



### Colorectal Carcinoma: An Update of Current Trends in Accra

*Carcinome colorectal: une mise à jour des tendances actuelles de Accra*

J. C. B. Dakubo\*, S. B. Naaeder\*, Y. Tettey†, R. K. Gyasi\*

#### ABSTRACT

**BACKGROUND:** Clinical experience and earlier studies indicate that the number of colorectal cancer cases seen annually in the Accra metropolis is increasing.

**OBJECTIVE:** This study was aimed at providing a current update on colorectal cancer in Accra, Ghana.

**METHODS:** A prospective study of confirmed cases of colorectal cancer diagnosed from January 1997 – December 2007.

**RESULTS:** Three hundred and fifty-nine colorectal cancer cases were studied. Males were 192(53.5%) and females 167(46.5%) with an annual incidence of 32.6 new cases. The crude incidence rates were 12.53, 9.87 and 11.18 per 100,000 population for males, females and overall respectively. Rectal bleeding 185(51.1%), abdominal mass 76(21.1%), intestinal obstruction 62(17.3%), intestinal perforation nine (2.5%) and iron deficiency anaemia nine (2.5%) cases were the main presentations. There were 168 (46.8%) rectal and 191(53.2%) colon tumours. Two hundred and thirty-one patients had laparotomy with 225 resections, and 128 patients for various reasons did not undergo surgery. The Astler Collier stages of the tumours at diagnosis were C<sub>2</sub> 84(36.7%), C<sub>1</sub> 53(22.1%), B<sub>2</sub> 49(21.4%), D 17(7.4%), B<sub>1</sub> 14(6.1%) and A 12(5.1%) cases. Adenocarcinoma was the commonest histological type 321(89.4%), with the majority either well-differentiated (62.5%) or moderately well-differentiated (25.6) carcinomas. Poorly differentiated carcinomas accounted for 28 cases (7.8%). Post-operative mortality was 6.1%. Long term survival could not be assessed as the majority of patients were lost to follow up.

**CONCLUSION:** The incidence of colorectal cancer has increased over the last four decades in tandem with an aging population of Accra with adenocarcinoma as the predominant histological type. *WAJM* 2010; 29(3): 178–183.

**Keywords:** Colorectal carcinoma; Rectal bleeding; Colonoscopy; Large bowel tumours.

#### RÉSUMÉ

**CONTEXTE:** L'expérience clinique et les études précédentes indiquent que le nombre de cas de cancer colorectal vu chaque année dans la métropole d'Accra est en augmentation.

**OBJECTIF:** Cette étude visait à fournir une mise à jour sur le cancer colorectal à Accra, au Ghana.

**MÉTHODES:** Une étude prospective de cas confirmés de cancer colorectal à partir de Janvier 1997– Décembre 2007.

**RÉSULTATS:** Trois cent cinquante-neuf cas de cancer colorectal ont été étudiés. Les hommes sont 192 (53,5%) et les femmes 167 (46,5%) avec une incidence annuelle de 32,6 nouveaux cas. Les taux d'incidence brut ont 12,53, 9,87 et 11,18 pour 100.000 habitants pour les hommes, les femmes et globale, respectivement. Rectorragie 185 (51,1%), masse abdominale 76 (21,1%), une occlusion intestinale 62 (17,3%), perforation intestinale neuf (2,5%) et l'anémie ferriprive neuf (2,5%) ont été les principales allocutions. Il y avait 168 (46,8%) et 191 du rectum (53,2%) des tumeurs du côlon. Deux cent trente et un patients ont eu une laparotomie avec 225 résections, et 128 patients pour diverses raisons, n'ont pas été opérés. Les étapes Astler Collier des tumeurs au moment du diagnostic ont été C<sub>2</sub> 84 (36,7%), C<sub>1</sub> 53 (22,1%), B<sub>2</sub> 49 (21,4%), D 17 (7,4%), B<sub>1</sub> 14 (6,1%) et A 12 (5,1%) des cas. Adénocarcinome est le type le plus fréquent histologique 321 (89,4%), avec la majorité soit bien différencié (62,5%) ou modérément bien différenciées (25,6) carcinomes. Mal cancers thyroïdiens différenciés ont représenté 28 cas (7,8%). la mortalité post-opératoire a été de 6,1%. Survie à long terme n'a pu être évalué que la majorité des patients ont été perdus au suivi.

