INNOVATIVE JOURNAL

**Journal of Medical Care Research and Review**

Homepage: http://mcrr.info/index.php/mcrr/index

Medical Care Research and Review
OPEN ACCESS
(O):2589-8949 (P): 2589-8930

# Rural HIV Negative Young Women have Higher Incidence of Early Onset Cancer of the Cervix Compared to their Urban Counterparts in Western Kenya – A Case Study of Jaramogi Oginga Odinga Teaching and Referral Hospital.

George Ogutu[1], MMed, MBChB; Arthur Ajwang[2], MBChB; Khama Rogo[3], PhD, MMed, MBChB;, MBChB; Shem Otoi[4], PhD-Bio Stats; Benson Estambale[5], PhD, MPH, MBChB;.

[1]PhD candidate at Jaramogi Oginga Odinga University of Science and Technology, [2]Uzima University School of Medicine, [3]African Institute for Health Transformation, [4]Sri Sri University, [5]Department of Research and Development - Jaramogi Oginga Odinga University of Science and Technology.

**DOI: https://doi.org/10.52845/mcrr/2025/08-03-2**

***Abstract: Background:*** Cervical cancer is the second leading cause of cancer incidence and the leading cause of cancer mortality in women in Kenya. At the Jaramogi Hospital (JOOTRH) Kenya we recorded an increase in incidences of early onset cancer of the cervix, mostly in young rural women, who were HIV negative. This informed the need for a study to identify the demographics especially the residences, rural or urban, of the patients.

***Objective:*** This study aimed at identifying the residences of the HIV negative women coming with increased incidences of early onset cancer of the cervix.

***Methodology:*** A review of hospital records of all patients aged 13-35 years presenting with Cancer of the Cervix regardless of HIV status at time of diagnosis from 2012 - 2019 was done in the retrospective arm of the study and purposive active recruitment of <35 done for the prospective arm from 2020 - 2021. The residences were recorded as either urban or rural as per the demographic data.

***Findings:*** HIV+ or HIV- woman in rural area has higher chances of being infected with cervical cancer compared to their counterparts in urban areas, with an odds ratio of 1.3 > 0.004 and 0.76 > 0.004.

***Conclusion:*** We concluded that HIV negative rural women are bearing the burden of increasing incidences of Early Onset Cancer of the Cervix at the Jaramogi Oginga Odinga Teaching and Referral Hospital in Western Kenya.

***Key words:*** Early Onset Cancers –ages <50 years old, identify, increase, incidences, HIV-Negative, residences, rural, urban.

## INTRODUCTION

Cervical cancer is the fourth most common cancer among women globally, with an estimated 604,000 new cases and 342,000 deaths in 2020 [1]. About 90% of the new cases and deaths worldwide in 2020 occurred in low and middle – income countries [1].

Sub-Saharan Africa (SSA) has the highest burden of cervical cancer in the world. Africa accounted for 21% of total cases and 26% of global deaths from cervical cancer in 2012 [1, 2].Cervical cancer is the second leading cause of cancer incidence and the leading cause of cancer-related deaths in women in Eastern, Western, Middle, and Southern Africa and these women in Sub-Saharan Africa are disproportionately affected with cancer of the cervix, between 2% to 4% having a lifetime risk of the disease [1]. In 2018, globally, cervical cancer was the fourth most common cancer among women and the seventh most common cancer overall with 570,000 new cases and 311, 000 deaths reported [2], 85% of whom were in low and middle-income countries, where vaccination, screening and treatment programs are limited [3]. Eighty percent (80%) of the new cases occur in low- and middle-income countries, where it is the second most common cancer in women, and the leading cause of cancer deaths in SSA, accounting for 15 % of all cancer deaths in women [1,4]. Western countries have experienced dramatic reductions in the incidence of and mortality from invasive cervical cancer, due to interventions that include vaccination against HPV and early diagnosis through mass screening with high coverage and treatment of patients with cervical cancer [5], while the burden in SSA still stays very high [2, 4]. Many SSA countries have not been able to establish and sustain cervical cancer screening programmes at the population level due to financial, logistical and socio-cultural barriers [6]. Additionally, various health care system factors including healthcare worker attitudes, lack of privacy and inadequate further evaluation/treatment facilities have been identified as barriers to cervical cancer screening uptake in SSA, alongside individual and community attributes [7-9]. Screening programmes were often poorly organized and generally did not reach the majority of targeted women [10, 11].

In Kenya, Cervical cancer contributes approximately 12% of all cancer cases diagnosed, and is the leading cause of all cancer deaths, with over 3,200 deaths reported in 2020 [1]. The uptake of screening is low (approximately 16% in 2015) [12]and only a quarter of 2,927 sampled health facilities offered screening in 2018 [13], despite the fact that Kenya has been implementing a national screening programme for more than a decade [13]. Understanding the individual, community and health system factors behind inefficiencies

in the programme can guide the country towards the attainment of the global elimination targets [13]. The increased incidences of Early Onset Cancer of the Cervix have again brought new challenges in preventing, managing and controlling the disease. Identifying the residences, urban or rural of these patients coming with the early onset cervical cancer, can guide in picking the contributing factors, be they socio-cultural, economic, health seeking behaviors, and health system factors and mitigate them to stem the tide. In the United States, the burden of cervical cancer is not equally distributed geographically, being higher in rural areas compared to urban areas [14]. One recent study found out that cervical cancer incidence rates were 15% lower in urban areas as compared to the rural areas [15].

## MATERIALS AND METHODS

### *Study site:*

The study was conducted at the Oncology Clinic of the Jaramogi Oginga Odinga Teaching and Referral Hospital {JOOTRH}. Kisumu County, about 6 Kilometers from the Kisumu city business district (CBD), along the Kisumu-Kakamega Road next to the Western region's Blood Transfusion Centre. The Oncology Clinic is a separated from the administration block by a small fishpond and is next to the JOOTRH College's Director's office. The Clinic operates 8 hours per day from Monday to Friday and has a staff base made of 1 Gynaecology-Oncologist, 1 Medical-Oncologist, 1 Medical officer, 4 Nurses, 1 Nutritionist, 1 Pharmacist and 1 support staff.

Kisumu City of Kisumu County is the third-largest city in Kenya after the capital, Nairobi, and Mombasa [14]. It is the second-largest city after Kampala in the Lake Victoria Basin. Located at the shores of the world's second largest freshwater lake, Lake Victoria and at 1,131 m (3,711 ft.), the vibrant third largest city in Kenya, Kisumu City, boasts of a rich history of international trade, tropical climate, good transport network and a vibrant population majorly the Luo ethnic tribe of Kenya. The city has a population of slightly over 600, 000 [14]. The metro region, including Maseno and Ahero has a population of 1,155,574 people (560,942 males, 594,609 females) according to the 2019 Kenya Population and Housing census which was conducted by the Kenya national Bureau of Statistics [14]. Kisumu is the principal city of western Kenya and forms the commercial, industrial and transportation center majorly due to its water and rail connections. Formally the headquarters of the greater Nyanza Province, the town has grown to be the third largest city in Kenya after Nairobi and Mombasa and is now the headquarters of Kisumu County [14]. The main industries in Kisumu are centered around processing of agricultural products, fishing, brewing and textile manufacturing industries [14]. The Luo tribe is the main inhabitants of Kisumu County, but because it is made up of the city and rural areas around the metro zone, it is a melting pot of other tribes like the Luhya, Kisii, Kuria, Somali, Kikuyu, Kamba and others [14].

The JOOTRH also serves the neighboring counties of Kakamega, Siaya, Kisii, Nyamira, HomaBay, Busia, Bungoma and Migori [14]. JOOTRH is a teaching and referral hospital, where many cancer cases such as gynaecological cancers are treated. It serves as the only oncology referral hospital in the county and for the counties of Siaya, HomaBay, Migori, Nyamira and Busia. Management of cervical cancer offered at this facility includes surgery and chemotherapy but has no radiotherapy unit. It offers also CT and MRI imaging and a well-equipped Pathology laboratory. The HIV-Clinic screens newly diagnosed patients for cancer of the cervix after two months of attendance treat pre-cancerous lesions immediately and refer the confirmed cancers to the Oncology Clinic.

### *Inclusion/Exclusion Criteria:*

The study included all the files of patients with early cancer of the cervical cancer, with documented residences (urban or rural), of ages 13-35 years, who were both HIV- Negative and HIV - Positive at time of diagnosis and had histological diagnosis, in the period of 2012 - 2019. We also purposively recruited all patients with above characteristics for the period 2020 – 2021.

