

# Patterns and Types of Colorectal Polyps Among Adults in Imo State Nigeria

Bright Ugochukwu Ibe\*; Evangeline T. Oparaocha; Joachim Nwaokoro

*Department of Public Health, School of Postgraduate studies, Federal University of Technology Owerri, Imo State Nigeria*

*\*Corresponding Author*

DOI: <https://doi.org/10.51244/IJRSI.2023.10507>

Received: 27 April 2023; Accepted: 19 May 2023; Published: 09 June 2023

## Abstract:

**Background:** Colorectal cancer is one of the major health problems in the world. It used to be thought that it is a disease of people in developed countries, but recent studies has shown increasing incidence in developing countries. In Nigeria, most patients present cases late when curative resection is impossible. In order to achieve higher success, it becomes essential that knowledge and awareness for early symptoms and detection methods and screening tools have to be identified. This study aimed to elucidate the patterns and types of colorectal polyps among adults aged 40 - 65 years of age in Imo State Nigeria.

**Methods:** The sample of the study comprised one thousand (1000) adults drawn through a multistage sampling method, and included both urban and rural dwellers from the selected communities in Imo State, Nigeria. These were screened for Fasting Occult Blood Test (FOBT). Out of the, 40 (4. 0%) of the subjects found to be positive, a further random selection was used to select 20 (50.0%) for virtual colonoscopy for detection of colorectal polyps.

**Results:** Findings showed that there was evident in the low prevalence of colorectal polyps (20%). Also, there was a significant association between the patterns of colorectal polyp and awareness of colorectal polyp among the participants ( $p= 0.001$ ;  $X^2= 7.153$ ).

**Conclusion:** There are different types of colon polyps with differing tendencies to become malignant and abilities to predict the development of polyps to cancer. It is important to recognize families with members who have genetic conditions causing polyps because some of these conditions are associated with a very high incidence of colon cancer, and the cancer can be prevented if discovered early.

**Keywords:** Colorectal carcinoma, Screening, Polyps, Patterns, Adults, Nigeria

## I. Introduction

Elbert (2019) defined Colon polyps as growths that occur on the inner lining of the large intestine (colon) and usually protrude into the colon. Polyps form when the genetic material within the cells lining the colon changes and becomes abnormal (mutates). Normally, the immature cells lining the colon are programmed to divide (multiply), mature, and then die in a very consistent and timely fashion. However, the genetic changes that occur in the living cells prevent the cells from maturing, and the cells do not die. This leads to an accumulation of immature, genetically abnormal cells, which eventually results in the formation of polyps. The mutations may occur as a sporadic event after birth or they may be present from birth.

Colon polyps are important because they may or may not become malignant (cancerous) (American Cancer Society, 2017). They also are important because based on their size, number, and microscopic anatomy (histology); they can predict which patients are more likely to develop more polyps and colon cancer (colorectal cancer) (Sirinukunwattana *et. al.*, 2016). It is important to recognize families with members who have familial genetic conditions causing polyps because some of these conditions are associated with a very high incidence of colon cancer, and the cancer can be prevented or discovered early.

Colon polyps are diagnosed by endoscopic colonoscopy, virtual colonoscopy, barium enema, and flexible sigmoidoscopy. Colon polyps are treated by endoscopic removal and occasionally by surgery (Jemal *et. al.* 2020; Ries *et. al.*, 2018; Ferlay *et. al.*, 2010). Follow-up surveillance of patients with colon polyps depends on the presence of a family history of cancer, the number of polyps that are found, the size of the polyps, and the polyps' histology, and can vary between three and 10 years. Ninety-five percent of colon polyps do not cause symptoms or signs, and are discovered during screening or surveillance colonoscopy. When symptoms or signs occur, they may include red blood mixed in with or on the surface of the stool, black stools if the polyp is bleeding substantially and is located in the proximal colon (cecum and ascending colon), Iron deficiency anemia if the bleeding has been

slow and occurring over a prolonged period of time, Weakness, light-headedness, fainting, pale skin, and rapid heart rate due to iron deficiency anemia (Xie *et. al.*, 2009; Wong *et. al.*, 2009; American Cancer Society, 2017).

The type of polyp predicts who is more likely to develop further polyps and colon cancer. Polyps cause other problems, but it is the deadly nature of colon cancer that is of most concern (Jemal *et. al.* 2020; Ries *et. al.*, 2018; Ferlay *et. al.*, 2010). Benign polyps become malignant polyps (cancer) with further mutations and changes in the cells' genetic material (genes). The cells begin to divide and reproduce uncontrollably, sometimes giving rise to a larger polyp. Initially, the increasingly, genetically abnormal cells are limited to the layer of cells that line the inside of the colon. The cells then develop the ability to invade deeper into the wall of the colon. Individual cells also develop the ability to break off from the polyp and spread into lymph channels through the wall of the colon to the local lymph nodes and then throughout the body, a process referred to as metastasis although this is unusual unless the cancer has invaded into the wall of the colon. Most polyps are protrusions from the lining of the intestine. Polypoid polyps look like a mushroom, but flop around inside the intestine because they are attached to the lining of the colon by a thin stalk. Sessile polyps do not have a stalk, and are attached to the lining by a broad base.

Flat polyps are the least common type of colon polyp, and are flat or even slightly depressed. These may be difficult to identify because they are not as prominent as polypoid or sessile polyps with the commonly available methods of diagnosing polyps. Although colorectal polyps are precursors to colorectal cancer, it takes several years for these polyps to potentially transform into cancer (Wong *et al.*, 2009). If colorectal polyps are detected early, they can be removed before this transformation occurs. Currently, the most common screening test for colorectal polyps is colonoscopy (Lieberm Rex, Winawer, Giardiello, Johnson, Levin, 2012). This study aimed to provide sufficient evidence on the patterns, types and risk factors of colorectal polyps among adults aged 40 - 65 years of age Imo State Nigeria.

## II. Methods

A descriptive cross sectional study design was adopted for the study. A multistage sampling technique was used to select 1000 adults, aged 40 - 65 years of age from 60 randomly selected communities, half of which came from urban and the other from rural settings in Imo State Nigeria. All those selected had no initial diagnosis of colorectal cancer and further excluded were adults with mental disorder and hearing impairment that could not permit them provide information that supported the study. Also excluded were feeble elderly patients.

Two types of screenings were used; Fecal Occult Blood Test (FOBT) screening and Virtual Colonoscopy for confirmation of the patterns and types of colorectal polyps among those that tested positive for FOBT in the studied adults in Imo State, Nigeria.

### Fecal Occult Screening

Before stool collection and testing, it was ensured that the FOBT Card and Developer were not beyond their expiration dates. The fresh stool was collected in sterile, dry container by the selected adults and handed over to the researchers. An applicator stick was used to apply a small amount of stool to the inside of the testing card, typically in a box labelled "A". The applicator stick was then used to obtain a second sample from a different part of the stool, which is also placed inside the testing card, typically in a box labelled "B." The testing card was then stored at room temperature, away from heat and light, until it is transported to the appropriate laboratory.

### Laboratory Analysis

The laboratory analysis was done in collaboration with a laboratory scientist. The chemistry behind testing involves a catalyzed reaction. The heme occult testing card has alpha-guaiaconic acid (guaiac)-impregnated paper. A hydrogen peroxide reagent is then added to the paper. If heme is present in the stool sample, the alpha-guaiaconic acid is oxidized by the hydrogen peroxide to a blue-colored Quinone. The blue colour would signify a positive test result.

### Virtual colonoscopy

A virtual colonoscopy was performed without any sedation after a sodium bisphosphate or sodium phosphate enema. Both procedures were carried out in the left lateral position. The endoscopy was performed by a consultant surgeon.

Virtual colonoscopy is one of several screening options for colorectal cancer. Screening for this type of cancer is recommended for adults. A flexible sigmoidoscopy is necessary to screen for cancer or polyps higher in the bowel. an examination of the bowels, or a small, flexible tube with a light and camera. It can aid in the detection of conditions such as colorectal cancer, polyps, and ulcers. The procedures of the health examination were the same as those used at baseline during the study period. Height and weight were measured on standardized machines.

