignancy [17]. Despite the cervical cancer screening intervention that has been put in place by the MOH and the stakeholders in place, there are still incidences of mortality due to cervical cancer [18]. Since no research has been done in the study area to address the issue, region-specific genotypes must be discovered and characterized considering that different HPV genotypes carry differing levels of risk. Therefore, if not detected early enough and managed in time it can lead to cervical cancer which is a serious health problem which predominantly affects women of reproductive age.

2. Methods and Materials

2.1. Study design and setting

This study adopted a mixed-methods approach comprising a quantitative laboratory analysis to characterize detect circulating HPV phenotypes and a short semi-structured questionnaire to investigate the sociodemographic attributes of the study participants. It was carried out at Rabuor Sub County Hospital which is a government-run health facility located in Kochieng East Sub-location, in Kadibo Division, Nyando Constituency in Kisumu County along Kisumu-Nairobi highway. It was selected as a study site to be a representative of the entire constituency due to the fact that it is easily accessible thus receives patients from all over the neighbouring villages. Kisumu County lies within longitudes 33^0 20`E and $35^0$ 20`E and latitude $0^0$20`South and $0^0$50`South. It sits on the shores of Lake Victoria, providing it with the potential to be a major centre of fishing. Rice is grown under irrigation in the Kano plains. Most of the water for irrigation comes from River Nyando, whose annual floods used to displace huge numbers of people but also deposit a lot of fertile salt all across the plain. Some of the basic services offered at the facility include cervical cancer screening, anti-retroviral therapy, family planning, home based care, in-patient department as well as maternity. The facility has 30 bed capacity for in-patients. The study managed to obtain the demographic and clinical report from 374 consenting, non-pregnant female aged 15

years and above since this age group was considered sexually active. Kisumu County has a population of 1,155,574 (according to the 2019 National Census) and a population density of 550 persons per Km^2. The population distribution by sex is 556,942 male and 594,609 female (2019 Kenya population and housing census).

2.2. Sample size determination and sampling procedure

A total number of 374 participants who were not pregnant and aged 15years and above, were given equal chance to be enrolled in the study. Thus, they were to make their own informed consent and would opt out whenever they felt uncomfortable in continuing within the study. This criteria ensured fairly, unbiased representative sample from the entire population under the study. The sample size was calculated based on a study done by De Vuyst *et al*. (2010) which found the prevalence of human papillomavirus infection in Mombasa, Kenya to be 42%.

Cochran's formula was used to determine and arrive at the required sample size, this was calculated as below:

$$n = \frac{Z^2 p\ 1-p}{d^2}$$

$$n = \frac{Z^2_{\alpha/2} * p\ 1-q}{d^2}$$

$$n = \frac{1.96^2 * 0.42 * 0.58}{0.05^2}$$

$$n = 374.3 \approx 374$$

2.3. Specimen Collection and Handling

For laboratory analysis, cervical specimens were collected from the cervix of female participants who signed the consent form. This was done by the trained, qualified personnel, using the Digene® HC2 DNA Collection Device after which, the collected samples were placed in PreservCyt® Solution containing Buffered Methanol CAS 67-56-1 as the preservative. The specimen were stored in Special Transport Media (STM) before being delivered to the testing facility without refrigeration after which, they were sent utilizing a 2-day delivery vendor in an insulated container to the testing laboratory. Considerably, a preservative (Buffered Methanol CAS 67-56-1) had been added to the STM to retard bacterial growth and to retain the integrity of DNA.

2.4. Detecting the risk levels and genotyping of HPV

The low-risk and high-risk HPV Probes were used to aid the detection and characterization of sexually transmitted HPV infections with HPV types 6, 11, 16, 18, 31, 33, 35, 39, 42, 43, 44, 45, 51, 52, 56, 58, 59, and 68 as well as to differentiate between two HPV DNA groups: low-risk HPV types 6, 11, 42, 43, and 44 and high-risk HPV types 16, 18, 31, 33, 35, 39. Additionally, HPV genotypes of the circulating human papillomavirus 16, 18, 31, and 45 were detected quantitatively in cervical swabs using the in vitro real time amplification test, the 14 Real-TM quant.