### *Sample:*

In this quantitative and qualitative study, in the 2012-2019 period, patients' files for all HIV positive and negative cervical cancer patients who were of the ages 13-35 years old were purposively selected. The samples consisted of HIV +VE and HIV-VE patients with early Onset cervical cancer, and were being treated at the oncology clinic of the JOOTRH, since the inception of the clinic in January 2012-2019 December. In the period of 2020-2021, participants were purposively selected using maximum variation sampling strategy, as they were diagnosed and registered in the Oncology clinic. The patients were drawn from different population categories of ethnicities, socio-economic statuses, rural or urban residences, level of education and religion. A total sample size of 52 files was selected, in the period of 2012 – 2019 and a sample of 86 participants was recruited actively in the prospective period of 2020 – 2021.

### *Procedure and Research design:*

This was a mixed-methods study design, including both quantitative and qualitative components. The quantitative components focused on age sets, rural or urban residences, HIV statuses, cervical cancer vaccination, screening, diagnosis, histology results, Figo Staging in the period of 2012-2019 and 2020-2021 data reviews and analysis, with data sources being the patient files in the former period while using clinical research forms and other source documents in the latter period. The qualitative component involved evaluating knowledge about cervical cancer, sourced through review of files and use of clinical research forms and semi-structured interviews in the former and latter periods respectively. The study was based on the JOOTRH's Oncology Clinic services to patients with early onset cervical cancer in both periods, within the age set of 13-35 years old.

### *Study period:*

The review of files was done for the period of 8 years since the inception of the Oncology period in January 2012 to December 2019 (2012-2019), and the period of active recruitment, collection of data with clinical research forms and other source documents was in the period of September 2020 to September 2021 (2020-2021).

***Measurement:***

Data was collected using structured document analysis forms and lists in the period of 2012-2019, while clinical research forms and semi-structured interviews were used for data collection in the period of 2020-2021. The study specifically sought to determine the incidences of early onset cervical cancer cases, HIV-status, the patients' demographics, knowledge of cancer, vaccinated against HPV, screening, stage of disease and histological results of the cancer tissues.

The primary outcome variable was the residence of the participant, either rural or urban, which came with early onset cancer of the cervix in both HIV Positive and Negative women of ages 13-35 years old. This variable was measured through all the reviewed files in the period of 2012 - 2019, and of the actively recruited patients in the period 2020 - 2021.

The quantitative data were analyzed using STATA. The qualitative data was thematically tabulated while the quantitative data was summarized in trend series (bar charts and line graphs).

***Ethical Considerations:***

All the documents analyzed and patients recruited in this study, were accessed after getting an approval from the JOOTRH's Ethical Review Committee (I.E.R.C) and express informed consent from the recruited patients. There was no patient who was coerced into joining the study and those who declined were not denied the standard of care for their ailment.

The approval for the review of the hospital records for the period 2012-2019 and active recruitment of patients for the 2020-2021 period, included statements about the rights of the subjects, in terms of their information collected, confidentiality and the publication of this report and any other accompanying information.

## FINDINGS

**Table 1**: **Cancer Of Cervix Table In The Period 2012 -2019 For HIV +Ve Cohort**

| Characteristics | n = 16 | | |
|---|---|---|---|
| | n / median | | % / range |
| Age, years | 27 | | 13-35 |
| Residence | | | |
| Urban | 6 | | 37.5% |
| Rural | 10 | | 62.5% |
| Vaccinated against H.P.V | | | |
| Yes | 0 | | 0% |
| No | 16 | | 100% |
| Screened Voluntarily Prior to Symptoms | | | |
| Yes | 2 | | 12.5% |
| No | 4 | | 25% |
| HIV Status | | | |
| Negative | 0 | | 0% |
| Positive | 16 | | 100% |
| On HAART | | | |
| Yes | 16 | | 100% |
| No | 0 | | 0% |
| FIGO 2012/2019 stage | | | |
| IIA2 | 12 | | 75% |
| IIB | 4 | | 25% |
| Tumour size, mm | 48mm | | >40mm |
| Histology | | | |
| Squamous cell carcinoma | 13 | | 81.25%% |
| Adenocarcinoma | 2 | | 12.5% |
| Adeno - squamous cell carcinoma | 1 | | 6.25% |
| Small Cell Neuro-Endocrine carcinoma | 0 | | 0% |
| Type of imaging | | | |
| CT | 16 | | 100% |
| Patient-based nodal status on CT | | | |
| Negative | 16 | | 100% |
| Inconclusive | 0 | | 0% |
| Positive | 0 | | 0% |
| Region with positive nodal status on imaging [b] | | | |
| Pelvic | 0 | | 0% |
| Common iliac | 0 | | 0% |
| Para-aortic | 0 | | 0% |
| Patient-based nodal status on pathology | | | |

| | | | |
|---|---|---|---|
| Negative | 16 | | 100% |
| Positive | 0 | | 0% |
| Unknown | 0 | | 0% |
| Nodal examination | | | |
| Absent | 16 | | 100% |
| Lymphadenectomy | 0 | | 0% |
| Nodal debulking | 0 | | 0% |
| Biopsy/fine-needle aspiration | 16 | | 100% |
| Sentinel node biopsy only | 0 | | 0% |

**Table 2: Cancer of Cervix Table In The Period 2012 -2019 For HIV–VE Cohort**

| Characteristics | n = 22 | | |
|---|---|---|---|
| | n / median | | % / range |
| Age, years | 23 | | 13-35 |
| Residence | | | |
| Urban | 10 | | 45.5% |
| Rural | 12 | | 54.5% |
| Vaccinated against H.P.V | | | |
| Yes | 0 | | 0% |
| No | 22 | | 100% |
| Screened Voluntarily Prior to Symptoms | | | |
| Yes | 7 | | 31.8% |
| No | 15 | | 68.2% |
| HIV Status | | | |
| Negative | 22 | | 100% |
| Positive | 0 | | 0% |
| On HAART | | | |
| Yes | 0 | | 0% |
| No | 22 | | 100% |
| FIGO 2020/2021 stage | | | |
| IIA2 | 2 | | 9.1% |
| IIB | 5 | | 22.7% |
| IIIB | 5 | | 22.7% |
| IIIC1 | 4 | | 18.2% |
| IIIC2 | 5 | | 22.7% |
| IVB | | | |
| Tumour size, mm | 62 | | > 40 |
| Histology | | | |
| Squamous cell carcinoma | 16 | | 72.7% |
| Adenocarcinoma | 2 | | 9.1% |
| Adeno - squamous cell carcinoma | 4 | | 18.2% |
| Small Cell Neuro-Endocrine carcinoma | 0 | | 0% |
| Type of imaging | | | |
| CT | 22 | | 100% |
| Patient-based nodal status on CT | | | |
| Negative | 10 | | 45.5% |
| Inconclusive | 3 | | 13.6% |
| Positive | 9 | | 40.9% |
| Region with positive nodal status on imaging [b] | | | |
| Pelvic | 9 | | 40.9% |
| Common iliac | 2 | | 9.1% |
| Para-aortic | 5 | | 22.7% |
| Patient-based nodal status on pathology | | | |
| Negative | 13 | | 59% |
| Positive | 9 | | 40.9% |
| Unknown | 0 | | 0% |
| Nodal examination | | | |
| Absent | 3 | | 13.6% |
| Lymphadenectomy | 4 | | 18.2% |

| | | | |
|---|---|---|---|
| Nodal debulking | 0 | | 0% |
| Biopsy/fine-needle aspiration | 22 | | 100% |
| Sentinel node biopsy only | 0 | | 0% |

