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Cancer Risk Factors Associated With Females In South Sudan

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Abstract
Female cancers in South Sudan represent a growing public health challenge driven by biological, reproductive, behavioural, and health-system factors. This study assessed the burden and associated risk factors of breast, cervical, and ovarian cancers among women in South Sudan. Findings from Chi-square and binary logistic regression analyses revealed significant associations between female cancers and poor reproductive healthcare, persistent HPV infection, low screening uptake, poverty, weak health infrastructure, limited awareness, and delayed healthcare-seeking behaviour. Women were found to be at substantially higher risk due to biological susceptibility, gender inequality, low HPV vaccination coverage, and inadequate cancer-control services. Preventive practices such as routine screening, HPV vaccination, treatment follow-up, and healthcare utilization were associated with improved outcomes, although access to these services remains limited. The study further identified major psychological, social, and financial burdens linked to cancer diagnosis. Overall, the findings highlight the urgent need to strengthen national cancer-control programs, expand HPV vaccination and screening services, improve public awareness, and enhance oncology care to reduce female cancer morbidity and mortality in South Sudan.

Keywords: *Cancer, risk factors, females, South Sudan.*

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I. Introduction

Cancer is a major global public health challenge and a leading cause of morbidity and mortality worldwide (Ott *et al.,* 2011). Among women, breast, cervical, and ovarian cancers account for a substantial share of the cancer burden and contribute to significant premature mortality, particularly in low- and middle-income countries where access to screening, diagnosis, and treatment remains limited (Dare *et al.,* 2021). Breast cancer (Bashar and Begam, 2022) is the most frequently diagnosed cancer among women globally, while cervical cancer remains a leading cause of cancer-related deaths among women in sub-Saharan Africa, driven by preventable risk factors and inadequate screening programmes (Kengela, 2019).

In South Sudan, the burden of female cancers is increasingly becoming a public health concern amid a fragile healthcare system, limited oncology services, weak cancer surveillance systems, and poor awareness regarding early detection (Mwanje, 2023). According to recent GLOBOCAN estimates, breast cancer is the most commonly diagnosed cancer among women in South Sudan, followed by cervical cancer. At the same time, ovarian cancer also contributes notably to female cancer morbidity (Torre *et al.,* 2017). Breast, cervical, and ovarian cancers together represent a major share of newly diagnosed female cancers in the country (Elamin *et al.,* 2015).

Cervical cancer poses a particularly serious challenge in South Sudan because of the absence of a national HPV vaccination program, low screening coverage, and delayed presentation for diagnosis (Jolem, 2023). Mwanje (2023) reported that South Sudan has no functional population-based cancer registry and limited cervical cancer prevention infrastructure, which complicates national cancer control efforts. Studies further indicate that cervical cancer screening uptake among women in South Sudan remains extremely low, contributing to high morbidity and mortality from late-stage disease (Jolem, 2023).

Similarly, breast cancer in South Sudan is frequently diagnosed at advanced stages due to poor awareness, sociocultural barriers, and limited diagnostic facilities (Tetteh and Faulkner, 2016). Ovarian cancer, although less common than breast and cervical cancers, remains highly fatal because it is often asymptomatic in its early stages and is commonly detected only after disease progression (Doubeni *et al.,* 2016). In many African

settings, including neighbouring countries with similar health systems, ovarian cancer patients present predominantly with advanced-stage disease, leading to poor survival outcomes (Manirakiza and Pfaendler, 2022).

Despite the growing burden of female cancers, there remains a scarcity of comprehensive epidemiological data on breast, cervical, and ovarian cancers in South Sudan. Existing studies are limited, fragmented, and largely hospital-based, thereby restricting understanding of national patterns, determinants, and outcomes. This lack of evidence hinders the effective planning of prevention, screening, and treatment strategies tailored to the South Sudanese context (Mwanje, 2023).

The study aims to assess the burden and associated risk factors of breast, cervical, and ovarian cancers among women in South Sudan.

II. Review Of Empirical Studies

Islami *et al.* (2024) conducted a study to comprehensively assess the current status, patterns, and trends of cancer disparities in the United States across different population groups. The study employed a descriptive epidemiological and population-based analytical model using secondary data obtained from national cancer surveillance systems and databases in the United States. The findings revealed persistent and substantial cancer disparities across the United States. The authors concluded that cancer disparities in the United States remain a major public health challenge driven by structural inequalities, social determinants of health, unequal healthcare access, and differences in exposure to cancer risk factors.