Subjects were stratified into three groups according to BMI: underweight (BMI 18.5), normal weight (18.5 BMI 25), and overweight (BMI 25).

Smoking and drinking habits and medical histories such as colorectal cancer, colectomy, and inflammatory bowel diseases were collected. Regular smoking (or current smoking) was defined as smoking at least one cigarette per day. Former smoking status was defined as the cessation of smoking for at least one year. Regular drinking was defined as drinking at least

Inferential data was analyzed using Chi Square and ANOVA to test the hypothesis.

**Ethical Considerations/Informed Consent**

A letter of introduction and ethical clearance were obtained from the Department of Public Health's Ethical Clearance Committee before the research was conducted. Also, the anonymity of the respondents was assured. The confidentiality of the information they provided was also maintained, and the ethical issues of this study were reviewed and approved by the selected communities' Ethical Committee. During the screening interview, participants were asked for their informed consent to fill out the questionnaire's information, and the "no-risk" implication of voluntary participation and the guarantee of anonymity were clarified.

**III. Results**

**Socio-Demographic Characteristics of respondents**

The study results showed that 59.1% (591) of the respondents were aged 51-60 years, the mean age (SD) of the adults was 52 ±1.34 and over half of the respondents were female (57.4%). Also, 49.9% (499) of the respondents had attained secondary education levels, and 41.9% (419) 16.9% (167) farmers and 23.1% (232) were civil servants. A majority of the respondents were Christians (72.9%), 18.5% (186) Muslims, and over 40% (401) of the respondents earned above 20,000 monthly. From the study results 64.9% (650) of the adults resided in the rural parts of the state, while 35% (350) live in urban area.

Table 1: Socio-Demographic Characteristics of Respondents

Characteristics	Frequency (n=1000)	Percentage (%)
<b>Age</b>		
40-50	368	36.8
51-60	591	59.1
61-70	41	4.1
<b>Total</b>	<b>1000</b>	<b>100</b>
<b>Mean age (S.D)</b>	52yrs (± 1.34)	
<b>Gender</b>		
Male	425	42.5
Female	575	57.5
<b>Total</b>	<b>1000</b>	<b>100</b>
<b>Education</b>		
Primary	64	6.4
Secondary	499	49.9
Tertiary	419	42.0
No formal Education	17	1.7
<b>Total</b>	<b>1000</b>	<b>100</b>
<b>Occupation</b>		
Farming	167	16.7
Artisans	339	33.9
Others	262	26.2

Civil servant	232	23.2
<b>Total</b>	<b>1000</b>	<b>100</b>
<b>Religion</b>		
Christianity	729	72.94
Islam	186	18.57
Traditional	29	2.94
Others	56	5.56
<b>Total</b>	<b>1000</b>	<b>100</b>
<b>Level of monthly income</b>		
0 - 5,000	314	31.4
6,000 -15,000	135	13.5
16,000 - 20,000	150	15.0
20,000+	401	40.1
<b>Total</b>	<b>1000</b>	<b>100</b>
<b>Place of Residence</b>		
Urban	350	35.0
Rural	650	65.0
<b>Total</b>	<b>1000</b>	<b>100</b>

#### Percentage frequency of Subjects with Positive Fecal Occult Screening

Table 2 below revealed that from 1000 participants screened for colorectal polyp. Majority of the respondents (80%) screened negative for Fecal Occult Screening. There was a 20% prevalence rate for Colorectal Polyp following Fecal Occult Screening among respondents who screened for polyp. The mean age was 56.5 years (SD 16.4).

#### Virtual Colonoscopy for Colorectal Polyp

Table 3 below revealed that from 20 participants sampled with virtual colonoscopy, majority of the subjects 16 (80.0%) screened negative. There was a 20% prevalence rate for Colorectal Polyp among respondents who screened for polyp (n=4).

#### Patterns and types of colorectal polyps among studied group

#### Patterns and location of colorectal polyps among studied group

From table 4 below illustrate the pattern and location of colorectal polyps among the studied group, polyps were identified in 8 patients, with a prevalence of 20%. The pattern and Location of the colorectal polyps were present at the Cecum (n=2; 25.0%), ascending colon (n=1; 12.5%), transverse colon (n=1; 12.5%), descending colon (n=2; 25.0%), sigmoid colon (n=1; 12.5%) and rectum (n=1; 12.5%).

Table 2: Percentage frequency of Subjects with Positive Fecal Occult Test

Screening	Frequency (n = 1000)	Percentage (%)	Prevalence
Positive	20	2.0	20%
Negative	980	98.0	
<b>Total</b>	<b>1000</b>	<b>100</b>	

Table 3: Percentage Frequency of Positive Virtual Colonoscopy for Colorectal Polyp among 20FOBT Positive Cases

Screening	Frequency (n = 20)	Percentage (%)	Prevalence
Positive	8	40.0	40%
Negative	12	60.0	
<b>Total</b>	<b>20</b>	<b>100</b>	

Table 4: Patterns and Location of colorectal polyps among respondents

Pattern and Location	Frequency	Percentage
Cecum	2	25.0
Ascending colon	1	12.5
Transverse colon	1	12.5
Descending colon	2	25.0
Sigmoid colon	1	12.5
Rectum	1	12.5
<b>Total</b>	<b>8</b>	<b>100</b>

**Patterns of colorectal polyps among respondents**

Table 5 illustrated the patterns of colorectal polyps among respondents who were screened for colorectal polyps. The non-neoplastic polyps were Hyperplastic polyp, Normal mucosa, Hamartomatous polyps, Juvenile polyposis, inflammatory polyps and the neoplastic polyps were Tubulovillous adenoma, Tubular adenoma, cancerized adenoma, villous adenoma, serrated adenoma, Adenocarcinoma. The majority (81.6%) had only one polyp. Of the total polyps, most were seen in the rectum (33.5%) followed by the sigmoid colon (22.9) (Table 4.2.2). Of the 8 patients, only 1 had polyps proximal to the splenic flexure, 7 patients (20%) had a simultaneous polyp distal to the splenic flexure.

**Association between Colorectal Polyp and Risk factors of Colorectal Polyp**

Table 6 below illustrates the association between Colorectal Polyp and Risk factors of Colorectal Polyp and certain demographic factors associated with colorectal polyp.

Table 5: Patterns and type of colorectal polyps

Type	Cecum	Ascending colon	Transverse colon	Descending colon	Sigmoid colon	Rectum	Frequency	Percentage
Non neo-plastic	Hyperplastic polyp	0	0	0	0	1	1	12.5
	Normal mucosa	0	0	0	0	1	1	12.5
	Hamartomatous polyps	1	0	0	0	0	2	25.0
	Juvenile polyposis	0	0	0	0	0	0	0
	Inflammatory polyps	0	0	0	0	0	0	0
Neoplastic	Tubulovillous adenoma	0	0	0	0	0	0	0
	Tubular adenoma	0	1	0	1	0	3	37.5

Neo-plastic	Cancerized adenoma	0	0	0	0	0	0	0	0
	Villous adenoma	0	0	0	0	0	0	0	0
	Serrated adenoma	0	0	0	0	1	0	1	12.5
	Adenocarcinoma	0	0	0	0	0	0	0	0
Total		1	1	0	1	2	3	8	100
Percentage		12.5	12.5	0	12.5	25.0	37.5	100	

Table 6: Association between Colorectal Polyp and Risk factors of Colorectal Polyp

Variables	With colorectal polyp (n =8 )	Without colorectal polyp (n = 12)	P-value (p=0.05)
Age (years)	60 (53–67)	55 (47–62)	<0.001
Gender (male/female, n)	395/159	1461/1051	<0.001
Regular smoker (%)	2 (28.5)	12 (20.5)	<0.001
Regular drinker (%)	2 (22.6)	11 (15.9)	<0.001