**Table 3: Cancer of Cervix Table in the Period 2020 -2021 For HIV+VE Cohort**

| Characteristics | n=17 | | |
|---|---|---|---|
| | n / median | | % / range |
| Age, years | 31 | | 13-35 |
| Residence | | | |
| Urban | 14 | | 82.4% |
| Rural | 3 | | 17.6% |
| Vaccinated against H.P.V | | | |
| Yes | 0 | | 0% |
| No | 17 | | 100% |
| Screened Voluntarily Prior to Symptoms | | | |
| Yes | 6 | | 35.3% |
| No | 11 | | 64.7% |
| HIV Status | | | |
| Negative | 0 | | 0% |
| Positive | 17 | | 100% |
| On HAART | | | |
| Yes | 17 | | 100% |
| No | 0 | | 0% |
| FIGO 2020/2021 stage | | | |
| IIA2 | 9 | | 52.9% |
| IIB | 3 | | 17.6% |
| IIIB | 3 | | 17.6% |
| IIIC1 | 1 | | 5.9% |
| IIIC2 | 1 | | 5.9% |
| IVB | 0 | | 0% |
| Tumour size, mm | 75mm | | >40mm |
| Histology | | | |
| Squamous cell carcinoma | 13 | | 76.4% |
| Adenocarcinoma | 1 | | 5.9% |
| Adeno - squamous cell carcinoma | 3 | | 17.6% |
| Small Cell Neuro-Endocrine carcinoma | 0 | | 0% |
| Type of imaging | | | |
| CT | 17 | | 100% |
| Patient-based nodal status on CT | | | |
| Negative | 120 | | 70.6% |
| Inconclusive | 30 | | 17.6% |
| Positive | 2 | | 11.8% |
| Region with positive nodal status on imaging [b] | | | |
| Pelvic | 2 | | 11.8% |
| Common iliac | 1 | | 5.9% |
| Para-aortic | 1 | | 5.9% |
| Patient-based nodal status on pathology | | | |
| Negative | 15 | | 88.2% |
| Positive | 2 | | 11.8% |
| Unknown | 0 | | 0% |
| Nodal examination | | | |
| Absent | 5 | | 29.4% |
| Lymphadenectomy | 2 | | 11.8% |
| Nodal debulking | 0 | | 0% |
| Biopsy/fine-needle aspiration | 17 | | 100% |
| Sentinel node biopsy only | 0 | | 0% |

**Table 4: Cancer of Cervix Table in the Period 2020 -2021 For HIV–VE Cohort**

| Characteristics | n=49 | | |
|---|---|---|---|
| | n / median | | % / range |
| Age, years | 23 | | 13-35 |
| Residence | | | |
| Urban | 21 | | 42.9% |
| Rural | 28 | | 57.1% |
| Vaccinated against H.P.V | | | |
| Yes | 0 | | 0% |
| No | 49 | | 100% |
| Screened Voluntarily Prior to Symptoms | | | |
| Yes | 10 | | 20.4% |
| No | 39 | | 79.6% |
| HIV Status | | | |
| Negative | 49 | | 100% |
| Positive | 0 | | 0% |
| On HAART | | | |
| Yes | 0 | | 0% |
| No | 49 | | 100% |
| FIGO 2020/2021 stage | | | |
| IIA2 | 4 | | 8.2% |
| IIB | 18 | | 36.7% |
| IIIB | 10 | | 20.4% |
| IIIC1 | 6 | | 12.2% |
| IIIC2 | 9 | | 18.4% |
| IVB | | | |
| Tumour size, mm | 71 | | >40 |
| Histology | | | |
| Squamous cell carcinoma | 30 | | 61.2% |
| Adenocarcinoma | 5 | | 10.2% |
| Adeno - squamous cell carcinoma | 10 | | 20.4% |
| Small Cell Neuro-Endocrine carcinoma | 4 | | 8.2% |
| Type of imaging | | | |
| CT | 49 | | 100% |
| Patient-based nodal status on CT | | | |
| Negative | 30 | | 61.2% |
| Inconclusive | 4 | | 8.2% |
| Positive | 15 | | 30.6% |
| Region with positive nodal status on imaging [b] | | | |
| Pelvic | 15 | | 30.6% |
| Common iliac | 4 | | 8.2% |
| Para-aortic | 9 | | 18.4% |
| Patient-based nodal status on pathology | | | |
| Negative | 34 | | 69.4% |
| Positive | 15 | | 30.6% |
| Unknown | 0 | | 0% |
| Nodal examination | | | |
| Absent | 10 | | 20.4% |
| Lymphadenectomy | 10 | | 20.4% |
| Nodal debulking | 0 | | 0% |
| Biopsy/fine-needle aspiration | 49 | | 100% |
| Sentinel node biopsy only | 0 | | 0% |

**Table 5: Sample**

| AGE GROUP | PERIOD 2012-2019 | PERIOD 2020-2021 |
|---|---|---|
| 10-14 | 1 | 0 |
| 15-19 | 0 | 6 |
| 20-25 | 15 | 31 |
| 26-30 | 12 | 14 |
| 31-35 | 10 | 15 |
| 36-40 | 2 | 12 |
| 41-45 | 5 | 5 |
| 45&a bove | 7 | 3 |
| **TOTAL** | **52** | **86** |
| **P-VLUE** | **0.012** | **0.017** |
| **MEAN** | **6.5** | **10.75** |
| **CI (MEAN)** | **1.921, 11.079** | **2.562, 18.938** |
| **DF** | **7** | **7** |
| | | |

**Analysis of the increase in incidence of Early Onset Cancer of the Cervix in HIV –VE women aged 13 – 35 years old in the period 2020 – 2021**

Total HIV –VE = 61

Patients aged 13 – 35 HIV –VE = 49

Hence Percentage= $\frac{49}{61}$ = 80.3 x 100 = 80.32 % this year had Early Onset Cervical Cancer

**As compared to the period between the opening of the Oncology Clinic in 2012 – 2019 (8years) below**

**Analysis of the incidence of Early Onset Cancer of the Cervix in HIV –VE women aged 13 – 35 years old in the period 2020 – 2021**

Total HIV –VE = 31

Patients aged 13 – 35 years old HIV –VE = 22

Hence Percentage = $\frac{22}{31}$ = 8.87/8 years (2012 -2019) x 100 = 8.87 % per year had Early Onset Cervical Cancer.

Interpretation

- There was a significant and major increase in the incidence of Early Onset cancer of the cervix in the period of 2020 – 2021 of HIV –VE women aged 13 – 35, making up to 80.32% as compared to the earlier period of 2012 – 2019, that made up only 8.87% annually of the same cohort.

**Table 6: Analysis of predisposition of HIV+ women in rural to cervical cancer infection**

| | Urban | Rural | Total |
|---|---|---|---|
| HIV+ | 21 | 25 | **46** |
| HIV- | 37 | 55 | **92** |
| **Total** | **59** | **80** | **138** |

$$OddsRation = \frac{HIV^{+} \times RURAL}{HIV^{-} \times URBAN} = \frac{22 \times 55}{37 \times 25} = 1.3$$

$$100(1.3 - 1)\% = 30\%$$

$$X_{Cr}{}^{2} > X^{2}{}_{c}$$

$$1.3 > 0.004$$

The results are statistically significant

Interpretation

- A HIV+ woman living in rural area is 30% more likely to get infected with cervical cancer compared to HIV- in urban area.

$$OddsRatio = \frac{HIV^{-} \times RURAL}{HIV^{+} \times URBAN} = \frac{37 \times 25}{22 \times 55} = 0.76$$

$$100(1 - 0.76)\% = 24\%$$

$$X_{Cr}{}^{2} > X^{2}{}_{c}$$

$$0.76 > 0.004$$

The result is statistically significant

Interpretation

- A HIV- woman living in rural area is 24% less likely to get infected with cervical cancer compared to HIV+ woman living in urban area.
  HIV+ or HIV- woman in rural area has higher chances of being infected with cervical cancer compared to their counterparts in urban areas.

**Table 7: The likelihood of getting cervical cancer in the 2012-2019 and 2020-2021 periods**

| | URBAN | RURAL | Total |
|---|---|---|---|
| 2012-2019 | 19 | 33 | **52** |
| 2020-2021 | 40 | 47 | **87** |
| **Total** | 57 | **80** | **139** |

$$OddRatio = \frac{2020 - 2021 \times Rural}{2012 - 2019 \times Urban} = \frac{19 \times 47}{40 \times 33} = 0.68$$
$$100(1 - 0.68)\% = 32\%$$

$$X_{Cr}{}^2 > X^2{}_c$$
$$0.68 > 0.004$$

The result is statistically significant

Interpretation

A woman, whether in town or rural area was 32% less likely to get cervical cancer between 2012 and 2019 compared to 2020-2021 period.