Bhatla *et al.* (2021) conducted a study to provide an updated global overview of cervical cancer, including its epidemiology, risk factors, prevention strategies, screening approaches, diagnosis, staging, and treatment modalities. The authors used a narrative review model based on the synthesis of current scientific literature, international cancer guidelines, epidemiological reports, and clinical evidence related to cervical cancer. The findings demonstrated that cervical cancer remains one of the leading causes of cancer-related morbidity and mortality among women globally, especially in resource-limited settings. The study concluded that cervical cancer is largely preventable through effective HPV vaccination, regular screening, early diagnosis, and timely treatment.

Arbyn *et al.* (2020) conducted a study to estimate the global incidence and mortality burden of cervical cancer in 2018 and to examine its geographic distribution across countries and regions. The study employed a descriptive epidemiological modeling approach using data from the Global Cancer Observatory (GLOBOCAN 2018). The findings revealed that cervical cancer remained one of the leading causes of cancer morbidity and mortality among women worldwide in 2018. The study concluded that cervical cancer represents a major global public health challenge characterized by profound international inequalities.

Horton *et al.* (2020) conducted a study to evaluate strategies for integrating breast cancer prevention, early detection, diagnosis, treatment, and palliative care into existing national health systems to reduce mortality, improve survival, and enhance equitable access to quality cancer care. The study employed a health systems strengthening and integrated care model grounded in policy analysis, evidence synthesis, and comparative global health frameworks. The findings demonstrated that fragmented cancer services in LMICs often contribute to delayed diagnosis, inadequate treatment, high mortality, and financial hardship for patients. The study concluded that effective breast cancer control requires comprehensive health system strengthening rather than isolated disease-specific interventions.

Brand *et al.* (2019) conducted a study to examine the major delays and barriers affecting access to cancer care in low- and middle-income countries (LMICs). The study employed a systematic review model based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework. The findings revealed that delays in cancer care in LMICs are multifactorial and occur at nearly every stage of the cancer continuum. The study concluded that improving cancer outcomes in LMICs requires comprehensive health-system strengthening and equitable cancer-control strategies.

Bray *et al.* (2018) conducted a study to provide comprehensive global estimates of cancer incidence and mortality for 36 cancer types across 185 countries. The study utilized the GLOBOCAN statistical modeling framework by applying standardized estimation techniques. The findings revealed that cancer remains a major global public health concern, with approximately 18.1 million new cases and 9.6 million deaths reported in 2018. The authors concluded that the global cancer burden is rising, driven by population growth, aging, and changes in the prevalence of risk factors.

Bultz and Carlson (2006) conducted a study to examine the significance of emotional distress among cancer patients and to advocate for its recognition as the “sixth vital sign” in oncology care. The study employed a conceptual and clinical framework model grounded in psycho-oncology practice rather than an experimental statistical model. The authors reviewed emerging evidence from psychosocial oncology research, clinical observations, and cancer care practices to support the development of a standardized distress screening model. The findings demonstrated that emotional distress is highly prevalent among cancer patients across

different stages of diagnosis, treatment, survivorship, and palliative care. The study concluded that emotional distress should be recognized as a critical component of comprehensive cancer care and incorporated into routine clinical assessment worldwide.

IV. Materials And Methods

The study employed a cross-sectional descriptive survey in which the data were collected using a structured questionnaire in Juba, November 2025. The study utilized a sample size of 384 participants. The formula of sample size determination is;

Where:

- n = required sample size.
- Z = Value from the standard normal distribution corresponding to the desired confidence level. For a 95% confidence level, Z = 1.96.
- P = Estimated proportion of the population. Commonly assumed to be 0.5 when the true proportion is unknown, as this gives the maximum sample size.
- 1 - p = Complement of the estimated proportion. If p = 0.5, then 1-p = 0.5.
- e = Margin of error (expressed as a decimal). Often set at 0.05 for a 5% margin of error.

Substituting the values:

Therefore, the required sample size is approximately 384 respondents.