**CONCLUSION:** L'incidence du cancer colorectal a augmenté au cours des quatre dernières décennies en tandem avec un vieillissement de la population d'Accra d'un adénocarcinome que le type prédominant histologique. *WAJM* 2010; 29 (3): 178–183.

**Mots-clés:** cancer colorectal, saignements rectaux; coloscopie; tumeurs du gros intestin.

Departments of \*Surgery, †Pathology, University of Ghana Medical School, Accra, Ghana.

**Correspondence:** Dr. Jonathan Cuthbert Balea Dakubo, Department of Surgery, University of Ghana Medical School, P. O. Box 4236, Accra, Ghana. E-mail: jdakubo@yahoo.com

## INTRODUCTION

Colorectal cancer is a common malignancy with annual incidence of over 945 000 new cases worldwide and mortality of 492 000.<sup>1</sup> The highest incidence rates of the disease are noted in North America and Western Europe with the lowest incidence rates reported from developing countries.<sup>2</sup> It is the fourth most common cancer diagnosed and the second most common cause of cancer deaths in the U.S. accounting for an estimated 145,290 new cancer cases and 56,290 deaths in the year 2005.<sup>3</sup> Similar rankings are reported in most western countries.<sup>4</sup>

Recent data from North America have continued to show a decrease in incidence rates of colorectal carcinoma in whites since the mid-1980s, particularly for the distal colon and rectum following the advent of flexible sigmoidoscopy and polypectomy. In the late 1970s, incidence rates for metastatic disease among whites began to decline.<sup>5,6,7</sup> The decline in incidence rates among whites largely has been attributed to more widespread screening for colorectal carcinoma. However, similar trends by stage have not been observed in European and in North American blacks.<sup>2</sup> The incidence of cancer and chronic non-communicable diseases is increasing in developing countries owing to increased life expectancy and probably changes in risk factors that occur with economic development.

In Accra, Ghana, cancer of the colon and rectum is the third most common malignancy diagnosed<sup>8</sup> and the 10<sup>th</sup> cause of cancer deaths. It represents the 8<sup>th</sup> and the 9<sup>th</sup> cause of cancer deaths in males and females respectively<sup>9</sup> at Korle-Bu Teaching Hospital. Accra is a cosmopolitan city, however a greater proportion of the population is made up of indigenous Africans who have not travelled out of the country. This analysis of colorectal carcinoma diagnosed at the main referral hospital where colorectal cancer surgery is performed gives an update of the disease in a purely black population.

## SUBJECTS, MATERIALS, AND METHODS

Since the last report on colorectal

cancer from this centre in 1994<sup>10</sup> tracking of new colorectal cancer cases seen at the centre was maintained. Records of cases seen at the endoscopy unit and the four general surgical wards where these patients were admitted and treated were evaluated prospectively. Each patient's presenting symptoms, physical signs and endoscopic findings were evaluated following which they were followed through their management in the hospital. The type of surgery they underwent as well as the chemotherapeutic and radiation treatments were studied. The immediate complications of these patients following surgery or chemoradiation were assessed as well as the causes of deaths after surgery. The final histopathology reports of specimens obtained either by biopsy or resection were obtained from the Pathology Department. This analysis involves 359 confirmed cases of colorectal cancers that were seen at the Korle-Bu Teaching Hospital between January 1997 and December 2007.

The data extracted for analysis included the patient's demography, presenting symptoms, treatment given and outcome, location of tumour, pathological stage of the tumour in the resected specimen, the histopathological type and grade of cancer.

## RESULTS

From January 1997 to December 2007, 359 new cases of colon and rectal cancers were diagnosed and treated at the Korle-Bu Teaching Hospital. This gives an annual incidence rate of 32.6 cases. Males (192) and females (167) were

affected in approximately equal proportions.