2.5. Data Analysis

The data collected was entered into Microsoft Excel (2010) worksheets, secured with a password. It was then cleaned and entered into the Statistical Package for Social Sciences (SPSS®) version 20.0 where descriptive statistics and multiple regression analysis were done.

Regression analysis was used to determine the odds ratio for the risk level of human papilloma virus among the participants. In addition, qualitative data was analysed using descriptive statistics to answer the specific objective that entails the characterization of the circulating genotypes of human papilloma virus among female patients attending Rabuor Sub County hospital, Kisumu County

3. Study Results

3.1. Socio-demographic characteristics of participants

This study involved 374 female respondents seeking health services at Rabuor Sub County Hospital. Majority (170; 45.5%) of the participants were aged 20 to 29 years, while only 10 (2.7%) were aged 50 years and above. In terms of the level of education, secondary was the majority 139 (37.2%) with the minority being from university 14 (3.7%). Most (225; 60.2%) of the respondents were married, with 81(36.0%) having been married in the last 5 years. Based on the occupation of the respondent, business persons were the majority, accounting for 179 (47.9%). The participants had an average monthly earning of KSh 7176.20, while their husbands on average earned KSh 13,039.84; together, the total average earning was KSh. 21030.21 (Table 1)

Table 1. Socio-Demographic Characteristics of the respondents

Variable	Frequency (n)	Percentage (%)
Age in years		
< 20	44	11.76
20-29	170	45.45
30-39	95	25.4
40-49	55	14.71
≥ 50	10	2.67
Education Level		
Primary	132	35.29
Secondary	139	37.17
College	89	23.8
University	14	3.74
Marital Status		
Married civil/traditional	225	60.16
Unmarried but not committed	149	39.84

Duration of Marriage (years)			
1-5	81	36	
6-10	55	24.44	
11-15	55	24.44	
> 15	34	15.11	
Occupation			
Farmer	115	30.75	
Employed	80	21.39	
Business person	179	47.86	
Family Earnings (KSh)			
Husband earning (mean)	374	100	13039.84
Wife earning (mean)	374	100	7176.20
Total family earning (mean)	374	100	21030.21

3.2. Risk level of human papillomavirus among female patients

Out of the 374 participants, HPV genotypes were only detected in 94 individuals, with the majority (n=71; 74.33%) having low risk level HPV while only 23 (25.67%) had high risk level HPV.

3.2.1. Demographics characteristics and HPV risk level among female patients

Bivariate logistic regression analysis showed that respondents who aged 20 to 29, 30 to 39 and 40 to 49 years were 0.47 (95% CI; 0.24-0.94; p = 0.033), 0.40 (95% CI; 0.18-0.85; p = 0.018) and 0.19 (95% CI; 0.07-0.52; p = 0.001) times less likely to be at increased risk for development of cervical cancer due to high-risk HPV type as compared to the age of below 20 years, respectively. In multivariate regression, the respondents who were between 40 to 49 years were 0.15 times less likely to be at increased risk for development of cervical cancer due to high-risk HPV type as compared to the age of below 20 years (AOR; 0.15, 95% CI: 0.03-0.79; p = 0.026).

On occupation, bivariate regression analysis revealed that the respondents who were employed and in business were 0.51 (95% CI: 0.26-0.98; p = 0.044) and 0.53 (95% CI: 0.32-0.89; p = 0.017) times less likely to be at increased risk for development of cervical cancer due to high-risk HPV type as compared to farmers, respectively. In the multivariate regression the study revealed that those who were employed were less likely to be at increased risk for development of cervical cancer due to high risk HPV type as compared to farmers (AOR=0.20; 95% CI: 0.05-0.73; p = 0.015). These findings are summarized on Table 2.

