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A Comprehensive and Significant Analysis of Demographical Radiotherapy Data in Northern Bangladesh: A Numerical Study at TMSS Cancer Center

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Abstract: Cancer is a universal public health concern, and understanding its demographic distribution is crucial for effective prevention, early detection, and treatment. This article presents the findings of one-and-a-half-year study conducted at the TMSS Cancer Center (TCC) in the northern part of Bangladesh in exploring the status of cancer cases in this specific area. A retrospective analysis was performed on medical records of cancer patients taking radiotherapy at TCC coming from the specific part of Bangladesh through a comprehensive study conducted in the center between Aug-2022 to Feb-2024. Data were collected on age, gender, residence, cancer type, and stage at diagnosis. Descriptive and quantitative evaluations were used to assimilate the demographic characteristics of the population. During the study period, an 854 cancer cases were evaluated across 16 districts in the northern region of Bangladesh. The mean age of the patients was 53 years as there were 384 male patients, accounting for 44.96% of the total, with an average age of 56.5 years besides 456 female patients, constituting 53.4% of the total, having an average age of 49.6 years.

The present analysis noted a distinctive age pattern among different cancer types. Head and neck cancer cases were predominant in the age group of 51-60 years while breast cancer cases were more prevalent amongst individuals aged 41-50 years. Cervical cancer cases, on the other hand, exhibited a higher frequency per age range of 51-60 years. Implication of such a study reflects on the epidemiological profile of cancer in the northern Bangladesh, highlighting the importance of targeted approaches to cancer prevention, early detection, and management. By addressing the effective needs of different demographic groups and cancer type's implements methods towards reducing the burden of cancer, hence, improving the overall health services of the population.

Keywords: TMSS, Radiotherapy, Demographic, Cancer, Stage, Diagnosis, Cancer Type, Head and Neck, Northern part, Bangladesh, Cancer Center.

1. Introduction

Cancer is a health challenge, causing significant morbidity and mortality worldwide. According to World Health Organization (WHO), cancer is one of the leading causes of death globally, with an alarming increase of new cases projected in the coming years [1]. There were 19.29 million new cases of cancer worldwide in 2020, it is estimated. The four most common cancers occurring worldwide are female breast, lung, bowel, and prostate cancers. Worldwide there will be 28 million new cases of cancer each year by 2040 as per worldwide cancer statistics [2]. The WHO's latest report highlights the pressing need to address the global cancer crisis. An estimated 65% of all cancer-related deaths occur in low- and middle-income countries, including Bangladesh [3], where the healthcare infrastructure faces various challenges in managing the increasing cancer burden. The situation in Bangladesh is particularly concerning; with cancer rates showing a consistently upward rising trend of incidence in recent years. The northern region of the country, comprising of diverse communities and healthcare accessibility challenges, has experienced a high surge in cancer cases, warranting focused research efforts to better understand and address the demographic aspects of cancer management.

Radiotherapy plays a critical role in cancer treatment, offering curative and palliative options to patients at various stages of the disease. However, the availability and utilization of radiotherapy services in resource-constrained regions, such as the northern part of Bangladesh, may be influenced by various demographic factors, including gender, and residential location. Therefore, studying the demographic status of cancer disease radiotherapy treatment becomes crucial in designing targeted strategies to improve access and optimize treatment outcomes in this specific region.

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The TCC, as a remarkable healthcare institution providing essential cancer care services, including radiotherapy along with surgery and chemotherapy to a large number of patients. This research will utilize a retrospective analysis of patient records over the span of 18 months to investigate the demographic characteristics of individuals undergoing radiotherapy treatment at this center. By examining age distribution, gender ratios, cancer types prevalent in the region, and their respective stages at diagnosis, this study aims to identify potential patterns and disparities that may impact cancer treatment outcomes in this region of Bangladesh. The findings from this research hold valuable implications for healthcare policymakers, researchers, and practitioners alike. Understanding the demographical status of cancer disease radiotherapy treatment in the northern Bangladesh will aid in devising targeted interventions to bridge healthcare gaps, enhance awareness, and improve the quality of cancer care in this region [3]. Ultimately, this analysis contributes to the global effort to combat cancer, serving as a crucial step towards achieving equitable and pragmatic cancer management in Bangladesh and beyond.