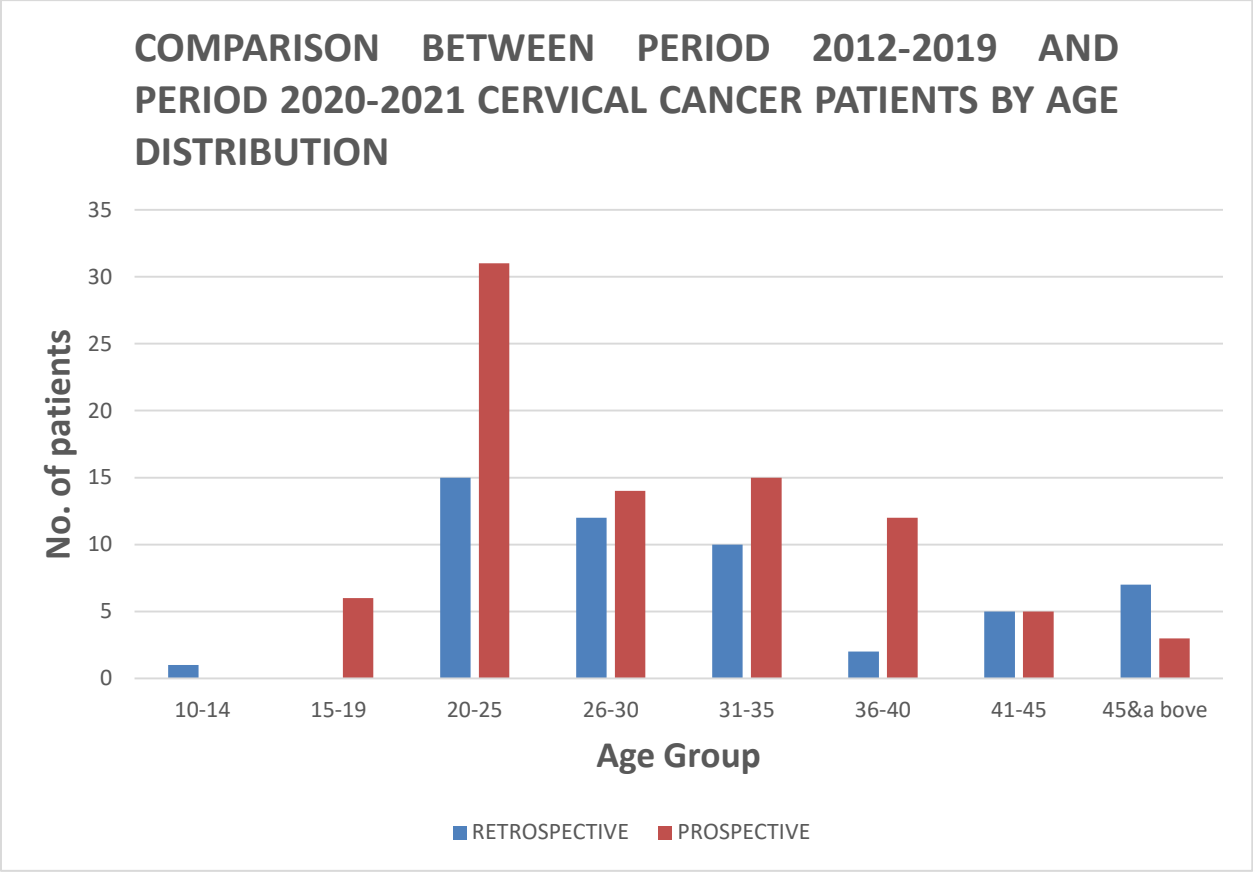


**Figure 1: Period 2012-2019 and Period 2020-2021**

- Although the number of observations aredifferent (prospective 86, retrospective 52), there is more prevalence of cervical cancer among young (<35 years old) women.
- Although first period is longer at 8 years (2012-2019) than the second period of study, more cases were reported in the latter. The prevalence rate of cancer of the cervix is increasing with time.
- Women in the 20-25 years age bracket exhibit more cases compared to other child-bearing age groups, although with a longer eight-year duration (2012-2019) for the first period, as compared tothe second shorter study period of one year (2020-2021).

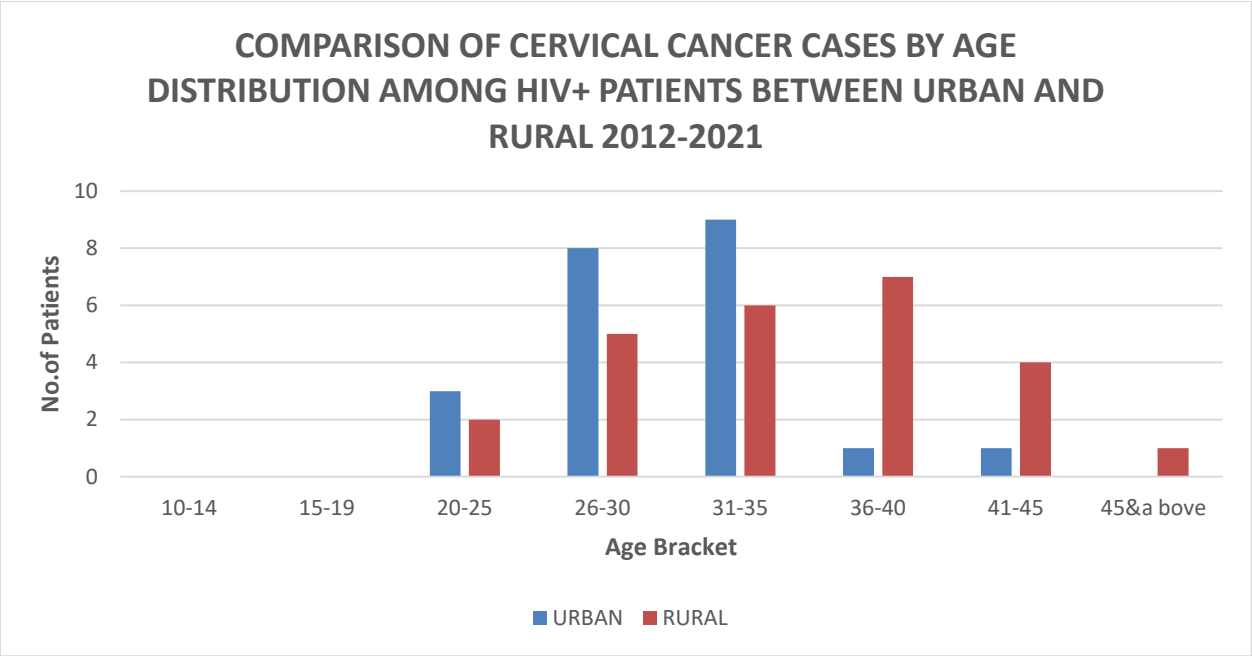


**Figure 2: Distribution of Cervical Cancer among HIV+ patients 2012-2021**

- Over the period, there is more prevalence in the rural areas.
- Young women in urban areas experience more prevalence compared to similar age group in rural areas, although the 2012-2019 periodis longer at 8 years, compared to the 2020-2021 period that is shorter at one year.
- Older women in rural areas present more cervical cancer cases compared to those in urban areas.
- There was a higher percentage of rural residing HIV negative (HIV -VE) young women (<35 years of age), diagnosed with cancer of the cervix in the prospective study, at 57%, compared with 43% residing in the urban centers.

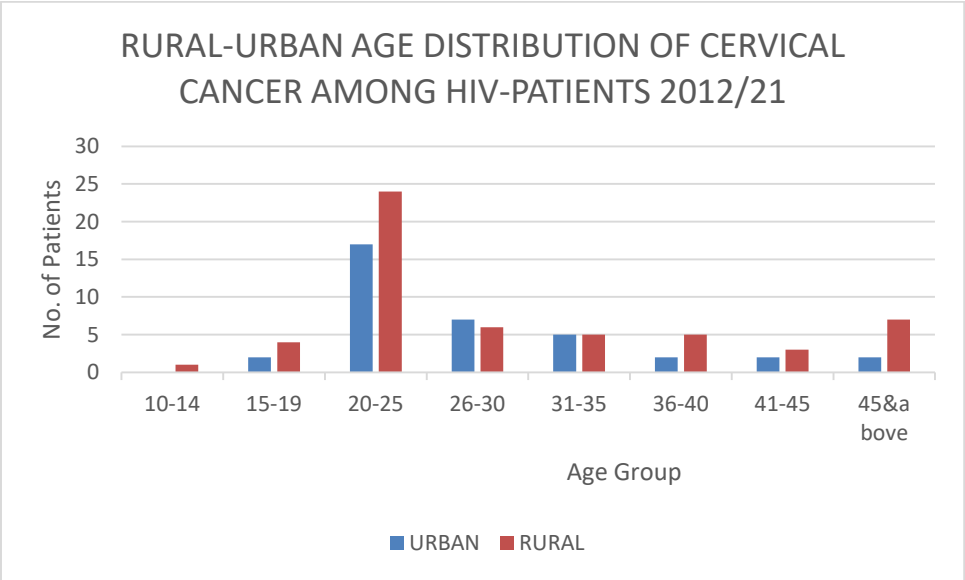


**Figure 3: Rural-Urban Cervical Cancer Age Distribution among HIV- Patients**

- It is surprisingly 1 patient below 14years in rural area presented with cervical cancer, in the retrospective arm.
- 4 patients aged between 15-19 in rural presented cervical cancer cases, in the period 2020-2021 of study.
- The prevalent age bracket is 20-25 years old and biased towards rural patients, even though the period is longer at 8 years, 2012-2019, while the other study period is shorter at one year, 2020-2021).
- The first period, although is a longer duration of eight years, 2012-2019, the young (<35 years old) HIV negative (HIV -VE) women diagnosed at FIGO Stages III and IV, are at 80% for those residents of the rural settings, as compared to 20% of those who reside in the urban centers.