Table 2. Demographics characteristics on human papilloma virus risk level status among female patients attending Rabuor sub-County hospital

Variables	N (%)	Low-risk n (%)	High-risk n (%)	COR (95% CI)	P-Value	AOR (95% CI)	P-Value
Age Category Years							
< 20	44(11.76)	25(56.82)	19(43.18)	Ref		Ref	
20-29	170(45.45)	125(73.53)	45(26.47)	0.47(0.24-0.94)	**0.033**	0.38(0.1-1.38)	0.14
30-39	95(25.4)	73(76.84)	22(23.16)	0.4(0.18-0.85)	**0.018**	0.41(0.1-1.63)	0.206
40-49	55(14.71)	48(87.27)	7(12.73)	0.19(0.07-0.52)	**0.001**	0.15(0.03-0.79)	**0.026**
≥ 50	10(2.67)	7(70)	3(30)	0.56(0.13-2.47)	0.448	0.2(0.01-4.03)	0.294
Education Level							
Primary	132(35.29)	97(73.48)	35(26.52)	Ref		Ref	
Secondary	139(37.17)	103(74.1)	36(25.9)	0.97(0.56-1.66)	0.908	1.08(0.48-2.41)	0.858
College	89(23.8)	69(77.53)	20(22.47)	0.8(0.43-1.51)	0.496	0.97(0.35-2.69)	0.954
University	14(3.74)	9(64.29)	5(35.71)	1.54(0.48-4.91)	0.466	0.65(0.07-6.31)	0.708
Marital Status							
Married civil/traditional	225(60.16)	171(76)	54(24)	Ref		Ref	
unmarried but not committed	149(39.84)	107(71.81)	42(28.19)	1.24(0.78-1.99)	0.364	N/A	N/A
Duration of Marriage Years							
1-5	81(36)	60(74.07)	21(25.93)	0		N/A	N/A
6 – 10	55(24.44)	45(81.82)	10(18.18)	0.63(0.27-1.48)	0.293	0.94(0.3-2.94)	0.916
11 – 15	55(24.44)	41(74.55)	14(25.45)	0.98(0.45-2.14)	0.951	1.29(0.44-3.74)	0.639
≥ 15	34(15.11)	25(73.53)	9(26.47)	1.03(0.41-2.55)	0.952	2.11(0.58-7.76)	0.26
Occupation							
Farmer	115(30.75)	83(72.17)	32(27.83)	Ref		Ref	
Employed	80(21.39)	61(76.25)	19(23.75)	0.51(0.26-0.98)	**0.044**	0.2(0.05-0.73)	**0.015**
Business person	179(47.86)	134(74.86)	45(25.14)	0.53(0.32-0.89)	**0.017**	0.54(0.23-1.3)	0.171
Earnings							
Husband earnings	374(100)	N/A	N/A	1(1-1)	0.285	1(0.72-1.4)	0.985
Wife earnings	374(100)	N/A	N/A	1(1-1)	0.86	1(0.72-1.4)	0.985
Total earnings	374(100)	N/A	N/A	1(1-1)	0.46	1(0.72-1.39)	0.985

Table 2 - Demographics characteristics on human papilloma virus risk level status among female patients attending Rabuor sub-County hospital.

Ref - Reference group, OR- Odds ratio, CI-confidence interval. P value<0.05 was considered significant.

3.3. Circulating genotypes of human papillomavirus

3.3.1. Genotypes detected

Only 94 (25.13%) participants had HPV genotype circulating in their samples, while the remain-ing 280 (74.86%) tested negative. There was a marked difference in the prevalence of variants detected, as demonstrated by Figure 1.