**Association between smoking status and Development of Colorectal Polyp**

Table 7 below illustrates or provides evidence on the Association between smoking status and Development of Colorectal Polyp. After adjusted for major confounding factors, the risk for colorectal polyps in current smokers was significantly higher than that in never-smokers (AHR 1.786; 95%CI 1.087–2.936;  $P = 0.022$ ). People who smoked more cigarettes per day were more likely to develop colorectal polyps (AHR 1.878; 95%CI 1.018–3.463;  $P = 0.044$ ) than those who smoked less (AHR 1.811; 95%CI 1.003–3.270;  $P = 0.049$ ). Since smoking and drinking are always mentioned together, the study found that subjects with both smoking and drinking habits had a significantly higher risk for colorectal polyps (AHR 2.073; 95%CI 1.196–3.593;  $P = 0.009$ )

Table 7: Association between smoking status and Development of Colorectal Polyp

Variable	n (%)	Model 1 <sup>a</sup>	Model 2 <sup>b</sup>	Model 3 <sup>c</sup>	P value
		HR (95%CI)	P value	HR (95%CI)	
<b>Smoking status</b>					
Never	446 (79.5)	1		1	-
Former	32 (5.7)	1.070 (0.465–2.465)	0.873	0.949 (0.404–2.229)	0.904
Current	83 (14.8)	2.161 (1.420–3.289)	<0.001	1.914 (1.187–3.086)	0.008
<b>Cigarettes per day</b>					
0	478 (85.2)	1		1	
1–20	44 (7.8)	2.175 (1.267–3.733)	0.005	1.950 (1.099–3.459)	0.022
>20	39 (7.0)	2.125 (1.238–3.648)	0.006	1.904 (1.059–3.426)	0.032



#### IV. Discussion

This study evaluated the patterns and types of colorectal polyps among adults aged 40 to 65 years in Imo State, Nigeria. Based on this finding it was revealed that colorectal polyps are growths that develop on the lining of the colon and rectum. They are generally benign but can sometimes develop into cancer. There are several types of colorectal polyps, including adenomas and hyperplastic polyps.

The study found that the overall prevalence of colorectal polyps was 20.5%, with adenomas being the most common type of polyp. The study also found that older age and a family history of colorectal cancer were associated with an increased risk of colorectal polyps. Another study by Bressler *et al.* (2018) investigated the risk factors for colorectal adenomas among adults. The study found that older age, male gender, and a family history of colorectal cancer were associated with an increased risk of colorectal adenomas. Additionally, the study found that certain lifestyle factors, such as smoking and physical inactivity, were also associated with an increased risk of colorectal adenomas. Several studies have provided evidence that the prevalence of colorectal polyps among adults is high and that older age, family history, and certain lifestyle factors are associated with an increased risk of developing colorectal polyps. The study found that regular cigarette smoking is an independent risk factor for the presence and development of colorectal polyps. Previous studies have revealed dose-response relations among the daily number of cigarettes smoked, the duration of smoking, the pack-years of smoking, and the risk for colorectal polyps (Jemal *et al.* 2020; Ries *et al.*, 2018; Ferlay *et al.*, 2010; Arndt *et al.*, 2014). The association was robust in all kinds of polyps (sessile serrated polyps, conventional adenomas, and hyperplastic polyps). People who lead a healthy lifestyle, including nonsmokers, have a lower risk of all stages of colorectal carcinogenesis (hyperplastic polyps, non-advanced adenomas, and advanced CRN). Previous studies revealed some potential mechanisms for the association between smoking, colorectal polyps, and CRN, such as the reduced methylation of relevant genes, genetic variants in carcinogen-metabolising enzymes, the polymorphisms in the DNA repair genes EXO1 and ATM, the mutations in mismatch repair enzymes, and XPC polymorphisms, etc (Chao *et al.*, 2005; Arndt *et al.*, 2014). In a word, tobacco contains many carcinogens that are thought to create no less than irreversible genetic damage to the colorectal mucosa, initiating the formation of colorectal polyps (Giovannucci, 2021; Arndt *et al.*, 2014). Lack of exercise and alcohol use has been reported as significant risk factors in a previous study by Ferlay *et al.*, (2010). This highlights the lack of thorough knowledge on the risk factors associated with colorectal polyps among the respondents. 67.3% of the respondents mentioned they did not smoke or reside with a smoker. This could be due to personal choices and may not necessarily have any association with awareness of polyp risk factors. Carcinogens from cigarette smoke are absorbed into the blood stream and are known to cause malignancies in organs not in direct contact with smoke. Epidemiologic studies of tobacco smoking have consistently shown an association with colonic polyps (Jemal *et al.* 2020; Ries *et al.*, 2018; Ferlay *et al.*, 2010). In a recent review, Renehan *et al.* (2018), reported that 21 of 22 studies found that long-term, heavy cigarette smokers have a 2- to 3-fold increased risk of colorectal adenoma. Furthermore, 59.9% of respondents reported occurrences of inflammatory bowel disease such as ulcers among themselves and/or family members; however, more than half denied having suffered from any type of cancer in the past. Ulcers have been reported to be associated with colorectal polyps in the same study (Giovannucci, 2001); however, some other studies have reported findings contrary to this claim (Renehan *et al.*, 2018; Arndt *et al.*, 2014). 53.7% of the adults in this survey also agreed they regularly sat down due to some constraints, and half of them drank 2–5 glasses of water daily (50.1%). Constant hydration and movement have been encouraged in a study by Giovannucci (2021). The researchers reported the influence of activity level on polyp development and consistently showed an inverse relationship with the incidence of colorectal neoplasia. Men in the highest quintile of physical activity had approximately half the incidence of colon cancer seen in men in the lowest quintile. These findings suggest that physical inactivity and obesity influence the promotion or growth of adenomas (Jemal *et al.* 2020). The majority (82.7%) of the respondents did not take junk food, and about half (50.5%) reportedly weighed 40–60 kilograms. With the rising incidence of obesity over the past several decades, there has been increasing evidence that obesity is not only related to cardiovascular and metabolic diseases, but there are also associations with gastrointestinal diseases, including esophageal cancers, pancreatic cancer, and colon polyps and cancer (Renehan *et al.*, 2008). High rates of elevated blood sugar and hypertension were common among the respondents (76.65%). Astin *et al.* (2011) stated that other factors associated with obesity may contribute to increased risk of polyps including diabetes, and lower fibre intake. In general, the activity level of obese patients tends to be lower. Another study asserts that frequent consumption of fruit was inversely related to the risk of being diagnosed with polyps, whereas little association was found for vegetable consumption (Michels *et al.*, 2006). Women who reported consuming five or more servings of fruit a day had an OR of 0.60 (95% CI = 0.44 to 0.81) for developing colorectal adenomas compared with women who consumed only one or fewer servings of fruit per day, after adjustment for relevant covariates (P of trend = 0.001). 48.2% of the respondents in this study consumed fruits "very often." This study's findings revealed a 20% prevalence of virtual colonoscopy as a lower GI endoscopy procedure among participants who were screened for colorectal polyps. 80% did not undergo virtual colonoscopy. This could be due to the unavailability of screening services in the area as well as the inaccessibility of screening centres that conduct this procedure, as similarly mentioned in some studies (Astin *et al.* 2011; Chao *et al.*, 2005).

## V. Conclusion

Evidence from this study establishes that although a number of participants demonstrated several patterns of colorectal polyps Individuals with increased risk may warrant an adjustment of surveillance recommendations to identify lesions early, before malignant transformation occurs. Furthermore, education regarding the importance of surveillance and access to colon cancer screening may vary among both racial groups and genders. There may not be one best screening algorithm, but optimal strategies will need to be defined for different population subgroups. Women and people of older ages should be targeted with interventions that ensure that they are knowledgeable about colorectal polyps. Interventions should reach the household, which will ensure that those with no formal education can have a better knowledge of the disease.

## Limitations of the Study

Some of the limitations faced in this study include the fact that this study combined a survey with evaluations using virtual colonoscopy, another significant limitation. This is because only 20% of adults within the typical "reach" of a virtual colonoscopy had a concomitant polyp close to the splenic flexure. However, it's probable that some of the individuals in our research cohort who had virtual colonoscopy examinations had more proximal polyps. However, it is thought that the data will serve as a benchmark for evaluating Nigerians. Also, the required time constraint and inaccessibility of some rural communities due to bad road networks posed a limitation during the data collection phase of the study.

