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Article

Survival probabilities of stomach and colon cancer patients in Bangladesh

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Abstract: Cancer is predicted to be a progressively vital reason behind morbidity and mortality in the next few decades, in all regions of the world. In Bangladesh, about 150781 new cancer cases occur in 2018 and caused about 108137 deaths. Stomach and colon cancer have 6.3% and 2% of the total cancer deaths in Bangladesh. However, to the best of knowledge, no study has been conducted in Bangladesh on the survival probabilities of stomach and colon cancer patients. Therefore, we aimed to conduct a study on the survival probabilities of stomach and colon cancer patients with respect to sex, age, and body mass index. Only sixty-five patients with stomach or colon cancer from the eight divisional cities in Bangladesh were observed. A non-parametric, Kaplan-Meier product limit estimate for survival probabilities was utilized in this study. Less median survival time for female patients (22 months) than for males (31 months) was found. Almost similar patterns were observed for patients older than 45 years compared to younger patients and overweight patients. Taken together, this study suggests that male, younger and healthy weight patients' survival probabilities are higher than female, older and overweight patients respectively. To avoid these kinds of diseases and increase survival probabilities, we should always take a balanced diet and doing exercise regularly to keep a healthy weight. Government and non-government organizations need to take proper steps to create awareness levels among the people as well.

Keywords: cancer; stomach; colon; K-M estimates; survival probabilities

1. Introduction

Cancer, additionally referred to as malignancy, is an abnormal growth of cells. Cancer is the leading reason for death in economically developed countries (World Health Organization, 2008) and the second leading reason behind death in developing countries and is predicted to be a more and more important reason behind morbidity and mortality within the next few decades, in all regions of the world. In economically developing countries the burden of cancer is increasing as a result of population aging and growth likewise as, increasingly, an adoption of cancer-associated lifestyle choices including smoking, physical inactivity, and "westernized" diets (Jemal *et al.*, 2011). In Bangladesh, about 150781 new cancer cases occur in 2018 and caused about 108137 deaths.

There are more than hundred types of cancer, including breast cancer, skin cancer, lung cancer, stomach cancer, colon cancer, prostate cancer, and lymphoma. Around the world, lung cancer is the most commonly diagnosed cancer (11.6% of the total cases) and the leading reason behind cancer death (18.4% of the total cancer deaths), followed by colorectal cancer (9.2%), stomach cancer (8.2%), and liver cancer (8.2%) (Jemal *et al.*, 2011) wherein Bangladesh stomach and colon cancer have 6.3% and 2% of the total cancer deaths with incidence rates of 4.8% and 1.8% respectively (Bray, 2018). In Europe during 2000, the incidence for all cancers combined ranged from 400 cases per 100,000 for age group 50–54 to 2280 for age group 70–74 in men and from 490 to 1210 in women. Over 65% of deaths from cancer occurred in elderly patients aged 65 years or more (Ferlay *et al.*, 2004). A very large difference in prognosis also has been observed between the elderly and younger patients

(Janssen-Heijnen *et al.*, 2005). In colon cancer diagnosing age is also reciprocally associated with prognosis (Sant *et al.*, 1995).

Some population-based studies on cancer patients support the concept of the role of gender in predicting survival. It appears male patients were more susceptible to die from colon cancer. This finding is confirmed by some studies (Capocaccia *et al.*, 1997; Li *et al*., 2007) however, there are some controversies (Cheng *et al.*, 2001; Ji *et al.*,1998; Svensson *et al*., 2002) as well.

A stronger association between body mass index and colon and/or rectal cancer in men than in women have additionally been delineated in numerous studies (Wynder *et al.*, 1967; Lew *et al.*, 1979; Phillips *et al*., 1985; Wu *et al*., 1987; Graham *et al.*, 1988; Kune *et al.*, 1990). Among women, the risk is modified by menopause status, possibly through altered endogenous estrogen levels (Hou *et al*., 2006). It has been hypothesized that feminine sex steroids offer women protection both from the disease and in terms of survival (Hayne *et al.*, 2001; Payne, 2007).

Stomach cancer is a major health problem in many countries. Stomach cancer is a vital contributor to the worldwide burden of cancer (Van Cutsem *et al*., 2016) and less than a century ago it was the most common cancer in the world (Karimi *et al.*, 2014). Stomach cancer, or gastric cancer, is a build-up abnormal cells that form a mass in part of the stomach. It can develop in any part of the body. According to the WHO, stomach cancer caused 783,000 deaths worldwide in 2018. It is the sixth most common cancer worldwide, but the third leading cause of cancer-related deaths. Another study found that gastric carcinoma is one of the most common cancers and the second leading cause of cancer-related death in the world. Despite decline morbidity and mortality, the burden remains high (McLean and EI-Omar, 2014).