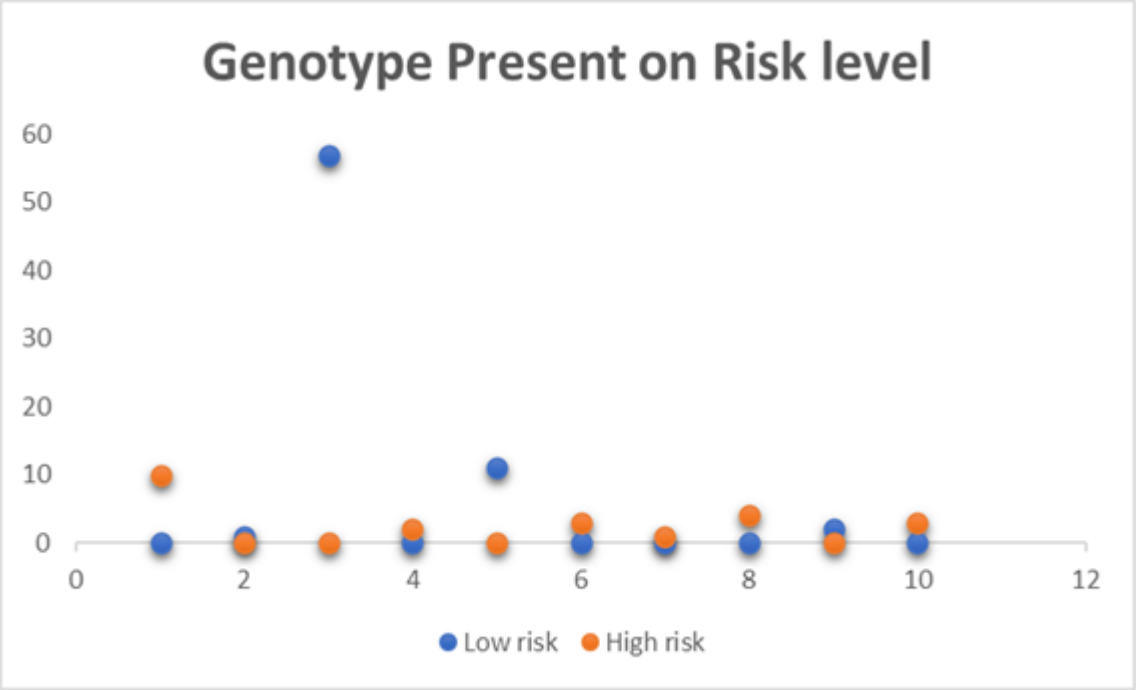

Figure 1. HPV circulating genotypes detected with their Risk Levels

Key Genotype present	
16,39,33,58,31,45,36,52,18,59,68,66,56,51	1
6, 11,31,43,36,44,44,59,68,66,54,61	2
6,11,36,43,44,54,61	3
16,18,39,33,58,31,45,36,52,56,51	4
6, 11, 31,43,36,44,	5
31,45,36,52, 18,59,68,66,54,61	6
56,51	7
31,45,36,52,56,51	8
6,11,36,43,44,54,	9
18,59,68,66,56,51	10

3.3.2. Demographic characteristics and HPV genotypes among female patients

Bivariate logistic regression analysis revealed that the respondents aged between 40 to 49 years were 0.26 (95% CI; 0.09-0.7; p = 0.008) times less likely to be at increased risk for development of cervical cancer due to circulating HPV genotype compared to those aged below 20 years. The same observation was made in the multivariate regression whereby the respondents aged between 40 to 49 years were 0.13 (AOR = 0.13; 95% CI: 0.02-0.72; p = 0.019) times less likely to be at increased risk for development of cervical cancer due to circulating HPV genotype compared to those aged below 20 years. Considering occupation from bivariate regression, the study revealed that the respondents who were employed were less likely to be at increased risk for development of cervical cancer due to high risk HPV type as compared to farmers (COR = 0.47; 95% CI: 0.23-0.95; p = 0.037). A similar observation was made in the multivariate regression, (AOR = 0.18; 95% CI: 0.04-0.7; p = 0.014). The results are as shown on Table 3.