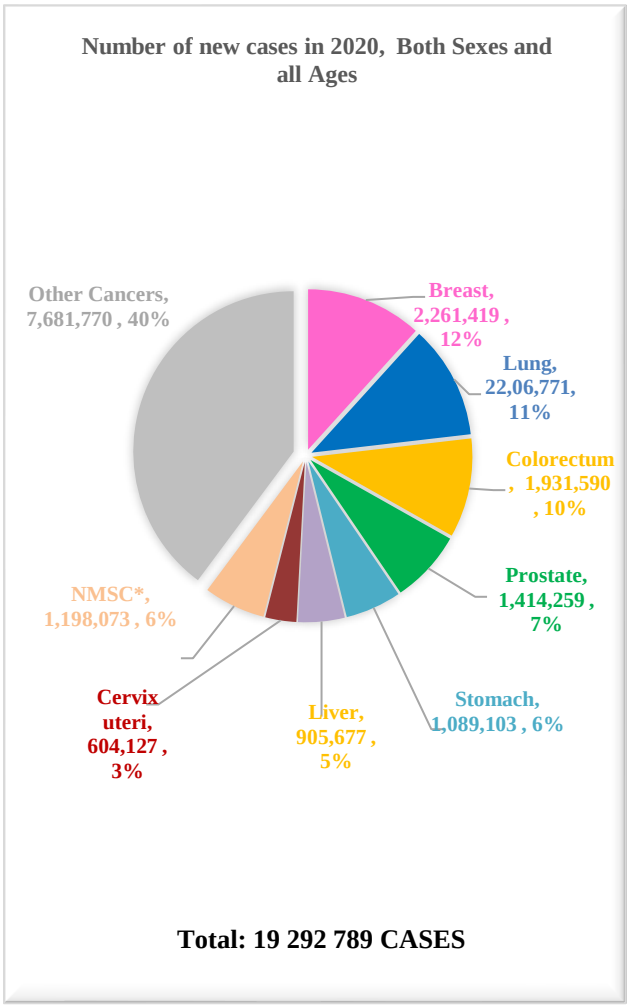


Fig. 1: Number of new cancer cases as per WHO-2020 report.

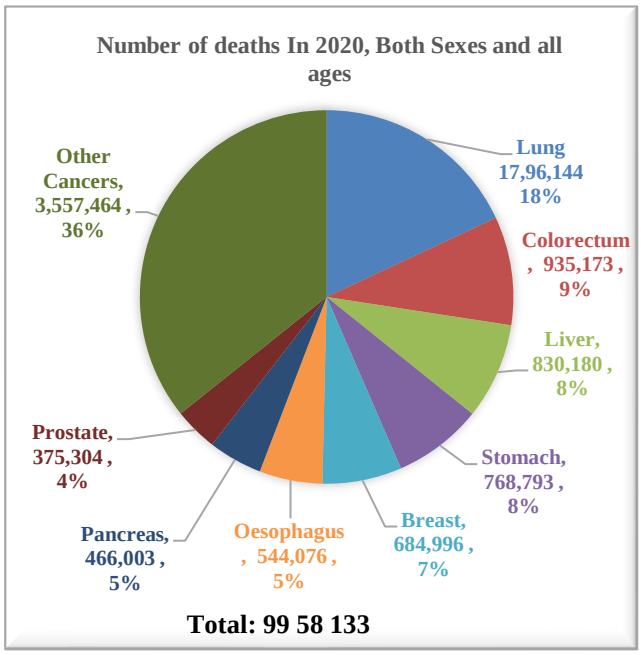


Fig. 2: Number of death due to cancer as per WHO-2020 report.

2. Materials and Methods

2.1. Study Design and Setting: This research employed a retrospective, observational study design to investigate the demographical status of cancer radiotherapy taken in the northern part of Bangladesh. The study has been conducted at the TMSS (Thengamara Mohila Sabuj Sangha) Cancer Center, a prominent healthcare facility in this region that provides comprehensive cancer care including radiotherapy services.

***2.2. Data Collection*:** Data was collected from the medical records of cancer patients who received Radiotherapy at TCC between Aug-2022 to Feb-2024 with appropriate ethical clearance and in accordance with data protection regulations. The study's data collection has been performed by trained healthcare personnel to ensure accuracy and consistency [4].