- There is a preponderance of young (<35 years of age) HIV negative (HIV -VE) women being diagnosed at advanced stages (FIGO Stages III and IV) of cancer of the cervix at 74% residing in the rural areas, as compared to 26% urban dwellers, all in the period of one year 2020-2021.

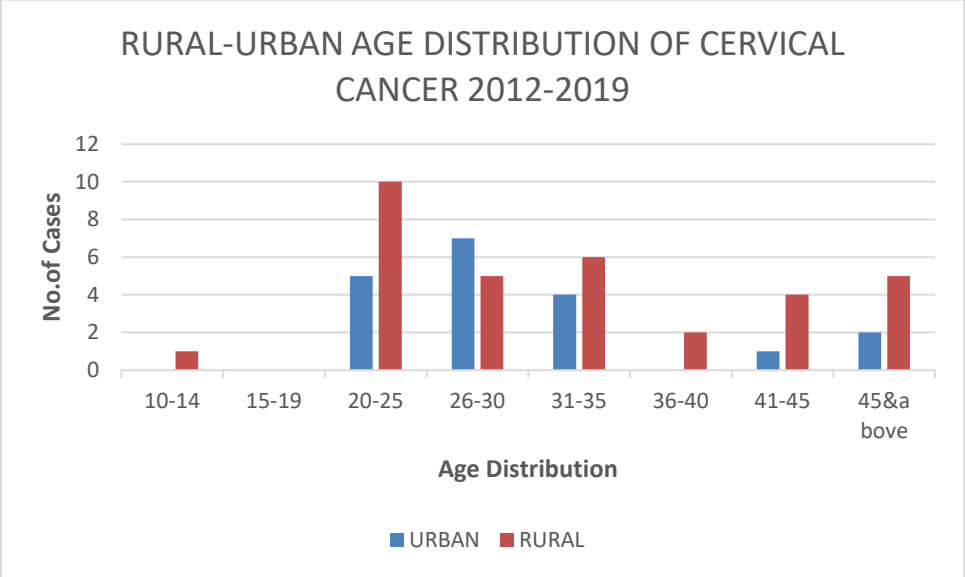


**Figure 4: Rural-Urban Age Distribution 2012-2019**

- Although the 2012-2019 period is long, only one patient below 20 years old (13yrs) presented with cervical cancer case, and she was from the rural region. No urban case featured in the below 20 years during that period.
- Most prevalence in the period was in age group 20-25, mostly in rural areas, but in a long period of eight years, 2012-2019, from the time the oncology clinic was set up to the end of 2019, the year of review.
- In the above period, although is a longer duration of eight years, 2012-2019, the young (<35 years old) HIV negative (HIV -VE) women diagnosed at FIGO Stages III and IV, are at 80% for those residents of the rural settings, as compared to 20% of those who reside in the urban centers.

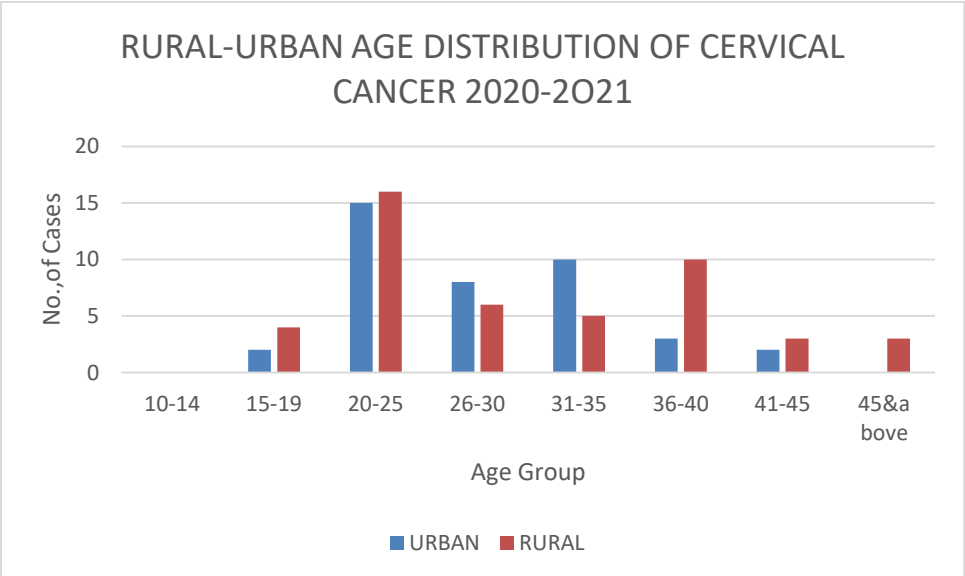


**Figure 5: Rural – Urban Age Distribution of Cervical Cancer 2020-2021**

- During this 2020-2021 study period, there were more cervical cancer cases than the previous period of study, 2012-2019.
- There were more cervical cancer incidences in very young women in this one year 2020-2021 study, than in the longer 8 years, 2012-2019 period, i.e., patients below 19 years than in the previous period.
- There are more cases in rural than urban.
- There most prevalent age group is 20-25 biased in favour of rural residents.

- There is a preponderance of young (<35 years of age) HIV negative (HIV -VE) women being diagnosed at advanced stages (FIGO Stages III and IV) of cancer of the cervix at 74% residing in the rural areas, as compared to 26% urban dwellers, all in a period of one year of 2020-2021.
- There was a higher percentage of rural residing HIV negative (HIV -VE) young women (<35 years of age), diagnosed with cancer of the cervix in the prospective study, at 57%, compared with 43% residing in the urban centers.

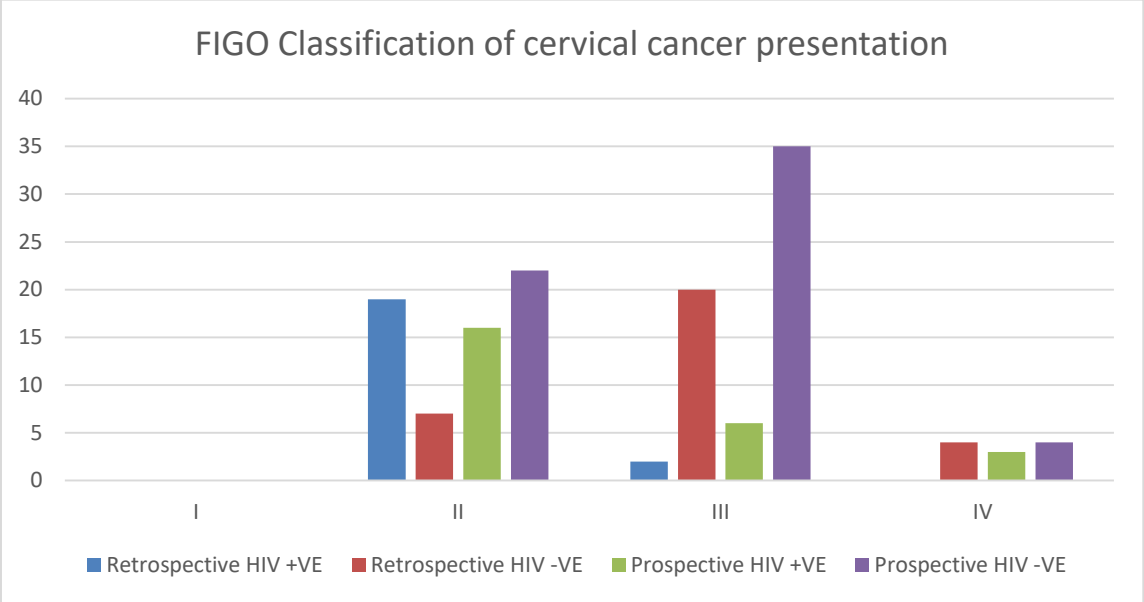


**Figure 6: FIGO Classification of Cervical Cancer Presentation**

- The 2012-2019 period, although is a longer duration of eight years, the young (<35 years old) HIV negative (HIV -VE) women diagnosed at FIGO Stages III and IV, are at 80% for those residents of the rural settings, as compared to 20% of those who reside in the urban centers.
- There is a preponderance of young (<35 years of age) HIV negative (HIV -VE) women being diagnosed at advanced stages (FIGO Stages III and IV) of cancer of the cervix at 74% residing in the rural areas, as compared to 26% urban dwellers, all in a duration of one year, 2020-2021 study period.
- The FIGO Staging of Cancer of the cervix had a P-value of 0.01906, being statistically significant, meaning diagnosis at advanced stages of III and IV for the young HIV -VE has increased compared to the HIV +VE in this period.