The target population was males and females who had been diagnosed with cancer and were aged 15 to 55+ years. It is distributed to five medical centers, such as Juba Medical Complex, Juba Teaching Hospital, Afia Medical Clinic Center, Gudele Hospital, and Catherina Medical Center, from 7th November to 23rd December 2025 by well-qualified investigators. Consent was obtained from the Ministry of Health –Research Ethics Review Board (MOH-RERB) in Juba, South Sudan.

The dependent variable was cancer in females, classified as follows: Individuals without female cancers (breast, cervical, and ovarian) were designated 0, while those with these cancers were designated 1. The independent variables were: hearing about cancer, hearing about cancer diagnostic procedures, can cancer be detected early by screening?, can vaccination prevent cancer?, how does cancer describe?, can cancer kill?, signs and symptoms of cancer in the early stages, those at greater risk of developing cancer, source of cancer information, healthy-looking people can have cancer, having general screening of health status, general screening periods to determine whether or not existent of cancer exists in the body, what the patient would do if cancer is detected positive?, the best time for vaccination against cancer, cancer stage after diagnosis, and cancer type after diagnosis.

The analysis was conducted using the statistical package for the social sciences (SPSS), version 21. Bivariate analysis using the chi-square test was conducted to assess associations between categorical variables and female cancers, determining whether there is a statistically significant. Similarly, the binary logistic regression was utilized where the outcome variable is binary (e.g., female cancers: yes/no).

V. Results

Cancer Risk Factors Associated with Knowledge by Chi-square Test.

The findings in Table 1 demonstrate very strong and statistically significant relationships between female cancers (breast, cervical, and ovarian cancers) and several cancer-related knowledge, perception, screening, and behavioural variables among respondents in South Sudan. The Chi-square test results show that all examined variables had p-values below 0.05, confirming that knowledge, awareness, and responses toward cancer are closely associated with the occurrence and recognition of female cancers within the population.

The variable “those who are at greater risk of developing cancer” showed a highly significant association with female cancers ($\chi^2 = 67.476$, $p = 0.000$). Most respondents correctly identified women as the group at highest risk, with 54 out of 74 respondents in this category reporting female cancers. This reflects awareness that breast, cervical, and ovarian cancers biologically occur primarily among women because of hormonal, reproductive, and genetic factors. Cervical cancer is linked to persistent human papillomavirus (HPV) infection, breast cancer is associated with hormonal exposure, obesity, reproductive history, and genetic mutations, while ovarian cancer is strongly influenced by reproductive and hereditary factors. The finding also demonstrates that respondents understand the sex-specific nature of female cancers. However, the large proportion selecting “all the above are at risk” suggests growing awareness that cancer can affect everyone regardless of sex or age. Socially, this awareness may result from increasing exposure to public health

information, personal experiences with cancer cases, and community discussions about chronic diseases. Within the South Sudan context, the strong association reflects the growing burden of female cancers amid weak preventive healthcare systems. Women in South Sudan face multiple vulnerabilities, including early marriage, high fertility rates, repeated childbirth, poor reproductive healthcare access, limited HPV vaccination, poverty, and low screening coverage, all of which increase the risk of cervical and breast cancers. Cultural barriers and gender inequality further limit women's access to early diagnosis and treatment, making female cancers more visible and severe within communities.

The relationship between general health screening and female cancers was statistically significant (χ^2 = 5.634, p = 0.018). Respondents who had undergone health screening were more likely to report awareness or presence of female cancers compared to those who had never been screened. Biologically, cancer screening increases the likelihood of detecting abnormal cellular changes before symptoms become severe. Screening methods such as Pap smears, clinical breast examinations, mammography, and pelvic examinations improve early diagnosis and treatment outcomes. The findings therefore indicate that health-seeking behaviour is strongly connected to cancer detection and awareness. Socially, individuals who seek screening services are often more health-conscious, educated, or exposed to healthcare information than those who do not. In South Sudan, however, routine screening services remain extremely limited because of inadequate healthcare infrastructure, shortages of trained personnel, lack of diagnostic equipment, poverty, and insecurity caused by prolonged conflict. Many people only seek healthcare when symptoms become advanced, which contributes to late-stage cancer diagnosis and poor survival outcomes. Thus, the significant association highlights the importance of expanding routine cancer screening programs across the country.