Table 3. Relationship between demographic characteristics and HPV genotypes among female patients

Variables	N (%)	No Genotype n (%)	Genotype Present n (%)	COR (95% CI)	P-Value	AOR (95% CI)	P-Value
Age Category Years							
< 20	44(11.76)	26(59.09)	18(40.91)	Ref		Ref	
20-29	170(45.45)	126(74.12)	44(25.88)	0.54(0.26-1.09)	0.087	0.3(0.08-1.13)	0.076
30-39	95(25.4)	73(76.84)	22(23.16)	0.47(0.21-1.03)	0.058	0.34(0.08-1.39)	0.133
40-49	55(14.71)	48(87.27)	7(12.73)	0.26(0.09-0.7)	**0.008**	0.13(0.02-0.72)	**0.019**
≤ 50	10(2.67)	7(70)	3(30)	0.75(0.17-3.31)	0.704	0.18(0.01-3.68)	0.264
Education Level							
Primary	132(35.29)	98(74.24)	34(25.76)	Ref		Ref	
Secondary	139(37.17)	103(74.1)	36(25.9)	1.06(0.6-1.86)	0.843	1.08(0.48-2.47)	0.85
College	89(23.8)	70(78.65)	19(21.35)	0.86(0.45-1.66)	0.658	0.95(0.33-2.71)	0.922
University	14(3.74)	9(64.29)	5(35.71)	1.89(0.59-6.07)	0.285	0.72(0.07-7.21)	0.783
Marital Status							
Married civil/traditional	225(60.16)	172(76.44)	53(23.56)	Ref		Ref	
Unmarried	149(39.84)	108(72.48)	41(27.52)	1.24(0.78-1.99)	0.364	N/A	N/A
Duration of Marriage (Years)							
1-5	81(36)	60(74.07)	21(25.93)	Ref		Ref	
6 - 10	55(24.44)	45(81.82)	10(18.18)	0.6(0.25-1.43)	0.247	0.85(0.26-2.78)	0.794
11 - 15	55(24.44)	42(76.36)	13(23.64)	0.94(0.42-2.1)	0.888	1.11(0.37-3.32)	0.851

> 15	34(15.11)	25(73.53)	9(26.47)	1.1(0.44-2.74)	0.841	2.1(0.56-7.93)	0.274
Occupation							
Farmer	115(30.75)	84(73.04)	31(26.96)	Ref		Ref	
Employed	80(21.39)	62(77.5)	18(22.5)	0.47(0.23-0.95)	**0.037**	0.18(0.04-0.7)	**0.014**
Business person	179(47.86)	134(74.86)	45(25.14)	0.6(0.35-1.01)	0.056	0.63(0.26-1.54)	0.312
Husband earnings	374(100)	N/A	N/A	1(1-1)	0.249	1(0.53-1.9)	0.992
Wife earnings	374(100)	N/A	N/A	1(1-1)	0.832	1(0.53-1.9)	0.991
Total earnings	374(100)	N/A	N/A	1(1-1)	0.409	1(0.53-1.89)	0.992

Table 3 - Relationship between demographic characteristics and HPV genotypes among female patients.

Ref - Reference group, OR- Odds ratio, CI-confidence interval. P value<0.05 was considered significant.

4. Discussions

This study aimed at detecting the circulating genotype and the associated risks levels of human papilloma virus among female patients attending Rabuor sub–County Hospital in Kisumu County. According to [19], age is an intrinsic factor that merits association with risk for acquiring HPV infection which is considered by providers who are attempting to target HPV vaccination based on woman's risk profile. Having said that, HPV genotypes among the respondents in the present study was significantly characterized among women of age group 20-29, 40-49 years. Comparatively, numerous studies have equally demonstrated an increased risk on HPV infections that occurs among adolescents as well as younger adults between the ages of 20 to 29, where more than 75% of new HPV infections have been reported to take place [20,19,10,11]. This could have been attributed to the fact that, in most cases youths engage in early sexual debut with some having multiple sexual partners, not being vaccinated against HPV due to varying reasons as well as low uptake of cervical cancer screening among the women in this age groups.