2.2.1 Inclusion Criteria

The inclusion criteria for patient selection were as follows:

- ✓ Patients diagnosed with cancer who received radiotherapy treatment at the TCC during the study period.
- ✓ Patients of all ages, genders, and cancer types have been included.

2.2.2 Exclusion Criteria

Patients have been excluded from the study due to the criteria:

- ✓ Patients with incomplete or missing medical records.

- ✓ Patients who received radiotherapy treatment at other healthcare facilities outside the TCC during the study.

2.3 Data Variables: The following demographic variables have been recorded as follows [5]:

- ✓ Age at the time of cancer diagnosis.
- ✓ Gender (male, female).
- ✓ Residential location (District).
- ✓ Types of cancer diagnosed (e.g., Head & Neck, breast, Cervix, Lung cancer, etc.).

2.4. Data Analysis: Descriptive statistical analysis has been performed to summarize and analyze the data [5]. Categorical variables are presented as frequencies and percentages, while continuous variables, such as age, were expressed as mean ± standard deviation. The demographic characteristics of cancer patients undergoing radiotherapy treatment have been evaluated and compared based on age, gender, residential location, cancer type, and diagnosis.

2.5. Ethical Considerations: The study followed the ethical guidelines stipulated in the Declaration of Helsinki and obtained approval from the appropriate institutional review board or ethics committee. To protect patient privacy and confidentiality, all patient data used in the study has been de-identified and anonymized.

2.6. Limitations: As with any retrospective study, this research also has me limitations, such as incomplete and missing data in medical records. Efforts have been made to minimize these limitations through rigorous data collection and analysis procedures [6].

2.7. Statistical Software: Data analysis was performed using Microsoft Excel software to ensure accurate and reliable results.

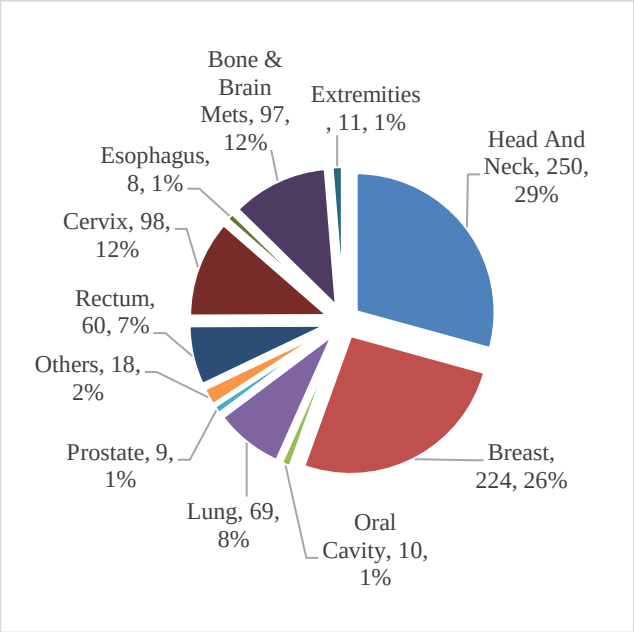
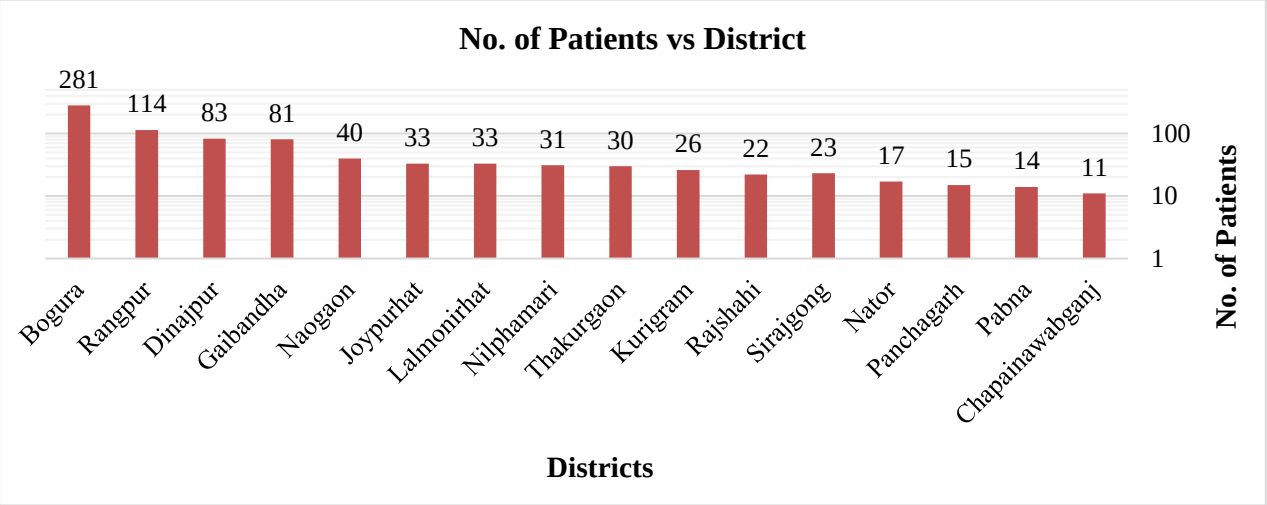