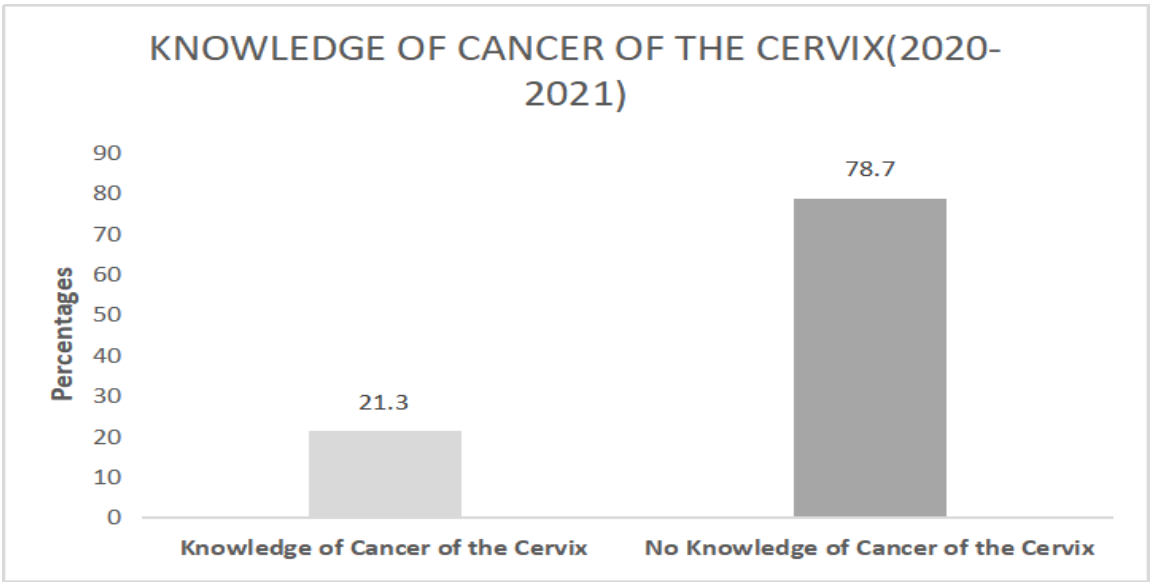


**Figure 7: Knowledge Gap on Cancer of the Cervix**

- A total of 18 patients had some prior knowledge of cancer of the cervix, as compared to 68 patients who had no idea at all on cancer of the cervix as a disease.
- The patients who had some knowledge on cancer of the cervix were mostly the ones who had self-referrals, as compared to those who had no knowledge at all, and thought they had normal vaginal discharge and bleeding post coitus, hence were referred in advanced stages to the oncology clinic.
- In the 21% who had some prior knowledge of cancer of the cervix, 22% (4 women) from the rural areas had some knowledge as compared to 78% (14 women) urban residents who had some knowledge.
- Amongst the 79% who had no knowledge of cancer of the cervix, 81% (55 women) were residents of the rural communities; whereas 19% (13) were urban dwellers.

***Screening of Cancer of the Cervix:***

In the first period of study, the voluntary screening programme had 23% HIV -VE patients screened while 77% had not been screened prior in the 2012-2019 period, when the diagnosis of cancer was confirmed. Amongst this 23% group that had been screened, 86% were urban residents, as compared to 14% of rural residents who had been screened in the eight years period (2012-2019) duration of the first period of review. Amongst the 77% of patients who had never been screened prior to diagnosis of cancer in the eight years, 2012-2019 study period, 71% were rural residents as compared to 29% who were urban dwellers.

The HIV +VE in the first period of review, had 10% who had come for the voluntary screening prior before diagnosis of cancer in the eight-year period, 2012-2019, while 90% had never been screened before cancer diagnosis in the same eight-year period, 2012-2019. In this 10% group who had come for voluntary screening, all of them, 100%, were rural residents, none of the urban residents had used the voluntary screening programme before diagnosis of cancer of the cervix. In the 90% group who had never been screened before cancer diagnosis in the eight years, 2012-2019 study period, 68% were from the rural areas, where as 32% were urban residents.

In the second study period, the voluntary screening programme had 20% HIV -VE patients screened while 80% had not been screened prior in the one-year period of 2020-2021, when the diagnosis of cancer was confirmed. Amongst this 20% group that had been screened, 83% were urban residents, as compared to 17% of rural residents who had been screened in the one-year 2020-2021study period. In the 80% group that had never been screened prior to diagnosis of cancer, 71% were from the rural areas, where as 29% were urban residents.

The HIV +VE in the second study period, had 28% who had come for the voluntary screening prior before diagnosis of cancer in the one-year period, 2020-2021, while 72% had never been screened before cancer diagnosis in the same one year study period, 2020-2021. In this 28% group who had come for voluntary screening, all of them 100%, were urban residents, none of the rural residents had accessed the voluntary screening before diagnosis of cancer of the cervix. Of the 72% who had not been screened prior to diagnosis in the one-year study period, 2020-2021, all of them, 100% were rural residents.

The above findings show a clear preponderance of lack of screening or minimal screening for cancer of the cervix amongst the young rural women; this is seen in both the 2020-2021 and the 2012-2019 study periods.

**DISCUSSIONS**

The study showed that the youngrural HIV –VE women were bearing the burden of early Onset Cancer of the Cervix (Ca. Cervix) at 47 (54%), more than their urban counterparts who were 40 (46%). This is in agreement with a study that was done in Kenya on sexual debut, and it reported that, the median age at sexual debut is about 18 years for both men and women, though by the age of 18, 50% of girls and 60% of boys have already initiated sex in both rural and urban areas, with the exception of a lower proportion (39%) among girls in urban areas, hence rural girls are more sexually active earlier [16], this link is important because early sexual debut is one of the risk factors to development of cancer of the cervix, via early exposure to HPV.

The other study that is in agreement with our finding is that, low socio-economic status is also often related to poor living conditions and poor personal hygiene, which may lead exposure to HPV earlier in life and can lead to early sexual debuts to access finances to improve their socio-economic statuses and afford basic needs as a girl [17], hence again, early exposure to HPV. Another study that had findings in agreement stated that, many SSA countries have not been able to establish and sustain cervical cancer screening programmes at the population level due to financial, logistical and socio-cultural barriers [6]. This is in contrast to a report of a study that was done in Nairobi city, which reported that of adolescents attending public secondary schools in Nairobi, 11% of girls and 50% of boys were sexually experienced, with a significant proportion of students reporting multiple sexual partnerships [18], hence more urban girls would be exposed to HPV early, therefor early development of Ca. Cervix in this context.

The study also analyzed the knowledge gap in Cancer of the Cervix, and the findings was that 68 participants (79%) had no knowledge of this cancer, as compared to 18 (21%) who had some knowledge, with a preponderance of those who had no knowledge being from the rural areas. This is an agreement to a study that was done in eleven rural health facilities in Kenya, and one of the most cited barriers to screening was inadequate knowledge by the patients/clients[19].This is in agreement with a study which reported that, the awareness of risk factors for Ca. Cervix, also varies from country to country, with huge knowledge gaps between the developed and developing countries, where, nearly all female students (98%) in Krakow or its vicinity in Poland-Europe have heard of Cervical Cancer, with 89.4% being aware of the risk of death associated with Ca. Cervix, and most (91.5%) are aware of cytological screening, and 86.5% think that they should have it done in the future [20]. The other study that supports our finding stated that, in Nepal, South Asia, which is a developing country, it was reported that more than 50% of high school

students were not familiar with the knowledge, which was similar to a Japanese survey on the same topic [21]. The lack of knowledge, hence less perceived susceptibility were major obstacles among mothers, limiting cervical cancer screening to 15% and yet Ca. Cervix is a major cause of death in Nepal, resulting in 18.4% of all deaths, despite the fact that the numbers may be under-reported due to a lack of a cancer registry [22]. An African study that is also in agreement with our finding, reported that the Ca. Cervix risk factor knowledge in Zimbabwe, of more than or equal to 13 out of 26, was reported to be at 13% of high school students and 14% of university students with a broad range of misconceptions about cervical cancer risk factors in both males and females [23]. A Kenyan study that seems to be in agreement to our finding, states that, in Kenya, although 91% of the surveyed women had heard of cancer, only 29% had heard of cervical cancer and some of its risk factors, fewer women (6%) had ever been screened for Ca. Cervix and cited barriers such as fear, time, and lacking knowledge about cervical cancer [24]. The Kisumu study, whose publication also supports our finding, reports that, just about 29% of the women surveyed had ever heard of cancer of the cervix, and only 6% had been screened previously [25].