The findings from this study as well demonstrated that, there was a significant risk level of human papillomavirus among female of age group 40-49 years among patient attending Rabuor sub County hospital. Additionally, the study showed that fourteen HPV types (HPV-16,-39,-33,-58,-31,-45,-36,-52,-18,-59,-68,-66,-56 and -51) were detected in this study showing co-circulation of various HPV types among the minority 94/374 (25.13%) female patients in Rabuor. In contrast, this finding is higher than the WHO estimate of 19.5% HPV prevalence in women from western Africa [21]. Although, it is consistent with that of [22] which revealed that those with high risk level HPV type were fewer than those with low risk level HPV type. On the other hand, another study revealed that HPV remains to be common in Kenya and prevalence is still high [23,24]. Conclusively, this is dependable with prevailing reports of the elevated HPV prevalence in women who trust their partners as compared to other women who don't trust their partners. Noteworthy is the fact that HPV infection is a multistep process which typically takes place over many years, although this finding reveals that this process may be significantly accelerated. Considerably, [25] revealed that one or more of these high-risk HPV type has been reported in more than 90% of

women diagnosed with cervical cancer. Another report by [26] showed that persistent infection with high-risk HPV genotypes and the integration of HPV DNA in the cells of the host are normally necessary and required for malignant transformation of the cervix. Moreover, [27] identified old age as the time when women who were previously infected with high risk level HPV develop cervical cancer.

5. Conclusion

This study reveals that there was a significant risk level of human papillomavirus among female of age group 40-49 years among patient attending Rabuor sub County hospital. Furthermore, the circulating HPV genotypes among the respondents was significantly characterized among women of age group 20-29, 40-49 years of age.

6. Recommendations

The Ministry of Health (national and County Government of Kisumu) should adequately support qualitative detection of High risk HPV and low risk HPV levels at all government health facilities for timely identification of women at increased risk for the development of cervical cancer. Equally, characterization of HPV genotypes should be embraced by health care workers at the facility level especially for those women who turn positive with acetic acid during cervical cancer screening.

7. Suggestion for further research

There is need to conduct a much bigger study, covering a much wider geographic area, and including more variables not included in the current study, like reproductive and sexual health of the women, especially relating to parity, pregnancy and childbirth. Further, such a study should include a detailed analysis to determine the relationship and distribution of different types of HPV genotypes. To be very objective, this study should be conducted at both health facility and community levels, to also capture the diagnosis process.

8. Abbreviations and acronyms

AOR - Adjusted Odds Ratio; BPS – Board of Post Graduate Studies; CDC - Centre for Disease Control; COR - Crude Odds Ratio; DNA - Deoxyribonucleic acid; HC2 - Hybrid Capture 2 Technology; HPV - Human papillomavirus; Hr HPV - High Risk Human Papilloma virus; HSIL-High-grade squamous intraepithelial lesion; JOOUST - Jaramogi Oginga Odinga University of Science and Technology, Lr HPV - Low Risk Human Papilloma virus; PCR - Polymerase Chain Reaction; RNA - Ribo-Nuclei Acid; SCH - Sub County Hospital, SPSS - Statistical Package for Social Sciences; STI - Sexually Transmitted Infections; STM - Special Transport Media, UNAIDS - United Nation AIDS; WHO - World Health Organisation.

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Declarations

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This research did not receive any grant from funding agencies in the public, commercial, or not-for-profit sectors.

Competing Interests Statement

The authors declare no competing financial, professional, or personal interests.

Consent for publication

The authors declare that they consented to the publication of this research work.

Ethical approval and consent to participate

This research was carried out in accordance with the ethical principles as defined in the guidance for Good Clinical Practice and the Principles as outlined in the Declaration of Hlsinki [28]. Approval to carry out the study was sought from the Board of Postgraduate Studies, Jaramogi Oginga Odinga University of Science and Technology. Ethical clearance was obtained from Ethics Review Committee (Tel: 057-2020801/2020803/2020321) and NACOSTI. Permission to collect data from the study area was obtained from Ministry of Public Health and Sanitation -Kisumu County, Nyando Sub County MOH, and the management of Rabuor Sub County Hospital through the facility in charge. A written informed consent was sought from each prospective participant prior to enrolment. Patients were assured of maximum confidentiality as all the information obtained were only used for research purposes.

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