The variable regarding screening frequency also showed a significant association with female cancers (χ^2 = 8.220, p = 0.042). Respondents who reported screening every six months had comparatively better representation among those aware of female cancers, while many respondents remained uncertain about appropriate screening intervals. This finding reflects variations in health literacy and preventive healthcare practices. Biologically, regular screening improves the possibility of identifying precancerous lesions and early-stage tumours before progression to advanced disease. For cervical cancer, particularly, regular screening can detect abnormal cervical cells early enough for effective treatment. In the South Sudan context, uncertainty regarding screening periods reflects poor public awareness campaigns and limited access to reliable cancer education. Preventive medicine is still underdeveloped, and most health services focus heavily on infectious diseases rather than non-communicable diseases such as cancer. Consequently, many individuals lack knowledge regarding when and how often cancer screening should occur. Economic hardship and transportation barriers also reduce regular healthcare attendance, especially among rural women.

The responses concerning actions taken after a positive cancer diagnosis were highly significant (χ^2 = 21.917, p = 0.000). Many respondents indicated that they would feel worried, follow doctors' schedules, or seek treatment at healthcare facilities. Fear and anxiety are biologically and psychologically expected reactions because cancer is commonly associated with pain, disability, infertility, and death. The notable number indicating removal of the uterus reflects awareness of hysterectomy as a treatment option for advanced cervical or uterine-related cancers. This demonstrates some understanding of medical interventions for female cancers. Socially, these responses reveal the emotional and behavioural consequences of cancer diagnosis within communities. Cancer often produces fear because treatment is expensive, access to oncology services is poor, and survival rates are perceived to be low. In South Sudan, specialized cancer care services are extremely limited, and many patients are referred abroad to countries such as Uganda, Kenya, or Sudan for treatment. Financial constraints, stigma, and reliance on traditional healers may delay treatment initiation. The findings therefore illustrate both increasing awareness of medical treatment and the major psychosocial burden associated with cancer diagnosis.

The strongest association in the table was observed for cancer type after diagnosis (χ^2 = 384.000, p = 0.000). All respondents diagnosed with cervical, breast, and ovarian cancers were classified within the female cancer category, while cancers such as prostate, lung, colorectal, liver, kidney, leukaemia, and others were entirely classified under the non-female cancer category. This finding confirms the accuracy of the study classification system and reflects the biological specificity of female reproductive cancers. Breast, cervical, and ovarian cancers are anatomically and hormonally linked to female reproductive organs and are among the most common cancers affecting women globally. In South Sudan, cervical and breast cancers are increasingly recognized as major public health concerns because of high HPV prevalence, limited vaccination coverage, poor reproductive healthcare services, delayed diagnosis, and low awareness. Cervical cancer remains especially important because many women present late with advanced disease due to a lack of screening programs. Breast cancer awareness is also rising, although mammography and oncology services remain scarce. The findings therefore emphasize the urgent need for national cancer control policies focusing on prevention, screening, vaccination, early diagnosis, and treatment of female cancers.

Table 1: Cancer Risk Factors Associated with Knowledge in Females by the Chi-square Test.

Variable	N	Breast, cervical, and ovarian cancers		Sig.
		No	Yes	
Those who are at greater risk of developing cancer				**0.000**(67.476)
Women	74	20	54	
Men	32	32	0	
Children	4	3	1	
All the above are at risk of developing cancer	274	193	81	
Have you ever had a general screening of your health status?				**0.018**(5.634)
Yes	181	128	53	
No	203	120	83	
General screening periods to check whether or not existent of cancer exists in the body				**0.042**(8.220)
Not sure	128	74	54	
Once a month	10	5	5	
Once every six months	178	128	50	
Once every year or more	68	41	27	
If cancer is detected positive				**0.000**(21.917)
Feel worried about it	157	100	57	
Isolate for good treatment	29	18	11	
Follow-up the doctor's schedule made for treatment	142	101	41	
Visit any healthcare facility nearby to keep updating your health condition	40	27	13	
Removal of the uterus if there are any side effects	16	2	14	
Cancer type after diagnosis				**0.000**(384.000)
Cervical	65	0	65	
Breast	66	0	66	
Prostate	29	29	0	
Lung	17	17	0	
Colorectal	26	26	0	
Skin (Melanoma)	10	10	0	
Lymphoma	20	20	0	
Kidney	9	9	0	
Leukaemia	43	43	0	
Liver	37	37	0	
Stomach	26	26	0	
Nasopharyngeal carcinoma	8	8	0	
Esophageal	7	7	0	
Ovarian	5	0	5	
Bladder	3	3	0	
Brain Tumour	2	2	0	
Pancreatic	2	2	0	
Multiple myeloma	2	2	0	
Kaposi's sarcoma	2	2	0	
Tongue	1	1	0	
Malignant	1	1	0	
Umbilical	1	1	0	
Rhabdomyosarcoma	1	1	0	
Malignant neck	1	1	0	

Cancer Risk Factors Associated with Knowledge by the Binary Logistic Regression Model.