Fig. 3: Organ wise radiotherapy treatment at TCC.

The Materials and Methods outlined above provide a detailed overview of the study design, data collection process, inclusion and exclusion criteria, data variables, analysis methods, ethical considerations, limitations, and the statistical software used. These steps were essential in investigating the demographical status of cancer patients' radiotherapy treatment at the TCC, Bogura, Bangladesh [9].

Table 1: The table shows the number of district-wise cancer patients, and the number of organs affected by cancer.

Districts / Organ	Bogura	Rangpur	Dinajpur	Joypurhat	Gaibandha	Rajshahi	Naogaon	Natore	Lalmonirhat	Sirajgong	Thakurgaon	Nilphamari	Panchagarh	Kurigram	Pabna	Chapainawabgonj
Head & Neck	73	32	32	15	20	9	9	7	16	7	10	4	6	7	5	3
Breast	91	25	21	5	15	5	17	4	3	5	9	10	2	6	4	2
Lung	22	13	9	2	10	1	3	-	1	1	2	1	-	3	-	1
Rectum	12	13	3	3	12	1	1	1	3	2	-	3	1	4	-	1
Cervix	33	6	12	5	9	2	7	1	3	5	5	7	-	1	1	1
Prostate	3	3	-	-	-	-	-	-	-	1	1	-	-	-	1	-
Extremities	8	2	-	-	1	-	1	1	-	-	-	1	-	-	-	-
Bone & Brain Mets	18	16	5	3	11	2	2	3	6	1	2	4	3	5	2	1
Others	5	4	1	-	3	2			1	1	1	1	2		1	2
Total:	**281**	**114**	**83**	**33**	**81**	**22**	**40**	**17**	**33**	**23**	**30**	**31**	**14**	**26**	**14**	**11**



Graph 1: Radiotherapy patient's vs Districts (Northern Part of Bangladesh)

3. Result

A brief demographical distribution was analyzed and presented in this section according to different cancer types and age groups based on the radiotherapy data at TCC.

3.1. Cancer Distribution by Type

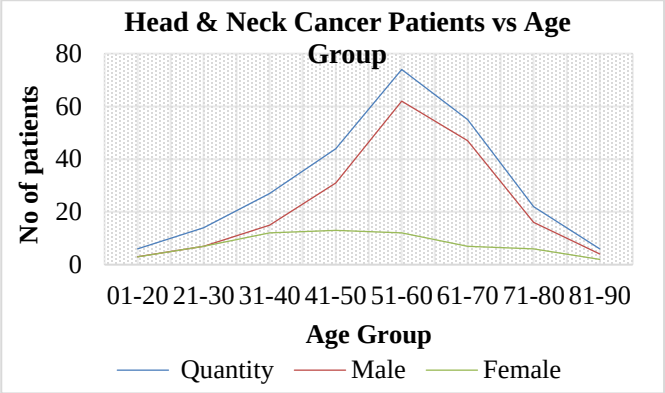
During the one and half year analysis, a total of 1013 cancer patients were treated by radiotherapy at the TCC among of them 854 patients had come from the northern part of Bangladesh. The distribution of cancer types among these patients revealed distinct patterns. The most prevalent types of cancer observed are:

3.1.1. Head & Neck

Among all cancer patients, 29.27% were diagnosed with head and neck cancer, making it the most frequently encountered cancer type at the TCC during the study period. Our analysis indicates that people of any age can be affected by head and neck cancer, but the incidence rate is higher among individuals aged 55±5 years, with a higher prevalence in men than women.