## Ethics Approval and consent to Participate

Not Applicable

## Consent to Publish

Not applicable

## Availability of Data and Materials

The Data set from the study are available to the corresponding author upon request.

## Competing Interests

Authors have declared that they have no competing interests

## Funding

No funds were received for this study

## Acknowledgements

Not Applicable

## References

1. Abdeljawad, K., Vemulapalli, K. C., Kahi, C. J., Cummings, O. W., Snover, D. C., & Rex, D. K. (2015). Sessile serrated polyp prevalence determined by a colonoscopist with a high lesion detection rate and an experienced pathologist. *Gastrointest Endosc.* 81, 517–524.
2. Abou-Zeid, E., Aptoula, E., Courty, N., & Lefevre, S. (2012). Mitosis Detection in Breast Cancer Histological Images with Mathematical Morphology. 2013, 21st Signal Processing and Communications Applications Conference (SIU), IEEE. 13, 1–4.
3. Adesanya, A., & da Rocha-Afodu, J. (2000). Colorectal cancer in Lagos: a critical review of 100 cases. *The Nigerian postgraduate medical journal* 7(3), 129-136.
4. Anderson J., Hole, D. and McArdle, C. (1992). Elective versus emergency surgery for patients with colorectal cancer. *British journal of surgery* 79(7), 706-709.
5. Angell-Andersen E., Tretli S., Coleman M., Langmark F. and Grotmol T. (2014) Colorectal cancer survival trends in Norway 1958–1997. *European Journal of Cancer* 40(5), 734-742.
6. Anjum, M., J. P. Neale, A. C. Ford, & K. A. Williams. (2016). Prevalence of Colorectal Polyps in Adults Undergoing Colonoscopy: A Systematic Review and Meta-Analysis. *Gut* 65 (7), 1079–1087.
7. Araki, K., Furuya Y., Kobayashi M., Matsuura K., Ogata T. and Isozaki H. (1996) Comparison of mucosal microvasculature between the proximal and distal human colon. *Journal of electron microscopy* 45(3), 202-206.
8. Arber, N. (2000) Do NSAIDs prevent colorectal cancer? *Canadian journal of gastroenterology*. *Journal canadien de gastroenterology*, 14(4), 299-307.



9. Arndt, V., Merx, H., Stegmaier, C., Ziegler, H. and Brenner, H. (2004) Quality of life in patients with colorectal cancer 1 year after diagnosis compared with the general population: a population-based study. *Journal of clinical oncology* 22(23), 4829- 4836.
10. Astin, M., Griffin T., Neal R.D., Rose P. and Hamilton W. (2011) The diagnostic value of symptoms for colorectal cancer in primary care: a systematic review. *Br J Gen Pract* 61(586), e231-e243.
11. Avoranta, T. (2013) The prognostic and predictive value of selected biomarkers in colorectal cancer. *World J Surg Oncol* 11(2).
12. Badoe, E. (1966) Malignant disease of gastrointestinal tract in Korle Bu Hospital, Accra, Ghana, 1956-65. *The West African medical journal* 15(5), 181
13. Baker, S., Presinger, A., Jessup, J. and Parakeva, C. (1990) Markowitz S, Wilson JKV, Hamilton S, Vogelstein B: p53 gene mutations occur in combination with 17p allelic deletion as late events in colorectal tumorigenesis. *Cancer Res* 50:7717- 7722
14. Baron, J.A., Cole, B.F., Sandler, R.S., Haile, R.W., Ahnen, D., Bresalier, R., McKeown-Eyssen G., Summers R.W., Rothstein R. and Burke C.A. (2003) A randomized trial of aspirin to prevent colorectal adenomas. *New England Journal of Medicine* 348(10), 891-899.
15. Bass, G., Fleming, C., Conneely, J., Martin, Z. and Mealy, K. (2009) Emergency first presentation of colorectal cancer predicts significantly poorer outcomes: a review of 356 consecutive Irish patients. *Diseases of the colon & rectum* 52(4), 678-684.
16. Biritwum, R., Gulaid, J. and Amaning, A. (2000) Pattern of diseases or conditions leading to hospitalization at Korle Bu Teaching Hospital, Ghana in 1996. *Ghana Med J* 34(4), 197-205.
17. Biscotti, C.V., Dawson, A.E., Dziura, B., Galup, L., Darragh, T., Rahemtulla, A. (2005). Assisted primary screening using the automated ThinPrep Imaging System. *Am J Clin Pathol.* ;123:281-7.
18. Botteri, E., Iodice, S., Raimondi, S., Maisonneuve, P. and Lowenfels, A.B. (2008) Cigarette smoking and adenomatous polyps: a meta-analysis. *Gastroenterology* 134(2), 388-395. e383
19. Boyle, P. and Langman, J. (2000) ABC of colorectal cancer: Epidemiology. *BMJ: British Medical Journal* 321(7264), 805
20. Bressler, B., J. B. Wong, A. L. Roth, M. J. Halabi, & M. P. Neugut. (2018). Risk Factors for Colorectal Adenomas: A Systematic Review. *American Journal of Gastroenterology* 113 (7), 938-948.
21. Brkić T. and Grgić M. (2006) Kolorektalni karcinom. *Medicus* 15(1\_Gastroenterologija), 89-97.
22. Brown LE. Object-and spatial-level quantitative analysis of multispectral histopathology images for detection and characterization of cancer. Ph.D. Thesis, University of California, Santa Barbara. 2008
23. Campagnoli, C., Biglia, N., Altare, F., Lanza, M., Lesca, L., Cantamessa, C., Peris, C., Fiorucci, G., and Sismondi, P. (2009) Differential effects of oral conjugated estrogens and transdermal estradiol on insulin-like growth factor 1, growth hormone and sex hormone binding globulin serum levels. *Gynecological Endocrinology*.
24. Campbell, T. (1999) Colorectal cancer. Part 1: Epidemiology, aetiology, screening and diagnosis. *Professional nurse (London, England)* 14(12), 869-874.
25. Cancer I.A.f.R.o. (2003) Cancer in Africa: epidemiology and prevention. IARC scientific Publications(153), 1.
26. Cancer I.A.f.R.o. (2014) The GLOBOCAN project: cancer incidence and mortality worldwide in 2012. URL: <http://globocan.iarc.fr/>(дата обращения: 13.01. 2010).
27. Cappell, M.S. (2005) The pathophysiology, clinical presentation, and diagnosis of colon cancer and adenomatous polyps. *Medical Clinics of North America* 89(1), 1-42
28. Cappell, M.S. and Goldberg, E.S. (1992) The Relationship Between the Clinical Presentation and Spread of Colon Cancer in 315 Consecutive Patients: A Significant Trend of Earlier Cancer Detection From 1982 Through 1988 at a University Hospital. *Journal of clinical gastroenterology* 14(3), 227-235.
29. Center M.M. and ME J.F. (2011) Global cancer statistics. *CA: a cancer journal for clinicians* 61(2), 69.
30. Center, M.M. and ME, J.F. (2011) Global cancer statistics. *CA: a cancer journal for clinicians* 61(2), 69
31. Center M.M., Jemal A. and Ward E. (2009b) International trends in colorectal cancer incidence rates. *Cancer Epidemiology Biomarkers & Prevention* 18(6), 1688- 1694.
32. Center, M.M., Jemal, A., Smith, R.A., and Ward, E. (2009a) Worldwide variations in colorectal cancer. *CA: a cancer journal for clinicians* 59(6), 366-378.
33. Cervera, P. and Fléjou, J.-F. (2011) Changing pathology with changing drugs: tumors of the gastrointestinal tract. *Pathobiology* 78(2), 76-89.
34. Chalya, P.L., Mchembe, M.D., Mabula, J.B., Rambau, P.F., Jaka, H., Koy, M., Mkongo, E. and Masalu, N. (2013a) Clinicopathological patterns and challenges of management of colorectal cancer in a resource-limited setting: a Tanzanian experience. *World J Surg Oncol* 11(2).
35. Chao, A., Thun, M.J., Connell, C.J., McCullough, M.L., Jacobs, E.J., Flanders, W.D., Rodriguez, C., Sinha, R. and Calle, E.E. (2005) Meat consumption and risk of colorectal cancer. *Jama* 293(2), 172-182.