Colon cancer is a type of cancer that begins within the large intestine (colon). The colon is the final part of the digestive tract. Colon cancer is sometimes referred to as colorectal cancer, which is a term that combines colon cancer and rectal cancer, which begins in the rectum. In the United States, Colorectal cancer is the second leading cause of cancer death among men and women combined. Around 25% of people diagnosed with colorectal cancer have a family history (fightcolorectalcancer.org/prevent-it/facts-about-colorectal-cancer/). The risk of cancer increases significantly with age and many cancers occur more commonly in developed countries. Rates are increasing as more people live to an old age and as lifestyle changes are occurring in the developing world (Jemal *et al*., 2011).

Cancer is a major reason behind death worldwide including Bangladesh. The incidence of various cancers is increasing day by day. The frequency of various forms of cancer occurring in Bangladesh is not similar to that of other worldwide population groups. To the best of our knowledge, no study has been conducted in Bangladesh to investigate the survival probabilities of stomach and colon cancer patients according to sex, age, and body mass index. Therefore, we aim to differentiate the survival probabilities of the colon and stomach cancer patients at the national level according to sex, age, and body mass index. This study reveals that female patients, patients older than 45 years and overweight patients have less median survival time than male, younger patients and healthy weight patients respectively.

2. Materials and Methods

2.1. Ethics approval and consent to participate

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The study was approved by the local ethics committee (University Research Center, Shahjalal University of Science and Technology, Sylhet, Bangladesh) and the ethical guidelines were strictly followed throughout the data collection. Written informed consent was obtained from all individual participants included in the study.

2.2. Participants and data collection

To differentiate the survival probabilities of the colon and stomach cancer patients according to sex, age and body mass index, initially a primary dataset was collected based on a questionnaire from eight divisional cities in Bangladesh using a convenient sampling. We found a total of 65 stomach and colon cancer patients during October 2018. Especially we collected the starting time of the diseases. After one year we communicated with them/relatives and then collected their status. We computed patients' survival time using the starting time of the disease and their death time. Remaining patients are considered as censored as they are still alive. The study was approved by the University Research Center, Shahjalal University of Science and Technology (SUST), Sylhet, Bangladesh and the ethical guidelines were strictly followed throughout the data collection. We informed participants about the purpose of the study before the data collection.

2.3. Statistical analyses

Kaplan-Meier product limit estimate (Kishore and Khanna, 2010; Kleinbaum and Klein, 2011) with Log-rank test were used to estimate the survival probabilities of stomach and colon cancer patients. We used SPSS 22.0 for data analysis.

3. Results

In this study we tried to find out survival time of stomach and colon cancer patients as an outcome and then compare the survival probabilities respect to gender, age and body mass index. As sample size is very small therefore, we considered age and body mass index only two categories. Initially we tried to run the Cox model with all explanatory variables (gender, age, and BMI) with their interactions but none is found significant therefore we strict our analysis only to estimate K-M survival probabilities and Log rank test. The study included 46 stomach cancer (71%) and 19 colon cancer patients (29%). Among the 65 patients, 41 patients (63%) are male and 24 patients (37%) are female. After one year we found 20 patients (30.8%) have died where 15 stomach patients and 5 colon patients. We observed the minimum and maximum age of the respondents was 11 and 80 years respectively. Almost two thirds (63.1%) were male respondents. Among male patients, most of them are from the Sylhet division followed by Rangpur, Chattogram, and Dhaka, and among female patients, most of them are from Sylhet and Rajshahi followed by Chattogram division (Figure 1).

3.1. Kaplan-Meier product limit estimates

In order to compare the survival probabilities of male and female patients we plotted the K-M survival curve (Figure 2), it is shown that the survival probabilities of male patients are comparatively higher than female patients. From Table 1, it is also observed that median survival time is higher for male patients than female patients.

In order to compare the survival probabilities of different age groups, we divided the patients into two groups (less than or equal to 45 years and more than 45 years). We plotted K-M survival curves (Figure 3), it is shown that the survival probabilities of young groups (less than or equal to 45 years) are slightly higher than comparatively old age patients. We also observed in Table 2 that the median survival time is higher (31 months) in the younger group than the older group (21 months).