The binary logistic regression findings in Table 2 demonstrate strong and statistically significant associations between female cancers (breast, cervical, and ovarian cancers) and several cancer-related knowledge, perception, treatment, and vaccination variables among respondents in South Sudan. The regression coefficients (B), odds ratios [Exp(B)], and confidence intervals indicate the strength and direction of these relationships, while the significant p-values (<0.05) confirm that these factors independently influence the likelihood of female cancer occurrence.

The findings show that respondents who identified women as being at greater risk of developing cancer were significantly more likely to be associated with female cancers compared with the reference category ("all the above are at risk"). Women had an odds ratio of 8.584, meaning they were more than eight times more likely to be associated with female cancers. Biologically, this result reflects the natural susceptibility of women to reproductive cancers such as breast, cervical, and ovarian cancers because these cancers are directly linked to female reproductive organs, hormonal exposure, menstrual and reproductive history, human papillomavirus (HPV) infection, genetic predisposition, and age-related hormonal changes. In the South Sudan context, the association is intensified by multiple social and structural factors. Women often experience limited access to education, poverty, early marriage, repeated childbirth, poor reproductive healthcare services, low screening coverage, and weak awareness programs. Cultural stigma surrounding breast and reproductive

diseases also discourages early healthcare seeking. Furthermore, the absence of organized national cancer screening and vaccination programs means that many women are diagnosed at advanced stages of disease. Therefore, the high odds ratio reflects not only biological vulnerability but also gender inequality and limited healthcare access in South Sudan.

The regression results further indicate significant negative associations between female cancers and respondents' intended actions if cancer were detected positive. Respondents who reported that they would "feel worried about it," "isolate for good treatment," "follow the doctor's treatment schedule," or "visit nearby healthcare facilities regularly" all had odds ratios far below 1.0, indicating protective or reduced likelihood relationships compared with the reference category ("removal of the uterus if there are side effects"). These findings suggest that positive health-seeking attitudes and adherence to medical follow-up are associated with lower odds of female cancer progression or occurrence. Biologically and clinically, regular follow-up care, adherence to treatment schedules, early medical consultation, and continuous monitoring improve cancer prognosis by allowing earlier detection, timely treatment, and prevention of complications. Socially, these findings reflect the importance of awareness, trust in healthcare systems, and healthcare utilization behaviours. In South Sudan, however, many women delay treatment because of financial hardship, insecurity, transportation barriers, reliance on traditional healers, fear of stigma, and limited oncology services. As a result, women who demonstrate positive attitudes toward follow-up care and healthcare utilization may represent individuals with better cancer knowledge, stronger social support, or improved healthcare access. The negative regression coefficients therefore indicate the protective effect of appropriate health-seeking behaviour against worsening female cancer outcomes.

The findings regarding vaccination age also show strong statistically significant associations. Respondents who identified the recommended vaccination age as 9-14 years or 15-20 years were significantly more likely to be associated with female cancer knowledge compared with those who were "not sure." The odds ratios of 5.015 and 4.510 indicate substantially greater awareness levels regarding cancer prevention through vaccination. These findings are biologically important because HPV vaccination before sexual debut is one of the most effective methods for preventing cervical cancer. Within South Sudan, however, knowledge regarding HPV vaccination remains limited because of weak public health education systems, low vaccine availability, poor immunization coverage, misinformation, and limited reproductive health awareness. Cultural misconceptions about vaccines and limited school-based vaccination programs further reduce awareness among adolescents and families. Therefore, respondents who correctly identified the recommended vaccination age likely represent individuals with better health literacy, educational exposure, or healthcare interaction.

Table 2: Cancer risk factors associated with knowledge in females by the binary logistic regression model.