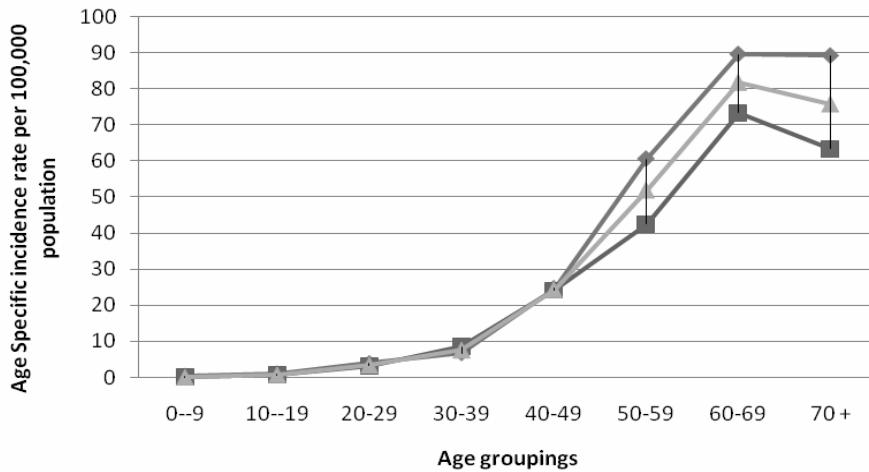
The sex, average annual incidence rate and age-specific incidence rates per 100,000 population for each decade are shown in Figure 1 and Table 1. The crude incidence rates of colorectal cancers were 12.53 (males), 9.87 (females) and 11.18 (total population) per 100,000 population. There were 233 (64.9%) patients aged less than 60 years and 126 (35.1%) patients aged 60 years or more.

Table 2 details the presenting symptoms of the patients. Rectal bleeding in 185 (51.1%), abdominal mass 76 (21.1%), intestinal obstruction 62 (17.3%), intestinal perforation nine (2.5%), and iron deficiency anaemia nine (2.5%) were the most frequent principal symptoms or conditions that prompted the patients to report to hospital. There were 191 (53.2%) colon and 168 (46.8%) rectal tumours. The distribution of the tumours along the colon and rectum was as follows: rectum 168 (46.8%), caecum 58 (16.2%), sigmoid 43 (12.0%), transverse 26 (7.2%), ascending 25 (7.0%), descending 22 (6.1%), hepatic flexure 9 (2.5%) and splenic flexure 8 (2.2%) cases.

Two hundred and twenty-five patients (62.7%) underwent surgical resection, while six (1.7%) patients with obstructing inoperable tumours had only colostomy. Endoscopic polypectomy only was performed in five (1.4%) patients. One hundred and twenty-eight patients (including the latter cases), made up of 118 patients with rectal and 10 colon tumour, did not undergo surgery. Of these 128 patients, 126 (35.4%) had

**Table 1: Average Annual Frequencies by Age and Sex and the Age-specific Incidence Rates of Patients with Colorectal Cancers**

Age Grouping (Years)	Average Annual new Cases			Age-specific Incidence Rate per 100,000 Population		
	Male	Female	Both Sexes	Male	Female	Both Sexes
0-9	0.09	0	0.09	0.31	0	0.15
10-19	0.27	0.18	0.45	0.99	0.59	0.83
20-29	1.09	0.91	2.00	3.82	3.16	3.47
30-39	1.36	1.64	2.91	6.77	8.58	7.68
40-49	3.09	2.82	5.91	24.65	24.14	24.4
50-59	4.09	2.64	6.73	60.57	42.48	51.9
60-69	3.27	2.55	5.81	89.54	73.4	81.68
70+	3.18	2.45	5.64	89.14	63.34	75.71



**Fig. 1: Sex And Age Specific Incidence Rate for Patients Diagnosed with Colorectal Cancer** ◆ Male ■ Female ▲ Both Sexes

**Table 2: Principal Presenting Symptoms or Conditions in Patients with Colorectal Cancers**

Presenting Symptom/Condition	Number of Patients (%)	Average Duration of Symptom (Month)
Rectal Bleeding	185 (51.1)	17.5
Abdominal Pain	76 (21.2)	5.4
Intestinal Obstruction	62 (17.3)	-
Intestinal Perforation	9 (2.5)	-
Anaemia	9 (2.5)	-
Change in bowel Habits	6 (1.7)	6.4
Abdominal mass	5 (1.4)	6.8
Internal faecal fistula	2 (0.6)	-
Fistula in Ano	2 (0.6)	-
Intussusception	1 (0.3)	-
Mucus discharge PR	1 (0.3)	12.0
Diarrhoea	1 (0.3)	8.0