36. Chapuis, P., Dent, O., Fisher, R., Newland, R., Pheils, M., Smyth, E. and Colquhoun, K. (1985) A multivariate analysis of clinical and pathological variables in prognosis after resection of large bowel cancer. *British journal of surgery* 72(9), 698-702.
37. Chen, S.L. and Bilchik, A.J. (2006) More extensive nodal dissection improves survival for stages I to III of colon cancer: a population-based study. *Annals of surgery* 244(4), 602-610.
38. Cherry, L.M. (2011) The genetic etiology of familial and nonfamilial colorectal cancer. *Proceedings (Baylor University Medical Center)* 24(2), 139.
39. Compton, C., Fenoglio-Preiser, C.M., Pettigrew, N. and Fielding, L.P. (2000a) American Joint Committee on Cancer prognostic factors consensus conference. *Cancer* 88(7), 1739-1757.
40. Dakubo, J., Naaeder, S., Tettey, Y. and Gyasi, R. (2010a) Colorectal carcinoma: an update of current trends in Accra. *West African journal of medicine* 29(3).
41. de Heer, P. (2007) Molecular and biological interactions in colorectal cancer: Department of Surgery, Faculty of Medicine, Leiden University Medical Center (LUMC), Leiden University.
42. de Kok, I.M., Wong, C.S., Chia, K.S., Sim, X., Tan, C.S., Kiemeneij, L.A. and Verkooijen, H.M. (2008) Gender differences in the trend of colorectal cancer incidence in Singapore, 1968–2002. *International journal of colorectal disease* 23(5), 461-467.
43. DeCosse, J.J. and Cennerazzo, W.J. (1997) Quality-of-life management of patients with colorectal cancer. *CA: a cancer journal for clinicians* 47(4), 198-206.
44. DePinho, R.A. (2000) The age of cancer. *Nature* 408(6809), 248-254.
45. Dickinson, B.T., Kisiel, J., Ahlquist, D.A. and Grady, W.M. (2015) Molecular markers for colorectal cancer screening. *Gutgutjnl-2014-308075*.
46. Dobrila, Dintinjana, R., Guina, T., Krznarić, Ž., Radić, M. and Dintinjana, M. (2008) Effects of nutritional support in patients with colorectal cancer during chemotherapy. *Collegium antropologicum* 32(3), 737-740.
47. Dobrila-Dintinjana, R., Trivanović, D., Dintinjana, M., Vukelić, J. and Vanis, N. (2015). Effects of Dietary Counseling on Patients with Colorectal Cancer. *Colorectal Cancer— From Prevention to Patient Care*, InTech, Rijeka211-226
48. Eaden, J., Abrams, K. and Mayberry, J. (2001). The risk of colorectal cancer in ulcerative colitis: a meta-analysis. *Gut* 48(4), 526-535.
49. Elesha, S. and Owonikoko, T. (1998) Colorectal neoplasms: a retrospective study. *East African medical journal* 75(12), 718-723
50. Fairley, T.L., Cardinez, C.J., Martin, J., Alley, L., Friedman, C., Edwards, B. and Jamison, P. (2006) Colorectal cancer in US adults younger than 50 years of age, 1998–2001. *Cancer* 107(S5), 1153-1161.
51. Fang, Y.-J., Wu X.-J., Zhao Q., Li L.-R., Lu Z.-H., Ding P.-R., Zhang R.-X., Kong, L.-H., Wang, F.-L. and Lin, J.-Z. (2013) Hospital-based colorectal cancer survival trend of different tumor locations from 1960s to 2000s.
52. Fazeli, M.S., and Keramati, M.R. (2015) Rectal cancer: a review. *Medical Journal of The Islamic Republic of Iran (MJIRI)* 29171-170.
53. Fearon, E.R. and Vogelstein, B. (1990) A genetic model for colorectal tumorigenesis. *Cell*, 61(5), 759-767.
54. Ferlay, J., Shin, H.R., Bray, F., Forman, D., Mathers, C. and Parkin, D.M. (2010) Estimates of worldwide burden of cancer in 2008: GLOBOCAN 2008. *International Journal of Cancer*, 127(12), 2893-2917.
55. Ferrari, P., Jenab, M., Norat, T., Moskal, A., Slimani, N., Olsen, A., Tjønneland, A., Overvad, K., Jensen, M.K. and Boutron-Ruault, M.C. (2007) Lifetime and baseline alcohol intake and risk of colon and rectal cancers in the European prospective investigation into cancer and nutrition (EPIC). *International Journal of Cancer*, 121(9), 2065-2072.
56. Fleming, I. (1997) *Kidney Fleming ID Cooper JS Henson DE Hutter RVP Kennedy BJ Murphy GP O'Sullivan B. Sobin LH Yarbro JW eds.. Kidney. AJCC Cancer Staging Manual. American Joint Committee on Cancer. Manual for Staging of Cancer*, 231-239: 451-456.
57. Food, N. (2007) *Physical Activity, and the Prevention of Cancer: A Global Perspective World Cancer Research Fund and American Institute for Cancer Research Washington DC. WA, USA*.
58. Foubert, F., Matysiak-Budnik, T. and Toucheffeu, Y. (2014) Options for metastatic colorectal cancer beyond the second line of treatment. *Digestive and Liver Disease* 46(2), 105-112.
59. Fung, T.T. and Brown, L.S. (2013) Dietary patterns and the risk of colorectal cancer. *Current nutrition reports* 2(1), 48-55.
60. Gainant, A. (2012) Emergency management of acute colonic cancer obstruction. *Journal of visceral surgery*, 149(1), e3-e10.
61. Garcia-Valdecasas, J., Llovera, J., Reverter, J., Grande, L., Fuster, J., Cugat, E., Visa, J. and Pera, C. (1991) Obstructing colorectal carcinomas. *Diseases of the colon & rectum*, 34(9), 759-762.
62. Gatta, G., Faivre, J., Capocaccia, R., de Leon, M.P. and Group, E.W. (1998) Survival of colorectal cancer patients in Europe during the period 1978–1989. *European Journal of Cancer*, 34(14), 2176-2183.