In order to compare the survival probabilities based on body mass index, we divided the patients into two groups (healthy weight and overweight (BMI≥25). We plotted K-M survival curves (Figure 4), it is shown that survival probabilities of the healthy weight group are higher than the overweight group. We also observed in Table 3 that median survival time is higher (30 months) in healthy weight group than overweight group (23 months).

Table 1. Medians for survival time according to gender.

	Estimate	**Std. error**	**95% Confidence interval**	
			Lower bound	**Upper bound**
Male	31.000	4.729	21.731	40.269
Female	22.000	5.930	10.376	33.624

Table 2. Medians for survival time according to categorical age.

	Estimate	**Std. error**	**95% Confidence interval**	
			Lower bound	**Upper bound**
Less than or equal to 45 years	31.000	3.708	23.733	38.267
Greater than to 45 years	22.000	5.231	11.748	32.252

Table 3. Medians for survival time according to body mass index.

	Estimate	**Std. error**	**95% Confidence interval**	
			Lower bound	**Upper bound**
Within a healthy weight range	30.000	6.971	16.338	43.662
Overweight	23.000	13.880	.000	50.206

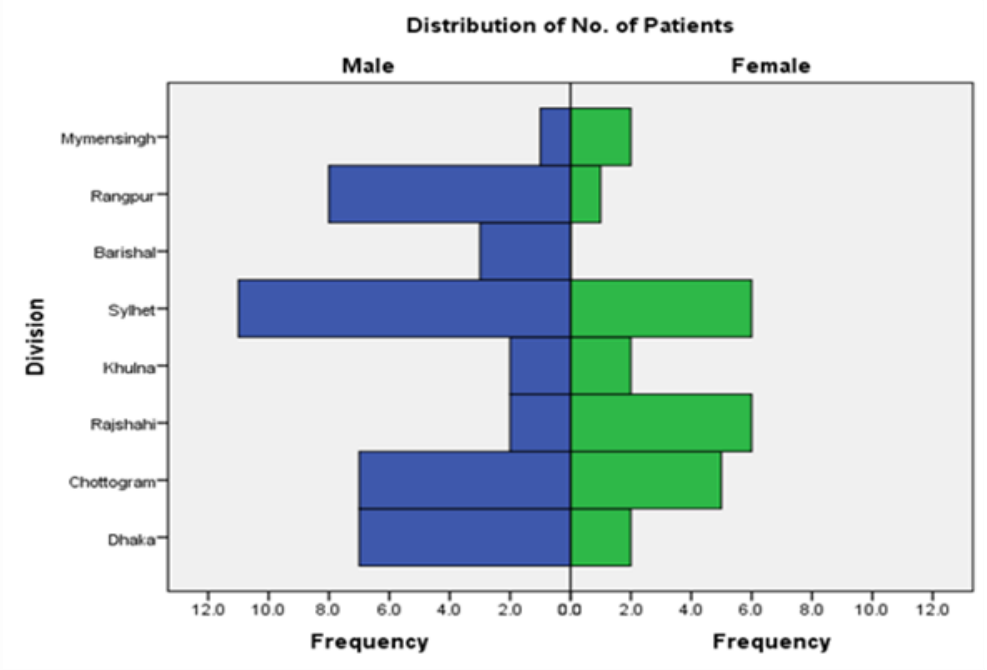


Figure 1. Distribution of the number of stomach and colon cancer patients by division and gender.