**Table 3: Histopathological Types of Colorectal Cancers**

Histopathology Type	Number of Tumours (%)
Invasive Well Differentiated Adenocarcinoma	225 (62.7)
a. Not Otherwise Stated (NOS)	161 (71.6)
b. Mucin secreting	51 (22.7)
c. Signet Ring Type	7 (3.1)
d. Colloid	3 (1.3)
e. Papillary	3 (1.3)
Invasive Moderately Differentiated	92 (25.6)
Anaplastic Tumours	28 (7.8)
Adenocarcinoma-In-Situ	4 (1.1)
Non-Hodgkins Lymphoma	6 (1.7)
Cloacogenic	1 (0.3)
Malignant Gastrointestinal Stromal Tumours(GIST)	1 (0.3)
Liepmysarcoma	1 (0.3)
Squamous Cell Carcinoma	1 (0.3)
<b>Total</b>	<b>359 (100.0)</b>

endoscopic biopsy alone and two (0.6%) had fistulectomy only for fistula-in-ano. Seventy-one (30.7%) patients who presented with intestinal perforation or intestinal obstruction were treated as emergency. In decreasing order of frequency, resection was performed on each segment of the large bowel as follows: right colon left colon 91.7% (77 out of 84) sigmoid colon 88.4% (38 out of 43 cases) and rectum 29.8% (50 out of 168) cases.

Table 3 gives the histological types of colorectal cancers with adenocarcinoma in 321 (89.4%) patients being the most common.

The Astler Collier stages of the tumours in patients who had surgery are shown in Table 4. Tumours were advanced at the time of presentation in many patients. One hundred and one patients had invasive well differentiated adenocarcinoma (Not Otherwise Stated, NOS) with 78 (48.5%) of these located in the rectum. Sixty-one patients with well differentiated tumours did not undergo surgery. Invasive moderately well differentiated and anaplastic carcinomas were present in 122 patients. Of these 64(52.5%) were located in the rectum. Forty-eight of these patients did not have surgery.

One hundred and sixty-eight rectal carcinomas were diagnosed, with a female preponderance of 93, mean age of 52.87 years to 75 males, mean age of 55.26 years. The pathological stages of the 50 rectal carcinomas that were resected were A 2, B<sub>1</sub> 6, B<sub>2</sub> 9, C<sub>1</sub> 10, C<sub>2</sub> 23 D 0. The remaining 118 patients did not undergo surgery.

Data on long term survivals are not available as the majority of patients were lost to follow-up. Twenty-nine patients (12.6%) developed a total of 36 complications while 14 patients (6.1%) died in the early post-operative period. Significant morbidities that occurred included wound infection nine, deep vein thrombosis eight, anaemia five, perineal wound break down five, anastomotic leak two, intra-abdominal abscess four, chest infection two, anastomotic break down one. The causes of death included septicaemia six, pulmonary embolism four, anaemia two, subdural haemorrhage and renal failure one each.

**Table 4: Astler Collier Stages of Tumours of Patients who had Surgery**

Astler Collier Stage	Number of Tumours (%)
A	12 (5.2)
B1	14 (6.1)
B2	49 (21.2)
C1	53 (22.9)
C2	84 (36.4)
D	19 (8.2)
<b>Total</b>	<b>231 (100.0)</b>

**Table 5: Published Studies on Colorectal Cancer in Accra since 1956 to Date and the Population of Accra during the Study Periods**

	Badoe <sup>12</sup> 1956–1965	Badoe <sup>14</sup> 1970–1975	Naaeder <i>et al</i> <sup>10</sup> 1987–1991	Dakubo <i>et al</i> 1997–2007
Male	23	35	66	197
Female	18	25	68	167
Total	41	60	137	359
Approximate annual new cases	4.1	10	26.8	32.6
Population of Accra during study period	388,396 <sup>13</sup>	715,177 <sup>15</sup>	1,431,099 <sup>16,17</sup>	2,905,726 <sup>18</sup>

## DISCUSSION

Colon and rectal cancers are diseases of advancing age with the incidence rising sharply after the sixth decade.<sup>4,11</sup> In 1966 Badoe<sup>12</sup> presented the first report of colon and rectal cancers in Accra, Ghana. The incidence then was approximately 4.1 new cases per year in a population of about 400,000.<sup>13</sup> There has been an increase in the incidence of colorectal cancer in Accra over the past four decades as shown in Table 5.<sup>14–18</sup> In this study, the number of new cases seen annually was 32.8 in a population of about 3,000,000<sup>18</sup>. The crude incidence rate was 11.18 per 100,000 population in both sexes combined. This incidence rate is very much lower than those reported from North America and Europe.<sup>19–23</sup> The demographic profile of Accra reveals that currently the proportion of the population aged 60 years and over has risen from 2.6 percent in 1984 to 3.9 percent in 2000.<sup>16–18</sup> This small population however accounted for 35.1% of the people afflicted and this supports the notion that colorectal cancer is a disease of old age and that as the population ages in Ghana and other developing countries the incidence of this disease will continue to rise.