Variable	B	S.E.	Sig.	Exp(B)	95% C.I	
					Lower	Upper
Those who are at greater risk of developing cancer (RC = All the above are at risk of developing cancer)						
Women	2.150	0.374	0.000	8.584	4.125	17.862
If cancer is detected positive (RC = Removal of the uterus if there are any side effects)						
Feel worried about it	-2.355	0.876	0.007	0.095	0.017	0.528
Isolate for good treatment	-2.431	0.988	0.014	0.088	0.013	0.610
Follow-up the doctor's schedule made for treatment	-2.799	0.889	0.002	0.061	0.011	0.348
Visit any healthcare facility nearby to keep updating your health condition	-2.870	0.941	0.002	0.057	0.009	0.359
The best time for vaccination against cancer (RC = Not sure)						
9-14 years old	1.613	0.475	0.001	5.015	1.975	12.736
15-20 years old	1.506	0.472	0.001	4.510	1.787	11.382

VI. Discussion

The findings in Table 1 appear because female cancers in South Sudan are influenced by a combination of biological susceptibility, reproductive health conditions, infectious disease exposure, weak healthcare systems, poverty, low screening coverage, and changing public awareness. The statistically significant Chi-square relationships indicate that knowledge, perceptions, and behaviours regarding cancer are strongly connected to women's real-life experiences with breast, cervical, and ovarian cancers. These findings are consistent with global cancer epidemiology studies, but their effects are intensified in South Sudan because of prolonged conflict, fragile health infrastructure, gender inequality, and limited cancer prevention services.

The finding that women were identified as the group at greatest risk of cancer is strongly supported by worldwide evidence. The World Health Organization (2024) confirmed that breast cancer is now the most commonly diagnosed cancer among women globally, while cervical cancer remains one of the leading causes of cancer deaths among women in low-income countries. Similarly, the International Agency for Research on Cancer (Sung et al., 2021) demonstrated that breast and cervical cancers disproportionately affect women because of hormonal exposure, reproductive factors, HPV infection, and inherited genetic mutations such as BRCA1 and BRCA2. Studies by Bray *et al.* (2018) and Arbyn *et al.* (2020) further confirmed that female reproductive cancers remain dominant causes of morbidity and mortality among women worldwide. In South Sudan, these biological risks are compounded by early marriage, repeated childbirth, polygamy, poor reproductive healthcare, low HPV vaccination uptake, untreated sexually transmitted infections, and limited maternal health services. Persistent HPV infection is especially common where screening and vaccination are weak, explaining the increasing visibility of cervical cancer among women.

The significant relationship between general health screening and female cancers is consistent with global studies showing that screening improves early detection and awareness. Islami *et al.* (2024) reported that routine mammography, Pap smears, HPV testing, and clinical breast examinations substantially reduce cancer mortality through early diagnosis. A study by Sherris *et al.* (2009) demonstrated that cervical cancer screening significantly lowers mortality in low-resource settings by identifying precancerous lesions before invasive cancer develops. Similarly, Gradishar *et al.* (2014) found that regular breast cancer screening increases survival because cancers are detected at earlier stages. In South Sudan, however, access to screening remains extremely limited. Hospitals often lack pathology laboratories, mammography machines, oncology specialists, and trained screening personnel. Many women only present to health facilities when symptoms are severe, which explains why awareness of cancer is often linked to experience with advanced disease rather than a preventive screening culture.

The significant association between screening frequency and female cancers reflects the importance of preventive healthcare behaviour. Worldwide studies confirm that regular screening intervals improve cancer prevention outcomes. The World Health Organization (2022) recommended periodic cervical cancer screening for women because regular testing detects precancerous abnormalities early. Research by Arbyn *et al.* (2020) confirmed that repeated HPV and cervical screening greatly reduce cervical cancer incidence and mortality. In developed countries, organized national screening programs have dramatically lowered cervical cancer deaths. However, in South Sudan, uncertainty about screening intervals reflects poor health literacy, limited public education campaigns, and the historical focus of the healthcare system on infectious diseases such as malaria, HIV/AIDS, and tuberculosis rather than chronic non-communicable diseases. Rural populations particularly experience transportation barriers, insecurity, and healthcare shortages, making regular screening difficult.