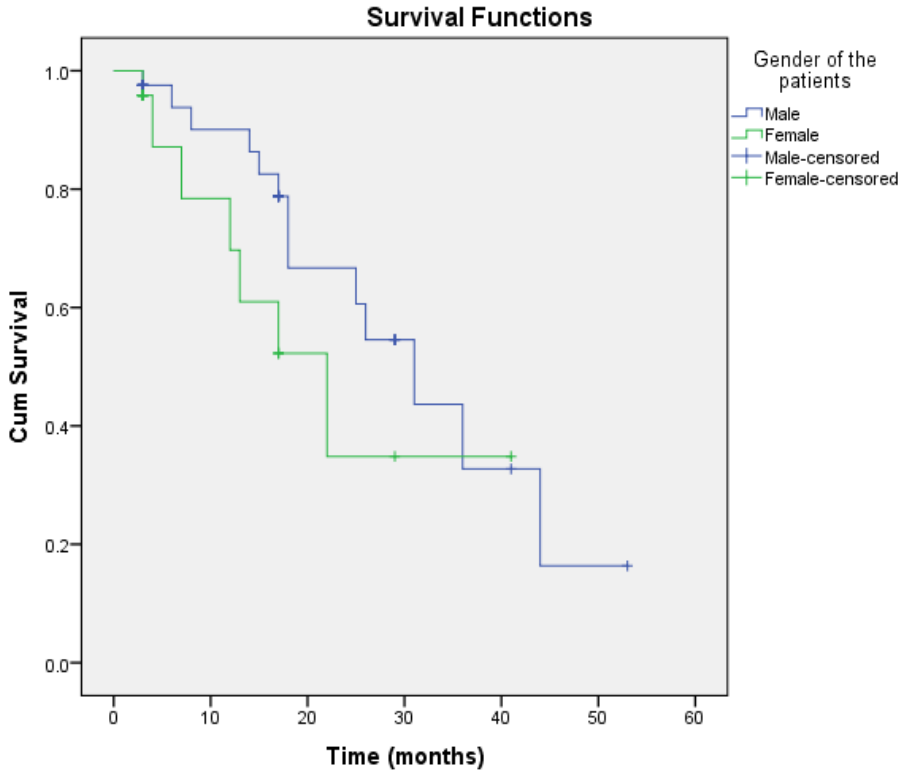


Figure 2. Plots of Kaplan-Meier product limit estimates of survival according to gender.

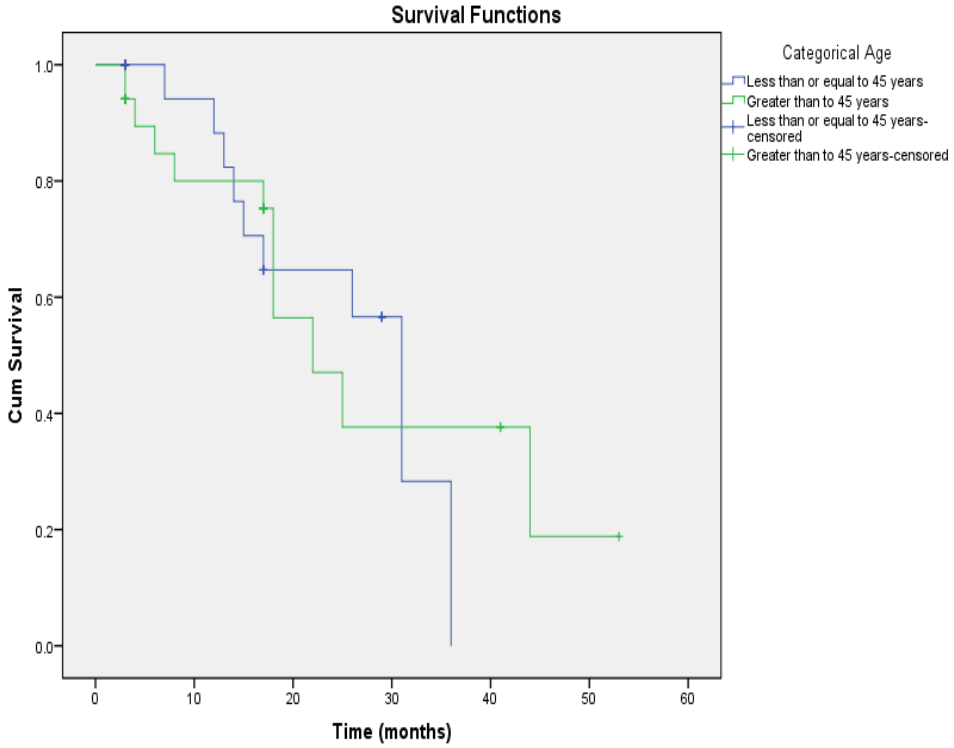
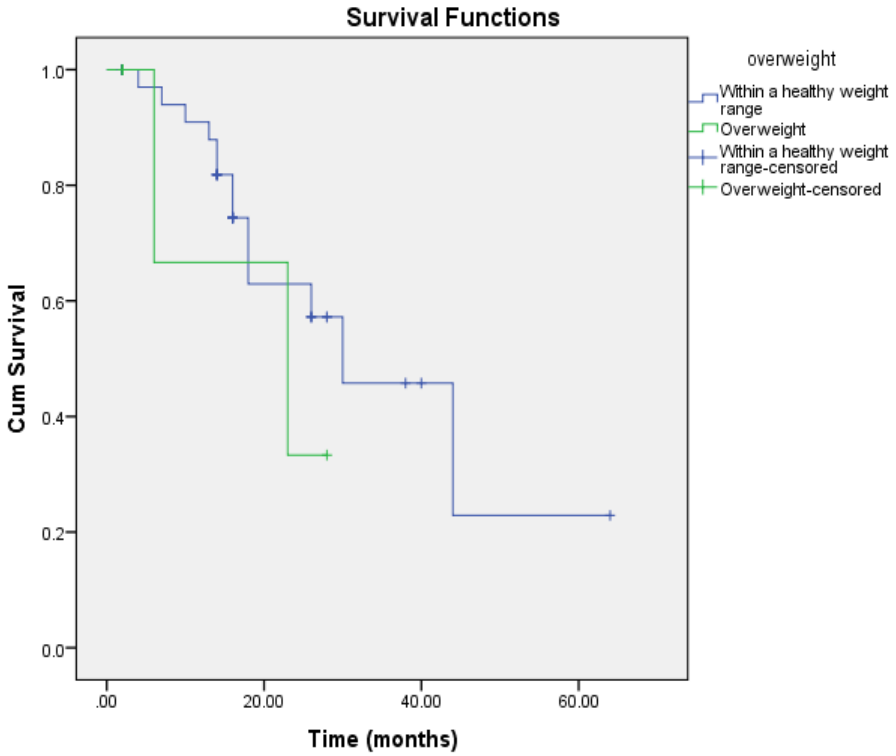