Diet is currently the most important exogenous factor identified in the causation of colorectal cancer. Intake of refined diet that increases the pH of the colon and increases transit time has been postulated to be important in the development of colorectal cancers.<sup>24, 25</sup> The increasing urbanization of Accra does not appear to be accompanied by significant changes in dietary habits

towards a Western diet.<sup>26</sup> It has been shown that the difference between the dietary fibre intake of high income earners (43.5g/day) in Accra and low income earners (39.0g per day) was not statistically significant and the average daily fibre intake of 39.4g/day is much higher than what obtains in the western world.<sup>27</sup>

Another study also found that the intake of insoluble fibre is similar for both rural and urban dwellers. It showed further that the bowel function of urban dwellers is similar to that of their rural counterparts whose diets are largely plant-based; high in fibre and low in fat.<sup>28</sup> It could therefore be concluded that people who live in Accra have tended to stick to foods that they have been traditionally accustomed to. This could partly be responsible for the comparatively low incidence of colorectal cancer in Accra. While the low incidence of the disease may be explicable by the intake of “protective diet” the observed progressive rise in the incidence of colorectal cancer over the past years cannot be similarly accounted for. Further local studies into the molecular genetics of these tumours are needed to help explain the rising incidence of the disease in Accra.

Survival of colorectal cancer patients depends mostly on their disease stage at the time of diagnosis.<sup>29</sup> Patients with colon and rectal cancer still report late to hospital even in the developed world.<sup>30</sup> In this study 203 out of 231 (87.9%) patients who had surgery presented with late disease (Astler Collier stages B<sub>2</sub> or worse). A number of factors

accounted for the late presentation with colorectal cancer. The significance of warning symptoms may not be obvious to many patients<sup>31</sup> who may not relate them to serious disease and so be ignored. Rectal bleeding is an important symptom in colorectal cancer. It was the most frequent and longest standing symptom in 51.1% patients (mean duration of 18 months). Single symptoms (frequent in early disease) are associated with long delay in diagnosis compared with multiple symptoms (indicating advanced disease) which are associated with shorter delay.<sup>32,33</sup> In fact, in this study change in bowel habit in 1.7% of patients (mean duration of six months), abdominal masses in 21.1% patients (mean duration five months), and abdominal pain in 1.4% patients (mean duration seven months) were symptoms obtained from the patients after repeated questioning and so were infrequently the index symptoms prompting hospital visit. For most of those who recognized these symptoms they were noticed in combination within six months of presentation. Presumably, these patients could have noticed earlier warning symptoms but did not pursue them for fear of a cancer diagnosis.<sup>23</sup> Majority of the patients with late disease in this study denied ever noticing any early single warning symptom. Intestinal obstruction (17.3%) and perforation (2.5%) presented as emergencies. Colorectal endoscopic screening has greatly improved the detection rates of early disease (Stages I and II disease) in the West, more so in whites than in blacks.<sup>5</sup> The stage of colorectal cancer at time of diagnosis reported in the US



Surveillance, Epidemiology and End Results (SEER) cancer statistics of 2008 indicates that Stage I (Astler Coller A) tumours accounted for 13.7%, Stage II (Astler Coller B<sub>1</sub> & B<sub>2</sub>) 27.9%, Stage III (Astler Coller C<sub>1</sub> & C<sub>2</sub>) 37.2% and Stage IV (Astler Coller D) 21.2%.<sup>30</sup> The comparative rates from this study were Stage I. 5.1%, Stage II. 27.4%, Stage III. 58.7% and Stage IV. 7.4%. The low number of Stage I tumours seen in this study is the result of absence of population screening programmes in this country. Also the relatively low number of Stage IV tumours was because of the low number of rectal tumours that were resected since many of the unresected ones were advanced tumours that were staged clinically. Performing colorectal endoscopy routinely on older patients with haematochezia might be an appropriate option by which many early tumours could be diagnosed. Indeed, flexible sigmoidoscopy should be the minimum endoscopic investigation employed in patients with haematochezia in our environment since as many as 67.1% (241 out of 359) of the tumours reported in this study were located in the left colon and the rectum. This assertion has been corroborated by a recent study that evaluated the place of either whole colonic imaging or flexible sigmoidoscopy in patients with colorectal symptoms.<sup>34</sup>

Of the 321 patients with adenocarcinoma all except four had invasive tumour. The patients with carcinoma-in-situ presented with rectal bleeding and had endoscopy which identified their tumours that were subsequently resected after histological confirmation of the diagnosis.