The strong association regarding reactions after a positive cancer diagnosis reflects the major emotional and psychosocial burden of cancer. Global studies consistently show that fear, anxiety, depression, and uncertainty are common following cancer diagnosis. Stanton *et al.* (2015) found that cancer diagnosis often produces psychological distress because patients associate cancer with suffering, infertility, social disruption, and death. Similarly, Bultz and Carlson (2006) demonstrated that emotional distress significantly affects treatment adherence and quality of life among cancer patients. In South Sudan, these fears are intensified because cancer treatment services are scarce and expensive. Many patients must travel abroad to countries such as Uganda, Kenya, or Sudan for radiotherapy, chemotherapy, or surgery. Financial hardship, stigma, and reliance on traditional healers often delay treatment. The response involving hysterectomy demonstrates growing awareness of biomedical treatment approaches, although fear of infertility and social consequences may discourage some women from seeking early care.

The extremely strong association between cancer type after diagnosis and female cancers confirms the biological specificity of breast, cervical, and ovarian cancers. Global evidence strongly supports this classification. Bhatla *et al.* (2021) confirmed that cervical, breast, and ovarian cancers are anatomically linked to female reproductive organs and are among the leading cancers affecting women worldwide. Studies by Michaels and Worthington (2024) further showed that breast cancer incidence continues to rise globally, particularly in low- and middle-income countries undergoing demographic and lifestyle transitions. In South Sudan, increasing urbanization, changing diets, obesity, delayed diagnosis, high fertility, and low vaccination coverage may contribute to the rising burden of female cancers. Cervical cancer is especially severe because many women present with advanced-stage disease after prolonged untreated HPV infection.

The findings also reflect the broader theory of social determinants of health. Studies by Marmot (2005) demonstrated that poverty, education, gender inequality, and healthcare access strongly shape disease outcomes. Similarly, Brand *et al.* (2019) consistently show that low-income countries experience higher cancer mortality because of delayed diagnosis and weak treatment systems. In South Sudan, prolonged armed conflict has weakened hospitals, displaced populations, disrupted vaccination programs, reduced women's educational

opportunities, and increased poverty. These structural conditions increase exposure to cancer risk factors while simultaneously reducing access to prevention and treatment services.

The findings in Table 2 appear because female cancers in South Sudan are influenced by a combination of biological susceptibility, behavioural practices, reproductive health conditions, limited preventive services, and major social inequalities. The binary logistic regression model demonstrates that these factors independently contribute to the likelihood of female cancers and cancer-related knowledge among respondents. The strong odds ratios and statistically significant p-values indicate that these relationships remain important even after controlling for other variables in the model.

The finding that women were more than eight times more likely to be associated with female cancers reflects both biological and epidemiological realities. Breast, cervical, and ovarian cancers are sex-specific diseases closely linked to female reproductive biology, hormonal exposure, reproductive history, genetics, and persistent infections such as HPV. Worldwide evidence strongly supports this pattern. The World Health Organization (2020) and Ginsburg (2013) consistently report that breast and cervical cancers remain among the most common cancers affecting women globally, especially in low- and middle-income countries. Similar global evidence was confirmed by Bray *et al.* (2018) and Sung *et al.* (2021), who showed that female cancers contribute substantially to global morbidity and mortality. However, the South Sudan context deepens and intensifies this association beyond biology alone. Many women experience chronic poverty, low educational attainment, weak reproductive healthcare access, and limited exposure to cancer information. Early marriage and repeated childbirth increase long-term hormonal and reproductive exposure, which may elevate risks for cervical and breast cancers. In addition, prolonged civil conflict has weakened healthcare infrastructure, disrupted immunization systems, and reduced access to early diagnosis and treatment services. These conditions contribute to late-stage cancer presentation, which is common in fragile health systems across sub-Saharan Africa. The findings also reflect the influence of gender inequality in South Sudanese society. Women often depend economically on family members or spouses before seeking healthcare, delaying screening and treatment. Cultural stigma surrounding breast examination, reproductive illnesses, and cancer discussions discourages many women from reporting symptoms early. Similar observations were reported in African cancer studies by Dos Anjos *et al.* (2025), who emphasized that social disadvantage and delayed healthcare access significantly worsen female cancer outcomes in low-resource countries. Therefore, the very high odds ratio in this study represents not only biological vulnerability but also the cumulative effects of structural inequalities and weak cancer-control systems.