The study found out that most patients presented to the hospital in advanced stages of cancer of the cervix, most of them being women from the rural areas. There were 39 (64%) patients diagnosed at FIGO Stages III and IV, while just 22 (36%) were diagnosed at Stages II and III in the prospective study, mostly due to presenting themselves for the voluntary screening programme. The preponderance of these patients who were diagnosed at advanced stages (FIGO III and IV) of Ca. Cervix, were rural residents, at 20 (74%), while urban residents are just at 7 (26%) of the total 27 participants. This is supported by a study that reported that, mortality from cervical cancer is much greater in resource-limited countries, especially in those patients who are rural residents, because of late or delayed diagnosis and limited options of treatment [26,1]. Another study with a report that supports the rural preponderance of advanced stages of Ca. Cervix at diagnosis stated that, in developing countries most cervical cancer patients live in the rural areas where sexual behaviour is more conservative than in urban centers and S.T.D's are less prevalent [27]. The other study that is in agreement with above finding, reports that the low socio-economic status is also often related to poor living conditions, this leads to lack of money and health insurance to access hospital services early, to get an early diagnosis [17]. In a study that support the advanced stages at presentation but with a reason that we did not investigate in our study, it reports that, at the Kenyatta National Hospital, it was established there was high prevalence of HPV 18 in samples of young patients with advanced squamous cell cervical cancer, and whether it is HPV 18 alone or in double infections that is a factor in such oncogenic transformation and progression remains to be established [27].The additional study that seems to support the study's above finding but we did not investigate HPV and the types, reports that, the finding of a high prevalence of HPV 16/18 in the biopsies from the rural cases, therefore raises the question as to whether the viruses may not be transmissible by means other than sexual contact [28], with another study stating that, indeed evidence of congenital HPV transmission is accumulating and if established may call for a radical reassessment of approaches to prevention of cervical neoplasia [29, 30].

In yet another finding, voluntary screening of the Ca. Cervix for young HIV-VE women was still very low, with preponderance in the rural areas, even though the services are free and offered in public health institutions. In the period 2020-2021, just 12 (20%) had been screened, of these, just 2 (17%) were rural dwellers, yet 10 (83%) were from the urban centers. On the contrary, of the 49 (80%) of the total 61 patients who had never been screened even once prior in this 2020-2021period HIV-VE arm, 35 (71%) were residents of rural areas, while just 14 (29%) of urban residents had not been screened. This may have happened due to the finding of lack of knowledge described above that is preponderant in the rural areas, with other agreeing past studies, of the above barriers for not going for screening in the finding above about screening, including fear and lack of time. This may have happened due to the finding of lack of knowledge described above, with other agreeing past studies or the above barriers for not going for screening in the finding above about screening, including fear and lack of time. This is supported by a published study, that reported that lack of knowledge and less perceived susceptibility were major obstacles among mothers in the rural areas, limiting cervical screening to 15% and yet Cancer of the Cervix is a major cause of death in Nepal, resulting in 18.4% of all deaths, despite the fact that the numbers may be under-reported due to a lack of a cancer registry [22]. A second study in Kenya that agrees with this finding, states that, the most frequently cited barriers to screening in the rural areas included staff shortages, lack of trained staff, insufficient space, and supply issues, while the patient barriers commonly perceived by the staff included inadequate knowledge, wait time, and fear of pain with speculum exam [19]. A separate study in agreement states that, few women (6%) in the rural areashad ever been screened for cervical cancer and cited barriers such as fear, time, and lacking knowledge about cervical cancer [24]. A study in Kisumu, reported that just about the same 6% had previously been screened even once for Ca. Cervix voluntarily. This is in contradiction to a study entitled cancer of the service screening and prevention that was done by the Family Aids Care and Education Services (FACES) , that showed that a majority of female medical staff members 41/51;80% reported having been screened for cervical cancer and additionally, 30 (81%) of the male medical staff members reported having at least one female member screened [19].

This study did not involve laboratory investigations of HPV types, hence it needs a follow up research that will involve taking Pap's smears to the laboratory to investigate the presence of HPV in the cervix of the respective patients, identify the various types of the HPV, ascertain if there are particular patients who have a combination or mixed presence of two or more HPV, especially in the rural areas where the burden of early onset caner of the cervix seems to be felt most.

This study was important for the future trajectory of Ca. Cervix in the country with the increasing incidences of all

types of cancers in the nation, which is squeezing the resources of individuals, families, communities, counties, hospitals and the national government, due to the evidence-based fact that most patients are coming at advanced stages (FIGO STAGES III and IV) of the disease. This disease is also affecting women of reproductive ages, in their most productive ages and most are mothers, and more than 70% die leaving their children behind as orphans. This disease also robs the patients of their dignity, especially in the advanced stages (FIGO STAGES III and IV), that they do come in, where they have to be taken care of and most of them develop vesico-vaginal-fistulae (V.V.F) or/and Recto Vaginal Fistulae (R.V.F), which are conditions that make the patients become ashamed, frustrated and ready to give up on living. The disease has to be taken more seriously by both the county and national governments and the mitigation measures by the W.H.O aggressively implemented in both the rural and urban areas, but with a greater emphasis in the rural zones, due to the findings the study got.

## CONCLUSION

The study concludes that, there is a preponderance of rural HIV negative young women with early onset cancer of the cervix coming to the Oncology Clinic of JOOTRH in Western Kenya. The young rural women are bearing the burden of early onset Ca. Cervix more than their urban counterparts.

There is a need in increasing knowledge and awareness of cancer of the cervix, with an emphasis of the rural areas. There is also a need to create awareness and promote aggressively the vaccination against HPV and early and annual screening of cancer of the cervix within the rural communities. A rural community social mobilization of populations, with the needed information for parents, guardians, relatives, government local administrators and teachers on HPV vaccination and screening. There is also a need for accurate teaching to dispel miscommunications, disinformation and myths about HPV vaccination in the rural communities. There is also a need of talking directly to the rural children about cancer of the cervix, and vaccination, so that they can talk to their parents with right information about the HPV Vaccination. Future studies should focus on mass awareness, and education about cervical cancer, HPV vaccination and screening with efficient, effective and innovative ways and tactics to deliver appropriate messages to the rural communities

## RECOMMENDATIONS

There is a need for a rural areas comprehensive study, in a multi-center, multi-national prospective, and with a larger sample size, to identify the factorscontributing tothis upsurge of early onset cancer of the cervix cases in rural young HIV-VE patients, and initiate interventions to curb this trend.

If these factors will not be studied, identified and mitigated, the incidences of rural young HIV-Negative women with early onset cancer of the cervix will continue to increase and we will continue having morbidities and mortalities at this young reproductive and productive age group.

There is a need to identify the HPV types, in a follow up research, that will involve taking cervical smears to the laboratory to investigate the presence of HPV on the cervix of the respective patients, identify the various types of the HPV, ascertain if there are particular patients who have a combination or mixed presence of two or more HPV types.

The mitigation should be done using theW.H.O's goals of (90-70-90). This means that all countries should as a Primary prevention, achieve, 90% of girls fully vaccinated with HPV vaccine by 15 years of age, as a Secondary prevention achieve 70% of women screened using a high-performance test, by 35 and 45 [26] years of age and as a Tertiary prevention achieve 90% of women identified with cervical disease are treated [26]; split further into 90% of women with pre-cancer lesions treated and 90% of women with invasive cancer managed. We also intend, as a core Primary prevention strategy, to advocate for inclusion of cancer of the cervix teaching as a topic in the science, social studies and biology curriculum of primary and high schools, to equip pupils and students with the knowledge. For the goals to be achieved, we will impress on the county governments and countries to invest more on the above strategies for the eradication of cancer and share with them the long-term cost-benefits/savings of their investments.