Table 2: Patients age group vs No of Head & Neck Cancer incidence.

Age (Years)	Quantity	Male	Female	Median Age	Standard Deviation
01-20	6	3	3	55	±15.27
21-30	14	7	7		
31-40	27	15	12		
41-50	44	31	13		
51-60	74	62	12		
61-70	55	47	7		
71-80	22	16	6		
81-90	6	4	2		



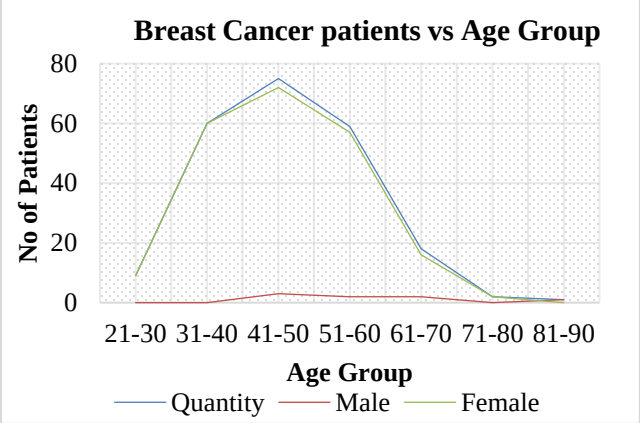
Graph 2: Head & Neck Cancer patients, Male, Female vs Age Group.

3.1.2 Breast Cancer

The second most common cancer type has been of breast cancer, accounting for 26.2% of cases. Our analysis indicates that individuals aged 20 and above can be affected by breast cancer, with the incidence rate being higher among those aged 46±4 years. Moreover, breast cancer exhibits a higher prevalence in women as that of men [7].

Table 3: Patients age group vs No Breast Cancer incidence

Age (Years)	Quantity	Male	Female	Median Age	Standard Deviation
21-30	09	0	09	46	±10.36
31-40	60	0	60		
41-50	75	3	72		
51-60	59	2	57		
61-70	18	2	16		
71-80	02	0	2		
81-90	01	1	0		



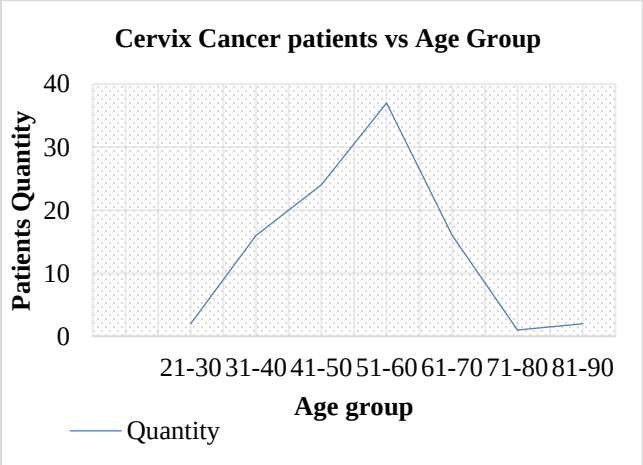
Graph 3: Breast Cancer patients, Male, Female vs Age Group

3.1.3. Cervix Cancer

Cervical cancer ranked third in terms of prevalence, constituting 11.5% of total cases. Our analysis indicates that women aged 20 and above can be affected by cervical cancer, with the incidence rate being higher among individuals aged 55±5 years.

Table 4: Patients age group vs No of Cervix Cancer incidence

Age (Years)	Quantity	Median Age	Standard Deviation
21-30	02	53	11.03
31-40	16		
41-50	24		
51-60	37		
61-70	16		
71-80	01		
81-90	02		



Graph 4: Cervix Cancer patients vs Age Group

3.1.4. Lung Cancer

Lung cancer ranked fourth, with 7.5% of radiotherapy patients treated among total patients. Where 6.5% was male and 1% was female.

3.2 Gender-based Cancer Distribution

Further analysis revealed distinct differences in cancer distribution based on gender.

3.2.1 Female

Among female patients, breast cancer was the most dominant, with 48% (219 female pts.) of the cases. Cervical cancer was the second most dominant with 21.5 % (98 pts.) and Head & Neck cancer was the third most prevalent comprising 13.6% of the total female cases [8].