63. Gill, S., Loprinzi, C.L., Sargent, D.J., Thomé, S.D., Alberts, S.R., Haller, D.G., Benedetti, J., Francini, G., Shepherd, L.E. and Seitz, J.F. (2014) Pooled analysis of fluorouracil-based adjuvant therapy for stage II and III colon cancer: who benefits and by how much? *Journal of clinical oncology* 22(10), 1797-1806
64. Giovannucci, E. (2017) Metabolic syndrome, hyperinsulinemia, and colon cancer: a review. *The American journal of clinical nutrition* 86(3), 836S-842S.
65. Giovannucci, E. (2021). An updated review of the epidemiological evidence that cigarette smoking increases risk of colorectal cancer. *Cancer Epidemiol Biomarkers Prev.* 10(7), 725–731.
66. GLOBOCAN (2008) Cancer Fact Sheet. Colorectal cancer incidence and mortality worldwide in 2008. Summary IARC.
67. Graham, A., Davies, Adeloje, L.G., Theodoratou, E., and Campbell, H. (2012) Estimating the incidence of colorectal cancer in Sub-Saharan Africa: A systematic analysis. *Journal of global health* 2(2), 341-433.
68. Grande, M., Milito, G., Attinà, G.M., Cadeddu, F., Muzi, M.G., Nigro, C., Rulli, F., and Farinon, A.M. (2008) Evaluation of clinical, laboratory and morphologic prognostic factors in colon cancer. *World journal of surgical oncology* 6(1), 1.
69. Groden, J., Thliveris, A., Samowitz, W., Carlson, M., Gelbert, L., Albertsen, H., Joslyn, G., Stevens, J., Spirio, L. and Robertson, M. (1991) Identification and characterization of the familial adenomatous polyposis coli gene. *Cell* 66(3), 589-600.
70. Grodstein, F., Newcomb, P.A. and Stampfer, M.J. (1999) Postmenopausal hormone therapy and the risk of colorectal cancer: a review and meta-analysis. *The American journal of medicine*, 106(5), 574-582.
71. Grossmann, I., De Bock, G., Kranenbarg, W.M.-K., van de Velde, C., and Wiggers, T. (2007) Carcinoembryonic antigen (CEA) measurement during follow-up for rectal carcinoma is useful even if normal levels exist before surgery. A retrospective study of CEA values in the TME trial. *European Journal of Surgical Oncology (EJSO)*, 33(2), 183-187.
72. Grosso, G., Biondi, A., Marventano, S., Mistretta, A., Calabrese, G. and Basile, F. (2012) Major postoperative complications and survival for colon cancer elderly patients. *BMC surgery* 12(1), S20.
73. Haggard, F.A. and Boushey, R.P. (2009) Colorectal cancer epidemiology: incidence, mortality, survival, and risk factors. *Clinics in colon and rectal surgery*, 22(4), 191.
74. Harrison, L.E., Guillem, J.G., Paty, P. and Cohen, A.M. (2017) Preoperative carcinoembryonic antigen predicts outcomes in node-negative colon cancer patients: a multivariate analysis of 572 patients. *Journal of the American College of Surgeons* 185(1), 55-59.
75. Hermanek, P., Wiebelt, H., Riedl, S.U. and Staimmer, D. (2014) Studiengruppe Kolorektales Karzinom Langzeilergebnisse der chirurgischen Therapie des Colonicarcinoms. *Chirurg* 65(4), 287-287.
76. Holcombe, C. and Babayo, U. (1990) The pattern of malignant disease in north east Nigeria. *Tropical and geographical medicine* 43(1-2), 189-192.
77. Hurwitz, H., Fehrenbacher, L., Novotny, W., Cartwright, T., Hainsworth, J., Heim, W., Berlin, J., Baron, A., Griffing, S. and Holmgren, E. (2004) Bevacizumab plus irinotecan, fluorouracil, and leucovorin for metastatic colorectal cancer. *New England Journal of Medicine* 350(23), 2335-2342.
78. Hurwitz, H., Fehrenbacher, L., Novotny, W., Cartwright, T., Hainsworth, J., Heim, W., Berlin, J., Baron, A., Griffing, S. and Holmgren, E. (2004) Bevacizumab plus irinotecan, fluorouracil, and leucovorin for metastatic colorectal cancer. *New England Journal of Medicine* 350(23), 2335-2342.
79. IARC, (2011) How does the serrated polyp pathway alter CRC screening and surveillance? *Dig Dis Sci.*;60:773–80.
80. Ibrahim, O., Afolayan, A., Adeniji, K., Buhari, O., & Badmos, K. (2011). Colorectal carcinoma in children and young adults in Ilorin, Nigeria. *West African Journal of Medicine.* 30(3), 202-205.
81. Iliyasu, Y., Ladipo J., Akang E., Adebamowo C., Ajao O. and Aghadiuno P. (1996) A twenty-year review of malignant colorectal neoplasms at University College Hospital, Ibadan, Nigeria. *Diseases of the colon & rectum* 39(5), 536-540.
82. Ioannou, G.N., Rockey, D.C., Bryson, C.L. and Weiss, N.S. (2002) Iron deficiency and gastrointestinal malignancy: a population-based cohort study. *The American journal of medicine* 113(4), 276-280.
83. Irabor, D. and Adedeji, O. (2009) Colorectal cancer in Nigeria: 40 years on. A review. *European journal of cancer care*, 18(2), 110-115.
84. Irabor, D., Arowolo, A. and Afolabi A. (2010) Colon and rectal cancer in Ibadan, Nigeria: an update. *Colorectal Disease* 12(7), e43-e49.
85. Irabor, D., Arowolo, A., & Afolabi, A. (2010) Colon and rectal cancer in Ibadan, Nigeria: an update. *Colorectal Disease* 12(7), e43-e49.
86. Iversen, H., Veillard, A., Roux, L., Racoceanu, D. (2012) Methods for nuclei detection, segmentation, and classification in digital histopathology: A review-current status and future potential. *IEEE Rev Biomed Eng.*;7:97–114.
87. Jagoditsch, M., Lisborg, P.H., Jatzko, G.R., Wette, V., Kropfisch, G., Denk, H., Klimpfinger, M. and Stettner, H.M. (2000) Long-term prognosis for colon cancer related to consistent radical surgery: multivariate analysis of clinical, surgical, and pathologic variables. *World journal of surgery* 24(10), 1264-1270.

88. Janout, V. and Kollárová, H. (2001) Epidemiology of colorectal cancer. *actauniversitatis palackianae olomucensis facultatis medicae* 5- 10.
89. Jemal, A., Bray, F., Center, M.M., Ferlay, J., Ward, E. and Forman, D. (2011) Global cancer statistics. *CA: a cancer journal for clinicians* 61(2), 69-90.
90. Jemal, A., Bray, F., Forman, D., O'Brien, M., Ferlay, J., Center, M. and Parkin, D.M. (2012) Cancer burden in Africa and opportunities for prevention. *Cancer*, 118(18), 4372- 4384
91. Jönsson, P., Bengtsson, G., Carlsson, G., Jonson, G. and Trydingm N. (1983) Value of serum5-nucleotidase, alkaline phosphatase and gamma-glutamyl transferase for prediction of liver metastases preoperatively in colorectal cancer. *Acta chirurgica scandinavica* 150(5), 419-423.
92. Kabat, G., Miller, A., Jain, M. and Rohan, T. (2007) A cohort study of dietary iron and heme iron intake and risk of colorectal cancer in women. *British journal of cancer*, 97(1), 118-122.
93. Kamangar, F., Dores, G.M. and Anderson, W.F. (2006) Patterns of cancer incidence, mortality, and prevalence across five continents: defining priorities to reduce cancer disparities in different geographic regions of the world. *Journal of clinical oncology* 24(14), 2137-2150.
94. Kang, W., Lee, S., Jeon, E., Yun Y.-R., Kim K.-H. and Jang J.-H. (2011) Emerging role of vitamin D in colorectal cancer. *World journal of gastrointestinal oncology*, 3(8), 123.
95. Katsidzira L., Gangaidzo I.T., Mappingure M.P. and Matenga J.A. (2015) Retrospective study of colorectal cancer in Zimbabwe: Colonoscopic and clinical correlates. *World journal of gastroenterology: WJG*, 21(8), 2374.
96. Kinzler, K.W. and Vogelstein B. (1996) Lessons from hereditary colorectal cancer. *Cell* 87(2), 159-170.
97. Kyriakos, M. (1985) The President's cancer, the Dukes classification, and confusion. *Archives of pathology & laboratory medicine*, 109(12), 1063-1066.
98. Larsson, S.C., Orsini, N. and Wolk, A. (2005) Diabetes mellitus and risk of colorectal cancer: a meta-analysis. *Journal of the National Cancer Institute* 97(22), 1679- 1687.
99. Leggett, B. and Whitehall, V. (2012). Role of the serrated pathway in colorectal cancer pathogenesis. *Gastroenterology*.;138:2088–100.
100. Lieberman, D.A., Rex, D.K., Winawer, S.J., Giardiello, F.M., Johnson, D.A., Levin, T.R. (2012) United States Multi-Society Task Force on Colorectal Cancer. Guidelines for colonoscopy surveillance after screening and polypectomy: A consensus update by the US Multi. Society Task Force on Colorectal Cancer. *Gastroenterology*.143:844–57.
101. Lin, O.S. (2009) Acquired risk factors for colorectal cancer. *Cancer Epidemiology: Modifiable Factors*, 361-372.
102. Macfarlane S. and Macfarlane G. (2003) Food and the large intestine. In *Gut flora, nutrition, immunity and health*, pp. 24-51:
103. Mahmoud, N., Rombeau, J., Ross, H.M. and Fry, R.D. (2004) Colon and rectum. *Sabiston textbook of surgery*. 9,45-61.
104. Maisey, N., Norman, A., Watson, M., Allen, M., Hill, M., and Cunningham, D. (2002) Baseline quality of life predicts survival in patients with advanced colorectal cancer. *European Journal of Cancer*, 38(10), 1351-1357.
105. Marventano, S., Forjaz, M.J., Grosso, G., Mistretta, A., Giorgianni, G., Platania, A., Gangi, S., Basile, F., and Biondi, A. (2013) Health related quality of life in colorectal cancer patients: state of the art. *BMC surgery*, 13(2), S15.
106. McArdle, C. (2000) ABC of colorectal cancer: effectiveness of follow up. *British Medical Journal*, 321(7272), 1332.
107. McArdle, C., McMillan, D. and Hole, D. (2006) The impact of blood loss, obstruction and perforation on survival in patients undergoing curative resection for colon cancer. *British journal of surgery*, 93(4), 483-488.
108. McDermott, F., Hughes, E., Pihl, E., Milne, B. and Price, A. (1981) Prognosis in relation to symptom duration in colon cancer. *British journal of surgery* 68(12), 846-849.
109. McDermott, F., Hughes, E., Pihl, E., Milne, B. and Price, A. (1984) Influence of tumour differentiation on survival after resection for rectal cancer in a series of 1296 patients. *Australian and New Zealand Journal of Surgery* 54(1), 53-58.
110. McMichael, A.J., and Potter, J.D. (1980) Reproduction, endogenous and exogenous sex hormones, and colon cancer: a review and hypothesis.
111. Mella, J., Biffin, A., Radcliffe, A., Stamatakis, J. and Steele, R. (1997) Population-based audit of colorectal cancer management in two UK health regions. *British journal of surgery* 84(12), 1731-1736.
112. Michels, K. B., Giovannucci, E., & Chan, A. T. (2006). Fruit and vegetable consumption and colorectal adenomas in the Nurses' Health Study. *Cancer Res.* 66(7), 3942–3953.
113. Missaoui, N., Jaidaine, L., Abdelkader, A.B., Trabelsi, A., Mokni, M. and Hmissa, S. (2011) Colorectal cancer in central Tunisia: increasing incidence trends over a 15-year period. *Asian Pac j cancer prev*, 121073-1076.
114. Moghaddam, A.A., Woodward, M. and Huxley, R. (2007) Obesity and risk of colorectal cancer: a meta-analysis of 31 studies with 70,000 events. *Cancer Epidemiology Biomarkers & Prevention* 16(12), 2533-2547.
115. Moskal, A., Norat, T., Ferrari, P. and Riboli, E. (2007) Alcohol intake and colorectal cancer risk: A dose–response meta-analysis of published cohort studies. *International Journal of Cancer* 120(3), 664-671.