Figure 3. Plots of Kaplan-Meier product limit estimates of survival according to the age of the patients.



F**igure 4. Plots of Kaplan-Meier product limit estimates of survival according to body mass index.**

4. Discussion

Cancer affects most of us at some point in our lives. Cancer cases are expected to surge 57% worldwide in the next 20 years, an imminent "human disaster" that will require a renewed focus on prevention to combat, according to the World Health Organization. The World Cancer Report, produced by the WHO's specialized cancer agency and released on World Cancer Day, predicts new cancer cases will rise from an estimated 14

million annually in 2012 to 22 million within two decades. Over the same period, cancer deaths are predicted to rise from 8.2 million a year to 13 million. Low- and middle-income countries accounted for about half (51%) of all cancers worldwide in 1975; this proportion increased to 55% in 2007 and is projected to reach 61% by 2050 (Bray and Møller, 2006). Incidence and death rates from stomach cancer have steadily declined over the last 50 years, even though stomach cancer remains the fourth most common malignancy and is second only to lung cancer as the leading cause of cancer deaths (Parkin *et al*., 2002). Stomach cancer accounted for >1 million estimated cases and 800230 deaths in 2007, with an estimated 60% of new cases occur in developing countries. Colorectal cancer was rather rare in 1950 but has become one of the predominant cancers in western countries, now accounting for approximately 10% of cancer-related mortality (Vasen *et al*., 2015). Although it is possible for cancer to strike at any age, most patients with invasive cancer are over 65 (Coleman and Rubinas, 2009). According to cancer researcher Robert A. Weinberg, "If we lived long enough, sooner or later we all would get cancer" (Johnson, 2010). Aging's effect on cancer is complicated by factors such as DNA damage and inflammation-promoting it and factors such as vascular aging and endocrine changes inhibiting it (De Magalhaes, 2013).

The results of Log-rank tests according to three cases (sex, age, and BMI) showed there is no significant difference between male vs female; older vs younger and healthy weight vs overweight of survival probabilities of cancer patients, however, observing the Figures 2, 3 and 4- we clearly see that there is a difference between the respective groups. Based on the exploratory data analysis we found male, younger and healthy patients' survival probabilities are comparatively higher than female, older and overweight patients respectively which is because of the well-known and established facts that women's and older peoples' immune system is not as stronger as males' and younger people. This study also suggests that overweight decreases the survival time which supports the previous studies as well.

5. Conclusions

Including all, we conclude that male, younger and healthy weight patients' survival probabilities are higher than female, older and overweight patients respectively. To improve the survival probabilities of cancer patients, government and non-government organizations need to increase their campaign about the causes and consequences of cancer for enhancing awareness levels on cancer. It is also important for people to take a balanced diet and exercise regularly to keep their healthy weight. Though, the Bangladesh government has been planning to set up cancer centers in eight medical colleges to reach out to these patients; however, it is urgently needed to create a data-house in each hospital so that doctors/researchers can get the exact picture of the cancer status in Bangladesh.

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Conflict of interest

None to declare.

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