***Source of Funding***

The PhD candidate financed the study with his personal funds, and was aided with the personnel at the hospital, together with volunteering students and the investigators availed their expertise locally to conduct the study. We used the local hospital paper records in the cabinets of the oncology department and the records office.Uzima University School of Medicine supported the study by availing the volunteering students.

## REFERENCE

[1]. Sung H, Ferlay J, Siegel R.L, Laversanne M, Soerjomataram I, Jemal A, et al. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 cuntries. CA Cancer J Clin. 2021:71:209-49. Doi:10.3322/caac.21660].

[2]. Ferlay J, Soerjomataram I, Dikshit R, Eser S, Mathers C, Rebelo M, et al. Cancer incidence and mortality worldwide: sources, methods and major patterns in GLOBOCAN 2012. Int J Cancer. 2015;136: E359-86.

[3]. UNAIDS. HIV and Cervical cancer. https://www.unaids.org/sites/default/files/media_asset/HIV-and-cervical-cancer_en.pdf [Accessed 14th August 2022].

[4]. Mbulaiteye SM, Bhatia K, Adebamowo C, Sasco AJ. HIV and cancer in Africa: mutual collaboration between HIV and cancer programs may provide timely research and public health data. J Infectious Agents and Cancer. 2011; 6 (1): 6-10. doi:1186/1750-9378-6-16.

[5]. Taylor, RJ, Morrell, SL, HA, & Wain GV. Effects of screening on cervical cancer incidence and mortality in New South Wales implied by influences of period of diagnosis and birth cohort. J Epidemiol Community Health. 2001;55(11), 782-8.

[6]. Temmerman M, Bustreo F. Cervical cancer services are the next frontier for universal healthcare coverage in LMICs. BMJ Opinion Blogs. 2017].

[https://blogs.bm.com/bmj/2017/09/20/cervical-cancer-services-are-the-next-frontier-for-universal-healthcare-coverage-in-lmics.

[7]. Binka C, Nyarko SH, Awusabo-AsareK, et al. Barriers to the uptake of cervical cancer screening and treatment among rural women in Ghana. Biomed Res Int. 2019;2019 doi: 10.1155/2019/6320938. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

[8]. Yimer NB, Mohammed MA, Solomon K, et al. Cervical cancer screening uptake in sub-Saharan Africa: a systematic review and meta-analysis. Public Health. 2021; 195:105-111. doi: 10.1016/j.puhe.2021.04.014. [PubMed] [CrossRef] [Google Scholar]

[9]. Lim JNW, Ojo AA. Barriers to utilization of cervical cancer screening in Sub Sahara Africa: a systematic review. Eur J Cancer Care (Engl) 2017;26(1):e12444. Doi: 10.1111/ecc.12444. [PubMed] [CrossRef] [Google Scholar]

[10]. Perez-Guzman PN, Chung MH, De Vuyst H, et al. The impact of scaling up cervical cancer screening and treatment services among women living with HIV in Kenya: a modeling study. BM Glob Heal. 2020;5(3):e001886. Doi: 10.1136/bmjgh-2019-001886. [PMC free article] [PubMed] [CrossRef] [Google Scholar].

[11]. Bhatla N, Nessa A, Oswal K, et al. Program organization rather than choice of test determines success of cervical cancer screening: case studies from Bangladesh and India. Int J Gynecol Obstet. 2021;152(1):40-47. doi: 10.1002/ijgo.13486. [PubMed] [CrossRef] [Google Scholar].

[12]. Nganga A, Nyangasi M, NkongeNG,et al. Predictors of cervical cancer screening among Kenyan women: results of a nested case-control study in a nationally representative survey. BMC Public Health. 2018;18(3):1-10.doi: 10.1186/s12889-018-6054-9. [PMC free article] [PubMed] [CrossRef] [Google Scholar].

[13]. Mwenda V, Mburu W, Bor J, Nyangasi M, Arbyn M, Weyers S, et al. Cervical cancer programme, Kenya, 2011-2020: lessons to guide elimination as a public health problem. Ecancermedicalscience. 2022; 16: 1442. doi: 10.3332/ecancer.2022.1442

[14]. Singh GK, Williams SD, Siahpush M, Mulhollen A. Socioeconomic, rural-urban, and racial inequalities in US cancer mortality: Part I-all cancers and lung cancer and part II-colorectal, prostate, breast, and cervical cancers. Journal of Cancer Epidemiology. 2011;2011:107497. DOI: 10.1155/2011/107497. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

[15]. Blake KD, Moss JL, Gaysynsky A, Srinivasan S, Croyle RT. Making the case for investment in rural cancer control: An analysis of rural cancer incidence, mortality, and funding trends. Cancer Epidemol Biomarkers Prev. 2017. [PMC free article] [PubMed] [Google Scholar].

[16]. LeConte AB, Szanislo P, Fennewald MS, Lou ID, Qiu S, Chen N et al. Differences in the viral genome between HPV-Positive cervical and Oropharyngeal cancer. PLOS ONE. 2018;13(8): E0203403. doi: 10.1371/journal.pone.0203403.

[17]. Free K, Roberts S, Bourne R, Dickie G, Ward B, Wright G, et al. Cancer of the cervix, old and young, now and then. Gynecol Oncol. 1991;43:129-36. doi: 10.1016/0090-8258(91)90058-D.

[18]. Boislard PMA, Poulin F. Individual, Familial, Friends-related and contextual predictors of early sexual intercourse. Journal of Adolescence. 2011; 34:289-300.

[19]. Rosser JI, Hamisi S, Njoroge B, Huchko MJ. Barriers to Cervical Cancer Screening in Rural Kenya: Perspectives from a Provider Survey. J Community Health. 2015;40(4): 756-761. doi: 10.1007/s10900-015-9996-1.

[20]. Dariotis J, Sonenstein F, Gates G, Capps R, Astone N, Pleck J, et al. Changes in sexual risk behaviors as young men transition to adulthood. Journal of Perspectives on Sexual and Reproductive Health. 2008; 40: 218-225.

[21]. Newcomb M.D., Locke T.F., Goodyear R.K. Childhood experiences and psychological influences on HIV risk among adolescent Latinas in Southern California. Journal of Cultural diversity and ethnic minority psychology. 2003; 9 (3): 219-235.

[22]. Kann L, Warren CW, Harris WA, Collins JL, Douglas KA, Collins ME, et al. J. Youth risk behavior surveillance - United States. 1993; 44: 1-57.

[23]. Maticka-Tyndale E. Commentary: Sexuality and Sexual health of Canadian adolescents: Yesterday, today and tomorrow. Canadian Journal of Human Sexuality. 2008; 17:85-95.

[24]. Fetene N. The prevalence of risky sexual behaviors among youth center reproductive health clinics users and non-users in Addis Ababa, Ethiopia. Public Library of Science Journal. 2018; 13(6):e0198657. doi: 10.1371/journal. Pone. 0198657.

[25]. Leif EA. Unsafe sexual behavior in South African Youth. Social Science and Medicine J. 2003; 56(1):149-65.

[26]. Arbyn M., Weiderpass E., Bruni L., De Sanjose S., Saraiya M., Ferlay J., et al. Estimates of incidence and mortality of cervical cancer in 2018: a worldwide analysis. THE LANCET-Global Health. 2020; Vol 8 (2): E191-E203.

[27]. Chu PC, Hwang JS, Wang JD, Chang YY. Estimation of the financial burden to the National Health Insurance for patients with cancers in Taiwan. J Formos Med Assoc. 2008; Vol.107 (1): 54-63.

[28]. Denny L, Prendiville W. Cancer of the Cervix. Early Dectection and cost effective solutions. International Journal of Gynecology & Obstetrics. 2015; 13(1). S28-S32.

[29]. Subramanian S, Trogdon J, Ekwueme DU, Gardner JG, Whitmore JT, Rao C. Cost of cervical cancer treatment: implications for providing coverage to low-income women under Medicaid expansion for cancer care. Women's Health Issues J. 2010; Vol 20(6): 400-5. doi: 10.1016/j.whi.2020.07.002. 29.

[30]. Seinfeld J. Cost-benefit analysis of cancer care and control: The case of cervical, colorectal and breast cancer in low and middle income countries. SSRN Electronic Journal. 2013. doi: 10.2139/SSRN. 2279542