3.2.2 Male

For male patients, head and neck cancer held the highest prevalence, with 50% (192 Pts.) of cases. Lung cancer was the second most common among male patients, constituting 14% (54 Pts.) and Rectum was the third most prevalent comprising 10% of the total male cases.

4. Discussion

The findings discern on the demographical patterns of cancer patients undergoing radiotherapy treatment at the TCC in Northern Bangladesh. The dominance of head and neck cancer among both male and female patients is of significant interest and could be attributed to factors such as regional lifestyle practices, environmental factors, and genetic predispositions.

The high prevalence of breast cancer among female patients aligns with global trends, underlining the importance of targeted screening and awareness campaigns for early detection. Similarly, the relatively high incidence of lung cancer among male patients warrants further investigation into potential risk factors, such as smoking habits and occupational exposures [2].

The prominence of cervix cancer, particularly among females, signifies the importance of continuing efforts to improve women's health and cancer prevention strategies in the region [8].

Findings of this study underscore the necessity for tailored cancer prevention, early detection, and treatment interventions that consider the specific demographical patterns observed in northern Bangladesh. As cancer incidence and prevalence patterns can vary based on geographical location and cultural practices, these insights can contribute to the development of more effective strategies for cancer management and control in the region.

This study provides valuable insights into the prevalence of different cancer types and their distribution by gender in northern Bangladesh. The results have implications for healthcare planning, resource allocation, and targeted interventions to address the specific challenges posed by different cancer types in the region.

5. Conclusion

In conclusion, this study relates to comprehensive analysis of cancer radiotherapy treatment and demographic patterns at TCC, in northern region of Bangladesh, has provided valuable insights into the distribution of patients, treatment modalities and the prevalence of different cancer types within the region. Here we use our one and a half year's patients documents and records for the analysis. The analysis revealed a distinct distribution of prevalent cancer types in the region. Head-neck cancer was the most common, accounting for **29%** of cases, followed by breast cancer at **26%**, cervix cancer at **12%**, and lung cancer at **8%**. Comparing these findings with global cancer trends, it is evident that the prevalence of specific cancer types differs regionally, emphasizing the necessity of tailored approaches to cancer prevention, early detection, and treatment. Notably, the prevalence of head-neck cancer in contrasts with global trends, where breast cancer ranks as the most common cancer. This discrepancy highlights the need for further investigation into the factors contributing to the higher incidence of head-neck cancer in this specific region. Socioeconomic, cultural, environmental, and lifestyle factors may all play a role in shaping this unique pattern. Therefore, a protocol and plan are required to a systematic research work in all over Bangladesh.

In addition, cancer distribution promotes a call for targeted research to elucidate the underlying causes of higher prevalence of head-neck cancer. This could involve interdisciplinary studies examining genetics, environmental exposures, Tobacco use, Low fruit and vegetable intake Harmful use of alcohol, dietary habits, and healthcare accessibility.

6. Compliance with Ethical Standards

There was no organization grant for this study project. There is no conflict of interest declared in this research article.

References

[1] Mondal RN, Shah, Jahan S, Sarker MR, Khanum JA, Mahfuj-Ul-Anwar, et al. Socio-Demographic and Clinical Characteristics of Cancer Patients of Rangpur, Bangladesh. Clin Oncol.2020; 5: 1735.

[2] Cancer Research UK. Worldwide cancer statistics. Cancer Research UK. CRUK; 2019. Available from: https://www.cancerresearchuk.org/health-professional/cancer-statistics/worldwide-cancer.

[3] Shah SC, Kayamba V, Peek RM, Heimburger D. Cancer Control in Low- and Middle-Income Countries: Is It Time to Consider Screening? Journal of Global Oncology. 2019; 5(5):1–8.

[4] Global Cancer Observatory [Internet]. Iarc.fr. 2018. Available from: https://gco.iarc.fr.

[5] Rahman, M. M., Shamsuzzaman M, Bhuiyan MMH, 'Development of spreadsheet for rapid assessment of therapeutic radiation dose delivery with electron and photon beams at various energies,' Journal of Cancer Prevention & Current Research, 2022; 13(1): 8–12. https://doi.org/10.15406/jcpcr.2022.13.00479.