Rectal cancers had the lowest resection rate of 29.8% in this study. Patients refused rectal surgery so as to avoid a permanent colostomy. Financial constraints, unresectability of advanced tumour and increased incidence of morbidity after neo-chemoradiation were the other negating factors. Cardiovascular disease was a frequent morbid complication of irradiation and prevented or delayed surgical resection in these patients. Postoperative mortality was 6.1% but data on long term survival are not available as the majority of patients failed to report for follow up.

## Conclusion

Colorectal cancer is a complex genetic disease with everonmental factors playing some role in their causation. These cancers are becoming frequently recognized solid tumours in clinical practice in Accra. Their age specific incidence rates rise shapely from age 40 years. The annual new cases of carcinoma of the large bowel has progressively increased over the past four decades in tandem with an aging population of the city. Invasive adenocarcinoma was the commonest cancer. Rectal bleeding was a frequent presenting symptom however this symptom was usually overlooked by the patients who then presented late with advanced tumours. Surgery as a mandatory aspect of the treatment was not applied to a majority of the patients with rectal cancer due to in-operatibility of the tumours at presentation and refusal of the patients to have a colostomy

Colorectal cancers are no longer uncommon among the indigenous people of Accra. Afflicting people who are younger than found in the developed world these cancers are aggressive and are mostly incurable at presentation. Further studies to eludate the molecular genetics of these cancers is recommended.

## REFERENCES

- Weitz J, Koch M, Debus J, Hohler T, Galle PR, Buchler MW. Colorectal cancer. *Lancet* 2005; **365**: 153–165.
- Stewart BW, Kleihues P. World Cancer Report. World Health Organization, International Agency for Research on Cancer, 2003. Pp 198-202
- Jemal A, Murray T, Ward E, Samuels A, Tiwari RC, Ghafoor A, *et al.* Cancer statistics. *CA Cancer J Clin.* 2005; **55**: 10–30. <http://caonline.amcancersoc.org/cgi/content/full/55/1/10>
- Boyle P, Langman JS. ABC of colorectal cancer epidemiology. *BMJ.* 2000; **321**: 805–808.
- Chu KC, Tarone RE, Chow WH, Alexander GA. Colorectal cancer trends by race and anatomic subsites, 1975 to 1991. *Arch Fam Med.* 1995; **4**: 849–856.
- Chu KC, Tarone RE, Chow WH, Hankey BF, Ries LA. Temporal patterns in colorectal cancer incidence, survival and mortality from 1950 through 1990. *J Natl Cancer Inst.* 1994; **86**: 997–1006.
- Nelson RL, Persky V, Tury K. Determination of factors responsible for the declining incidence of colorectal cancer. *Dis Colon Rectum.* 1999; **42**: 741–752.
- Biritwum RB, Gulaid J, Amaning AO. Pattern of diseases or conditions leading to hospitalization at Korle-Bu Teaching Hospital, Ghana in 1996. *Ghana Med J.* 2000; **34**: 197–205.
- Wiredu EK, Armah HB. Cancer mortality patterns in Ghana: a 10-year review of autopsies and hospital mortality. *BMC Public Health.* 2006; **6**: 159. <http://www.biomedcentral.com/147-2458/6/159>
- Naaeder SB, Archampong EQ. Cancer of the Colon and rectum in Ghana: a 5-year prospective study. *Br J Surg.* 1994; **81**: 456–459.
- Irby K, Anderson WF, Henson DE, Devesa SS. Emerging and widening colorectal carcinoma disparities between blacks and whites in the United states (1075–2002). *Cancer Epid Biomarkers and Prevention.* 2006; **15**: 792–795.
- Badoe WA. Malignant Diseases of the Gastro-intestinal tract in Korle-Bu Hospital, Accra, Ghana; 1956–1965. *West Afr J Med.* 1966; **15**: 181–185.
- 1960 Population Census of Ghana Vol II. Statistics of localities and enumeration areas. Census office of Accra 1962. 388,396.
- Badoe EA. Malignant Tumours of the large bowel (including rectum) Korle-Bu Hospital, Accra; 1970–75. *Ghana Med J.* 1977; **16**: 157–159.
- Ghana Statistical Service. 1970 Population census of Ghana. Special report 'A'. Statistics of, towns with population 10,000 and over. Accra. Census office of Accra, Ghana 1978. p. 715–717.
- Ghana Statistical Service. 1984 population of Ghana. Demography and Economic characteristics, Greater Accra Region. Accra. Statistical service Accra, Ghana 1987.
- Ghana Statistical Service. 1984 population Census of Ghana. The Gazetteer 1 (AA-KU). Alphabetical list of localities with statistics on population, Number of houses and main source of water supply. Accra. Statistical service Accra, Ghana. 1989,X.
- Ghana Statistical Service. 2000 Population and Housing census; Greater Accra Region. Analysis of District Data and Implications for planning. Accra. Statistical Service Accra, Ghana. 2005.X.