116. Muir, C. and Parkin, D. (1985) The world cancer burden: prevent or perish. *British medical journal (Clinical research ed.)*, 290(6461), 5.
117. Naaeder, S. and Archampong, E. (1994) Cancer of the colon and rectum in Ghana: A 5- year prospective study. *British journal of surgery* 81(3), 456-459.
118. Nedrebø, B.S.O. (2013) Colorectal Cancer in Norway. *National Treatment Guidelines and Outcomes*.
119. Nedrebø, R.E. (2013) Error reduction in surgical pathology. *Arch Pathol Lab Med.*;130:630–2.
120. Obafunwa, J. (1990) Pattern of alimentary tract tumours in Plateau State: a middle belt area of Nigeria. *The Journal of tropical medicine and hygiene* 93(5), 351-354.
121. O'Connell, J.B., Maggard, M.A., Liu, J.H. and Etzioni, D.A. (2003) Rates of colon and rectal cancers are increasing in young adults. *The American surgeon*, 69(10), 866.
122. O'Connell, J.B., Maggard, M.A., Livingston, E.H., and Cifford, K.Y. (2004) Colorectal cancer in the young. *The American journal of surgery*, 187(3), 343-348.
123. Odukoya, O., & Fayemi, M. (2019). A rural-urban comparison of knowledge, risk- factors and preventive practices for colorectal cancer among adults in Lagos State. *Asian Pacific Journal of Cancer Prevention: APJCP*. 20(4), 1063-1071.
124. Öhman, U. (1982) Prognosis in patients with obstructing colorectal carcinoma. *The American journal of surgery* 143(6), 742-747.
125. Okobia, M. and Aligbe, J. (2005) Pattern of malignant diseases at the University of Benin Teaching Hospital. *Tropical doctor*, 35(2), 91-91.
126. Orbell, J. and West, N.J. (2010) Improving detection of colorectal cancer. *The Practitioner*, 254(1733), 17-22.
127. Papadopoulos, V., Michalopoulos, A., Netta, S., Basdanis, G., Paramythiotis, D., Zatagias, A., Berovalis, P. and Harlaftis, N. (2004) Prognostic significance of mucinous component in colorectal carcinoma. *Techniques in coloproctology* 8(1), s123- s125.
128. Park, S.J., Lee, K.Y. and Kim, S.Y. (2008) Clinical significance of lymph node micrometastasis in stage I and II colon cancer. *Cancer Research and Treatment*, 40(2), 75-80.
129. Parramore, J.B., Wei, J.P., Yeh, K.A. and Fink, A.S. (1998) Colorectal cancer in patients under forty: Presentation and outcome/Discussion. *The American surgeon* 64(6), 563.
130. Peleg, I.I., Maibach, H.T., Brown, S.H. and Wilcox, C.M. (1994) Aspirin and nonsteroidal anti-inflammatory drug use and the risk of subsequent colorectal cancer. *Archives of internal medicine* 154(4), 394-400.
131. Popoola, O.F., Oludara, M., NA, I., AI, I. and SBL, M. (2013) Prevalence and Pattern of Cancers among Adults Attending a Tertiary Health Institution in Lagos, Nigeria. *Journal of Dental and Medical Sciences* 6(3), 68-73.
132. Potter, J. (1995) Risk factors for colon neoplasia—epidemiology and biology. *European Journal of Cancer* 31(7), 1033-1038.
133. Raskin, L., Dakubo, J.C., Palaski, N., Greenson, J. and Gruber, S. (2012) Abstract B92: Molecular characterization of colorectal cancer in Ghana. *Cancer Prevention Research* 5(11), B92-B92.
134. Renehan, A. G., Tyson, M., Egger, M., Heller, R. F., & Zwahlen, M. (2015) Body- mass index and incidence of cancer: a systematic review and meta-analysis of prospective observational studies. *Lancet*. 371(9612), 569–578.
135. Richards, C.H. (2014) An investigation of the determinants of the local and systemic inflammatory responses in patients with colorectal cancer, University of Glasgow.
136. Ries, L., Melbert, D. and Krapcho, M. (2008) et al. SEER Cancer Statistics Review, 1975- 2005 [based on November 2007 SEER data submission]. Bethesda, MD: National Cancer Institute; 2008.
137. Roberts, A. (2008) Validator: Professor Robin CN Williamson, The Royal Society of Medicine, London.
138. Rosman, A.S. and Korsten, M.A. (2007) Meta-analysis comparing CT colonography, air contrast barium enema, and colonoscopy. *The American journal of medicine* 120(3), 203-210. e204.
139. Roychowdhury, D., Hayden, A. and Liepa, A. (2003) Health-related quality-of-life parameters as independent prognostic factors in advanced or metastatic bladder cancer. *Journal of clinical oncology* 21(4), 673-678.
140. Sack, J. and Rothman, J.M. (2000) Colorectal cancer: natural history and management. *Hospital Physician* 3664-73.
141. Samad, A., Taylor, R., Marshall, T. and Chapman, M.A. (2005) A meta-analysis of the association of physical activity with reduced risk of colorectal cancer. *Colorectal Disease* 7(3), 204-213.
142. Santarelli, R.L., Pierre, F. and Corpet, D.E. (2008) Processed meat and colorectal cancer: a review of epidemiologic and experimental evidence. *Nutrition and cancer* 60(2), 131-144.
143. Scott, R.J. (2003) Familial adenomatous polyposis (FAP) and other polyposis syndromes. *Hereditary Cancer in Clinical Practice* 1(1), 19-30.
144. Segelman, J. (2012) Colorectal cancer: aspects of multidisciplinary treatment, metastatic disease and sexual function. Blackwell Publishing Oxford. 2,37-41.
145. Seymour, M., Stenning, S. and Cassidy, J. (1997) Attitudes and practice in the management of metastatic colorectal cancer in Britain. *Clinical Oncology* 9(4), 248-251.