[6] Rahman M, Shamsuzzaman M, Sarker M, Jobber A, Mia M, Asish Kumar Bairagi, et al. Dosimetric characterization of medical linear accelerator Photon and Electron beams for the treatment accuracy of cancer patients. World Journal of Advanced Engineering Technology and Sciences. 2021 Aug 30; 3(1):041–59. doi: 10.30574/wjaets. 2021.3.1.0046

[7] Cancer Tomorrow. gco.iarc.fr. [cited 2023 Aug 25]. https://gco.iarc.fr/tomorrow/home12.

[8] Sankaranarayanan R, Shyamalakumary B, Wesley R, Sreedevi Amma N, Parkin DM, Krishnan Nair M. Visual inspection with acetic acid in the early detection of cervical cancer and precursors. International Journal of Cancer. 1999; 80(1):161–3.

[9] Rahman, M. M., Rabby F., Ahmed, R., & Habib A. "Radiotherapy Bunker Shielding Calculations and Recommendations for Structural Design for High Energy Photon Facilities." no. 3, Sept. 2023, pp. 201–08. Journal of Radiation and Nuclear Applications, https://doi.org/10.18576/jrna/080302.

Biography:

Md. Motiur Rahman is an proficient Medical Physicist and work in TMSS Cancer Center, Bangladesh, as a Chief Medical Physicist and Assistant Project Director, where he has played a pivotal role in establishing cancer treatment facilities since February 2019. **Mr. Rahman** earned his Masters of Philosophy (M.Phil.) in Medical Physics from Jagannath University, Dhaka . He also holds a Master of Science (M.Sc.) and a Bachelor of Science (B.Sc.) in Applied Physics & Electronics Engineering from Rajshahi University. His academic background, coupled with his extensive practical experience, underpins his expertise in radiation oncology. Before his current role, Motiur served as Principal Radiation Oncology Medical Physicist at Delta Hospital Limited from 2011 to 2019. **Mr. Rahman** has a strong publication record, contributing to various journals on topics such as radiotherapy dosimetry and treatment planning. His notable works include papers on radiotherapy bunker shielding and dosimetric verification of treatment planning systems. Earlier in his career, he worked as a Senior Service and Application Engineer at Tradevision Ltd., where he provided technical support in radiotherapy software and dosimetry equipment. Motiur's dedication to medical physics and cancer treatment has significantly impacted the field, enhancing the quality of care for cancer patients in Bangladesh.

Professor **Dr. AKM Ahsan Habib** is a visionary leader and an esteemed medical professional currently serving as Project Director and Head of the Radiation Oncology Department at TMSS Medical College and Rafatullah Community Hospital. He earned his DMRT degree from BMSSU, bringing a wealth of expertise to his role in advancing cancer treatment. Before his tenure at TMSS, **Dr. Habib** led the Radiation Oncology Department at Shaheed Ziaur Rahman Medical College and Hospital. His dynamic and charismatic leadership style helped him make a lasting impact, culminating in the establishment of the TMSS Cancer Center in northern Bangladesh. Through his tireless efforts, the center has become a beacon of hope for cancer patients, providing state-of-the-art care in the region.

Rtn. Dr. Md. Matiur Rahman is a distinguished public health expert and leader in Bangladesh, currently serving as the Chief of the Health Sector at TMSS, one of the largest NGOs dedicated to supporting poor and marginalized communities. With a strong academic foundation, **Dr. Rahman** holds degrees in medicine, public health, and social sciences. He completed his MBBS from Dinajpur Medical College under the University of Rajshahi in 2002, followed by an MPH from Edward University in 2006, and a PhD from the Institute of Bangladesh Studies, University of Rajshahi, in 2013. **Dr. Rahman** is an active participant in national and international conferences, having presented at prestigious platforms such as the 5th International Conference on Child Right & Sight at Yale University, USA, and the International Conference on Peace & Value Education in Global Perspective in India. His areas of expertise include biotechnology, reproductive health, disaster management, nutrition, and the Covid-19 pandemic. A dedicated member of several professional organizations, **Dr. Rahman,** has received numerous accolades for his contributions to biotechnology and public health. His published research spans topics like primary health care for microfinance borrowers, contraceptive practices among RMG workers, and the health risks posed by Covid-19. His leadership and work continue to make a significant impact on health and social development in Bangladesh.