The regression findings showing protective effects among respondents who reported positive treatment and follow-up behaviours are also highly important. Respondents who indicated that they would follow medical treatment schedules, attend nearby healthcare facilities regularly, or seek proper treatment had significantly lower odds ratios. These findings appear because early healthcare utilization improves cancer prognosis through earlier diagnosis, timely treatment, and better disease monitoring. Clinically, cancers detected early are more treatable and associated with higher survival rates. Worldwide studies strongly support these findings. Allemani *et al.* (2018) demonstrated that survival rates improve substantially when women adhere to treatment schedules and receive timely oncology care. Horton *et al.* (2020) similarly confirmed that access to continuous cancer treatment and follow-up services significantly reduces mortality in low-income settings. Furthermore, Sauvaget *et al.* (2011) found that regular cervical cancer screening and follow-up dramatically reduce cervical cancer deaths. In South Sudan, these findings are particularly meaningful because healthcare-seeking behaviour is often constrained by insecurity, transportation challenges, shortage of hospitals, and high out-of-pocket medical expenses. Oncology services are extremely limited, and many patients must travel long distances or seek treatment outside the country. Consequently, women who demonstrate positive attitudes toward medical care likely represent individuals with greater awareness, stronger family support, urban residence, or improved financial capacity. Their reduced odds ratios therefore reflect the protective value of healthcare utilization in a setting where access to care remains highly unequal.

The vaccination findings are equally important. Respondents who correctly identified HPV vaccination ages of 9-14 years and 15-20 years were significantly more likely to demonstrate female cancer awareness. These findings appear because awareness of vaccination age reflects broader health literacy and understanding of cancer prevention strategies. Biologically, HPV vaccination before sexual debut prevents persistent HPV infection, the primary cause of cervical cancer. Global evidence strongly confirms this relationship. Studies by Harper and Williams (2010) and Garland and Machalek (2017) showed that HPV vaccination significantly reduces cervical precancerous lesions and future cancer risk. More recently, Arbyn *et al.* (2020) confirmed the long-term effectiveness of HPV vaccination programs in reducing cervical cancer incidence globally. The World Health Organization (2020) recommends routine HPV vaccination for girls aged 9-14 years because vaccine effectiveness is highest before exposure to HPV infection. In South Sudan, however, awareness and uptake of HPV vaccination remain very limited. Weak immunization systems, shortage of vaccines, poor school-based health programs, misinformation, and low reproductive health literacy reduce vaccine coverage.

Cultural misconceptions sometimes associate HPV vaccination with infertility or inappropriate sexual behaviour, discouraging parental acceptance. Rural populations are especially disadvantaged because healthcare facilities and awareness campaigns are limited. Therefore, respondents who correctly identified vaccination ages likely represent more educated individuals or those with better interaction with healthcare systems.

VII. Conclusion And Recommendations

Conclusion

The study concludes that female cancers in South Sudan are driven by a combination of biological, reproductive, behavioural, and structural factors, including weak health systems, poverty, and low awareness. Significant statistical associations show that knowledge, screening, vaccination awareness, and healthcare-seeking behaviours strongly influence cancer outcomes, with poor practices linked to a higher risk of breast, cervical, and ovarian cancers. The burden is worsened by conflict, limited oncology services, and delayed diagnosis, making outcomes more severe than global averages. Preventive behaviours such as screening and HPV vaccination are protective, while stigma, financial barriers, and reliance on traditional healers contribute to late presentation and poor treatment uptake. Further, the study concludes that reducing female cancer burden requires urgent strengthening of prevention, early detection, treatment infrastructure, and public health education in South Sudan.

Recommendations

The study recommends urgent establishment of a national cancer control program integrating prevention, screening, vaccination (HPV), diagnosis, treatment, and palliative care, supported by a national cancer registry. It calls for expansion of HPV vaccination for girls, improved and affordable nationwide screening and early detection services, and strengthened public cancer awareness and health education to promote early care-seeking. It further recommends integrating cancer services into reproductive and maternal health care, expanding oncology infrastructure and workforce, and introducing financial protection mechanisms to improve access to treatment. The study also emphasizes training healthcare workers, strengthening psychosocial support services, reducing rural and conflict-related inequities through outreach and mobile clinics, and promoting multi-sectoral and international collaboration. Finally, it encourages further research on cancer risk factors, barriers, and vaccination effectiveness to guide policy and planning.

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