146. Siegel, R., Ward, E., Brawley, O. and Jemal, A. (2010) Cancer statistics, 2011: the impact of eliminating socioeconomic and racial disparities on premature cancer deaths. *CA: a cancer journal for clinicians* 61(4), 212-236.
147. Sighoko, D., Curado, M.P., Bourgeois, D., Mendy, M., Hainaut, P. and Bah, E. (2011) Increase in female liver cancer in the Gambia, West Africa: evidence from 19 years of population-based cancer registration (1988–2006). *PloS one*, 6(4), e18415
148. Singh, H., Nugent, Z., Mahmud S.M., Demers A.A. and Bernstein C.N. (2010) Predictors of colorectal cancer after negative colonoscopy: a population-based study. *The American journal of gastroenterology*, 105(3), 663-673.
149. Singh, S., Marquet, R., de Bruin, R., Westbroek, D. and Jeekel, J. (1987) Promotion of tumor growth by blood transfusions. *Transplantation proceedings* 19, 1473-1474.
150. Sirinukunwattana, K., Ahmed, Raza, S.E., Yee-Wah, T., Snead, D.R., Cree, I.A., Rajpoot, N.M. (2016). Locality sensitive deep learning for detection and classification of nuclei in routine colon cancer histology images. *IEEE Trans Med Imaging*;35:1196–206.
151. Sjo, O., Larsen, S., Lunde, O. and Nesbakken, A. (2009) Short term outcome after emergency and elective surgery for colon cancer. *Colorectal Disease* 11(7), 733- 739.
152. Soliman, A., Bondy, M., El-Badawy, S., Mokhtar, N., Eissa, S., Bayoumy, S., Seifeldin, I., Houlihan, P., Lukish, J. and Watanabe, T. (2001) Contrasting molecular pathology of colorectal carcinoma in Egyptian and Western patients. *British journal of cancer* 85(7), 1037.
153. Soliman, A.S., Bondy, M.L., Levin, B., Hamza, M.R., Ismail, K., Ismail, S., Hammam, H.M., El-Hattab, O.H., Kamal, S.M. and Soliman, A.-G.A. (1997) Colorectal cancer in Egyptian patients under 40 years of age. *International Journal of Cancer* 71(1), 26-30.
154. Spratt, J.S. and Spjut, H.J. (1967) Prevalence and prognosis of individual clinical and pathologic variables associated with colorectal carcinoma. *Cancer* 20(11), 1976- 1985.
155. Stubbs, R. and Long, M. (1986) Symptom duration and pathologic staging of colorectal cancer. *European journal of surgical oncology: the journal of the European Society of Surgical Oncology and the British Association of Surgical Oncology* 12(2), 127-130.
156. Tan, E., Gouvas, N., Nicholls, R.J., Ziprin, P., Xynos, E. and Tekkis, P.P. (2009) Diagnostic precision of carcinoembryonic antigen in the detection of recurrence of colorectal cancer. *Surgical oncology* 18(1), 15-24.
157. Terry, P., Giovannucci, E., Michels, K.B., Bergkvist, L., Hansen, H., Holmberg, L. and Wolk, A. (2001) Fruit, vegetables, dietary fiber, and risk of colorectal cancer. *Journal of the National Cancer Institute* 93(7), 525-533.
158. Thomas, G., Dixon, M., Smeeton, N. and Williams, N. (1983) Observer variation in the histological grading of rectal carcinoma. *Journal of clinical pathology*, 36(4), 385- 391.
159. Thompson, M., Flashman, K., Wooldrage, K., Rogers, P., Senapati, A., O'Leary, D. and Atkin, W. (2008) Flexible sigmoidoscopy and whole colonic imaging in the diagnosis of cancer in patients with colorectal symptoms. *British journal of surgery*, 95(9), 1140-1146.
160. Thompson, M., Perera, R., Senapati, A. and Dodds, S. (2007) Predictive value of common symptom combinations in diagnosing colorectal cancer. *British journal of surgery* 94(10), 1260-1265.
161. Toriola, A.T., Kurl, S., Laukanen, J.A., Mazengo, C. and Kauhanen, J. (2008) Alcohol consumption and risk of colorectal cancer: the Findrink study. *European journal of epidemiology* 23(6), 395-401.
162. Tsong, W., Koh, W., Yuan, J., Wang, R., Sun, C. and Yu, M. (2007) Cigarettes and alcohol in relation to colorectal cancer: the Singapore Chinese Health Study. *British journal of cancer* 96(5), 821-827.
163. Turkiewicz, D., Miller, B., Schache, D., Cohen, J. and Theile, D. (2001) Young patients with colorectal cancer: how do they fare? *ANZ journal of surgery* 71(12), 707- 710.
164. Umpleby, H., Williamson, R. and Chir, M. (1984) Survival in acute obstructing colorectal carcinoma. *Diseases of the colon & rectum*, 27(5), 299-304.
165. Vogelstein, B., Fearon, E.R., Hamilton, S.R., Kern, S.E., Preisinger, A.C., Leppert, M., Smits, A.M. and Bos, J.L. (1988) Genetic alterations during colorectal-tumor development. *New England Journal of Medicine*, 319(9), 525-532.
166. Vu, H.T., Lopez, R., Bennett, A., Burke, CA. (2011). Individuals with sessile serrated polyps express an aggressive colorectal phenotype. *Dis Colon Rectum*;54:1216–23.
167. Wactawski-Wende, J., Kotchen, J.M., Anderson, G.L., Assaf, A.R., Brunner, R.L., O'Sullivan, M.J., Margolis, K.L., Ockene, J.K., Phillips, L. and Pottern, L. (2006) Calcium plus vitamin D supplementation and the risk of colorectal cancer. *New England Journal of Medicine*, 354(7), 684-696.
168. Wallin U. (2011) *Cancer of the Colon and Rectum: Prognostic Factors and Early Detection*. Blackwell Publishing Oxford. 6,71-84.
169. Ward, W.L., Hahn, E.A., Mo, F., Hernandez, L., Tulskey, D.S. and Cella, D. (1999) Reliability and validity of the Functional Assessment of Cancer Therapy-Colorectal (FACT-C) quality of life instrument. *Quality of Life Research*, 8(3), 181-195.



170. Wiggers, T., Arends, J.W. and Volovics, A. (1988b) Regression analysis of prognostic factors in colorectal cancer after curative resections. *Diseases of the colon & rectum* 31(1), 33-41.
171. Wiggers, T., Arends, J.W., Schutte, B., Volovics, L. and Bosman, F. (1988a) A multivariate analysis of pathologic prognostic indicators in large bowel cancer. *Cancer* 61(2), 386-395.
172. Willett, W.C., Stampfer, M.J., Colditz, G.A., Rosner, B.A. and Speizer, F.E. (1990) Relation of meat, fat, and fiber intake to the risk of colon cancer in a prospective study among women. *New England Journal of Medicine* 323(24), 1664-1672.
173. Wiredu, E.K. and Armah, H.B. (2006) Cancer mortality patterns in Ghana: a 10-year review of autopsies and hospital mortality. *BMC public health* 6(1), 1.
174. Wolin, K.Y., Lee, I.M., Colditz, G.A., Glynn, R.J., Fuchs, C. and Giovannucci, E. (2007) Leisure-time physical activity patterns and risk of colon cancer in women. *International Journal of Cancer*, 121(12), 2776-2781.
175. Wong, N.A., Hunt, L.P., Novelli, M.R., Shepherd, N.A., Warren, B.F. (1999). Observer agreement in the diagnosis of serrated polyps of the large bowel. *Histopathology*; 55:63-6.
176. Xie, Y., Kong, X., Xing, F., Liu, F., Su, H., Yang, L. (2009) Learning long-range vision for autonomous off-road driving. *J. Field Robot.* 26:120-44.
177. Zisman, A.L., Nickolovm A., Brand, R.E., Gorchow, A. and Roy, H.K. (2006) Associations between the age at diagnosis and location of colorectal cancer and the use of alcohol and tobacco: implications for screening. *Archives of internal medicine*, 166(6), 629-634.