19. Office for National Statistics, Cancer Statistics Registration: Registration of Cancer diagnosis in 2005, England.
20. Welsh Cancer Intelligence and Surveillance Unit. Cancer in Wales 1992 – 2006; A comprehensive Report. 2008. Wcisuwales.nhs.uk
21. NHS National Service Scotland, ISD. Cancer in Scotland. 2008. www.isdscotland.org/isd/files/cancer
22. National Cancer Registry (Ireland). Cancer in Ireland 1994 – 2007; a summary. 2008. www.ncr.ie
23. US Cancer Statistic Working Group. United States Cancer Statistics; 2004 Incidence and Mortality. Atlanta (GA); Department of Health and Human Service, Centre for Disease Control and Prevention, and National Cancer Institute: 2007.
24. Campos FG, Logullo Waitzberg AG, Kiss DR, Waitzberg DL, Habr-Gama A, Gama-Rodrigues J. Diet and Colorectal Cancer: current evidence for aetiology and prevention. *Nutr Hosp.* 2005; **20**: 18–20.
25. Thornton JR. High colonic pH promotes cancer. *Lancet* 1981; **i**: 1018–1020.
26. Opare-Obisaw C, Fianu DAG, Awadzi K. Changes in family food habits: the role of migration. *J of Consumer Studies and Home Economics.* 2008; **24**: 145–149.
27. Naaeder SB, Archampong EQ. Acute appendicitis and dietary fibre intake. *WAJM.* 1998; **17**: 264–267.
28. Naaeder SB. Colorectal Neoplasia in Ghana: Clinical and Pathological Aspects in Accra. MD Thesis. University of Ghana. 1993.
29. Sant M, Aareleid T, Berrino F, Bielska Lasota M, Carli PM, Faivre J, *et al.* EURO-CARE Working Group: Eurocare-3: Survival of Cancer patients diagnosed 1990–1994 – results and commentary. *Ann Oncol* 2003; **14**: 61–118.
30. Reis LAG, Melbert D, Krapcho M, Strinchcomb DG, Howlader N, Horner MJ, *et al.* (eds). SEER Cancer Statistics Review, 1975–2005, National Cancer Institute. Bethesda, MD. [http://seer.cancer.gov/csr/1975\\_2005/](http://seer.cancer.gov/csr/1975_2005/), based on November 2007 SEER data submission, posted to the SEER website, 2008.
31. Esteva M, Ramos M, Cabeza E, Llobera J, Ruiz A, Pita S, *et al.* The DECIRRE Research group. Factors influencing delay in the diagnosis of colorectal cancer: a study protocol. *BMC Cancer* 2007, **7**:86doi:10.1186/1471-2407-7-86. <http://www.biomedcentral.com/1471-2407/7/86>
32. Robertson R, Campbell NC, Smith S, Donnan PT, Sullivan F, Duffy R, *et al.* Factors influencing time from presentation to treatment of colorectal and breast cancer in urban and rural areas. *Br J Cancer.* 2004; **90**: 1479–1485.
33. Thompson MR, Perera R, Senapati A, Dodds S. Predictive value of common symptom combinations in diagnosing colorectal cancer. *Br J Surg.* 2007; **94**: 1260–1265.
34. Thompson MR, Flasshman KG, Wooldrage K, Rogers PA, Senapati A, O’Leary DP, *et al.* Flexible sigmoidoscopy and whole colonic imaging in the diagnosis of cancer in patients with colorectal symptoms. *Br J Surg.* 2008; **95**: 1140–11.