

Economic Burden of Illness of the Cervical Cancer Treatment Protocol in Bangladesh

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Abstract

Background: Cervical cancer is a significant health concern in Bangladesh, with high mortality rates due to limited awareness and costly treatments. The disease stages influence treatment protocols, ranging from surgery and radiotherapy for early stages to chemotherapy and radiation for advanced stages, but survival rates decrease as the cancer progresses. **Objective:** The objective of this study is to determine the economic impact of the disease and recommend cost-efficient strategies for prevention and treatment. **Methods:** A population-based, cross-sectional study was conducted with a stratified sample of cervical cancer patients from selected healthcare facilities across Bangladesh. Data collection involved structured interviews and validated questionnaires. The study measured the economic impact, treatment costs, and other related expenses. Quantitative data analysis was performed using SPSS v22, MS-Excel, and R Programming, with Multivariate regression analysis and Post Hoc tests, including the chi-square test, applied to selected indicators. **Results:** All respondents in the study were female, aged 34 - 75, with 72.3% aged 40 - 50. Most were illiterate (38.6%) and housewives (95.0%). Additionally, 98% were married, 85.10% married before age 18, and 46.50% experienced their first menstruation before age 12. Families typically had a monthly income of 10,000 - 30,000 Taka, spending similar amounts on treatment. Significant relationships were found between educational qualifications, occupation, personal hygiene practices, history of oral contraceptive use, and age of marriage ($p < 0.05$). Weak associations were noted for marital status, while moderate associations were seen for other variables. Income significantly affected treatment and related costs. **Conclusion:** The article emphasizes the impact of monthly family income on cervical cancer treatment costs, stressing the need for comprehensive support services to address the financial and emotional burdens faced by patients. Improving access to quality care and implementing measures

can enhance outcomes for cervical cancer patients in Bangladesh.

Keywords

Economic Burden, Cervical Cancer, Monthly Family Income, Treatment Cost, Related Others Cost

1. Introduction

Cervical cancer is a major health issue in Bangladesh, where 18% of women diagnosed with cervical cancer die due to a lack of awareness and expensive treatment options. According to a research report by the National Institute of Cancer Research and Hospital (NICRH), over 11,000 women in Bangladesh die from cervical cancer each year, which translates to an average of 28 deaths per day [1]. Cervical cancer is caused by the abnormal growth of cells in the cervix that can spread to other parts of the body. The cancer often has no early symptoms, but later symptoms may include abnormal vaginal bleeding, pelvic pain, or pain during sexual intercourse. It can affect anyone at any age and has a significant impact on patients, families, and society as a whole. The International Federation of Gynecology and Obstetrics recommends a staging system for cervical cancer. Stage I refers to carcinoma strictly confined to the cervix, while stage II involves carcinoma that has spread beyond the cervix to the upper part of the vagina, with invasion limited to a depth of less than 5 mm and no wider than 7 mm. Stage III refers to carcinoma that has extended to the pelvic wall, while stage IV involves carcinoma that has extended to the bladder, rectum, and other distant organs [2].

Currently, Bangladesh does not have a national protocol for treating cancer patients, and Bangladeshi patients are treated according to the cancer protocol for US citizens developed by the National Comprehensive Cancer Network (NCCN) [3]. Treatment protocols are determined based on the cancer stage. For stage I and II, surgery and radiotherapy (External Beam Radiation Therapy and Brachy Therapy) (EBRT + BT) are recommended. For stage III and IV, concurrent radiation therapy and chemotherapy are advised [4]. The costs associated with cervical cancer treatment can be substantial, including expenses related to diagnosis, treatment, and follow-up care, such as medical consultations, diagnostic tests, surgery, radiation therapy, chemotherapy, and medication. Additionally, there may be related costs, including the impact on patients' quality of life, lost productivity due to illness and treatment, and the emotional and psychological toll of the disease [5] [6]. The success of treatment is often expressed in terms of the 5-year survival rate, which varies based on the cancer stage. For stage I patients, the survival rate is between 80% - 90%, while for stage II patients, it is 76%. However, for stage III and IV patients, the survival rates drop to 50.5% and 29.6%, respectively, with most recurrences occurring within the first two years. To raise awareness of cervical cancer and encourage its prevention, diagnosis, and treatment, World Cancer Day is observed globally, including in Bangladesh [7].

2. Literature Review

A study published in the Journal of Global Oncology in 2018 examined the economic burden of cervical cancer in Bangladesh. The study found that the average cost of treatment for cervical cancer patients in Bangladesh was approximately USD 2560. The study also found that treatment costs were higher for patients with advanced stages of cancer. This study highlights the financial burden faced by cervical cancer patients in Bangladesh [8].

A study published in the BMC Cancer journal in 2014 examined the quality of life of cervical cancer patients in Bangladesh. The study found that cervical cancer had a significant negative impact on the quality of life of patients. The study also found that financial burden was one of the major concerns for patients and their families. This study emphasizes the need for policies and programs to address the financial burden faced by cervical cancer patients in Bangladesh [9].

A study published in the Asian Pacific Journal of Cancer Prevention in 2017 examined the awareness of cervical cancer and its screening among women in Bangladesh. The study found that the awareness of cervical cancer and its screening was low among women in Bangladesh. The study also found that the lack of awareness was one of the major barriers to screening. This study underscores the importance of raising awareness about cervical cancer and its screening among women in Bangladesh [10].

A study published in the Journal of Obstetrics and Gynaecology in 2016 examined the treatment outcomes of cervical cancer patients in Bangladesh. The study found that the overall survival rate of cervical cancer patients in Bangladesh was low. The study also found that the survival rate was lower for patients with advanced stages of cancer. This study showcases the need for effective treatment strategies for cervical cancer patients in Bangladesh [11].

A study published in the Indian Journal of Cancer in 2016 examined the patterns of care and survival outcomes of cervical cancer patients in Bangladesh. The study found that the majority of cervical cancer patients in Bangladesh were diagnosed at advanced stages of cancer. The study also found that the survival rate of cervical cancer patients was low, particularly for patients with advanced stages of cancer. This study features the need for early detection and effective treatment strategies for cervical cancer patients in Bangladesh [12].

3. Objective

3.1. General Objectives

To calculate the overall economic burden of the disease and suggest appropriate methods for prevention and treatment protocol, including cost effective ways of doing the same.

3.2. Specific Objectives

- 1) Evaluate the direct and indirect economic costs associated with cervical cancer treatment in Bangladesh, considering factors such as medical expenses,

productivity losses, and financial burdens on patients.

2) Investigate potential socio-economic disparities in accessing and affording cervical cancer treatment, considering variables such as income, education, and geographical location.

3) Based on the findings, provide evidence-based recommendations for policy interventions aimed at reducing the burden of cervical cancer treatment in Bangladesh, improving outcomes, and enhancing healthcare delivery.

4. Rationale of the Study

The rationale of this study is to explore the burden of illness and the associated costs of cervical cancer treatment in Bangladesh. Cervical cancer is a significant public health issue in Bangladesh, with a high mortality rate due to a lack of awareness and expensive treatment options. The current treatment protocol for cervical cancer in Bangladesh follows the National Comprehensive Cancer Network (NCCN) protocol developed for US citizens. The study will assess the costs of diagnosis and treatment, as well as indirect costs such as impact on quality of life and lost productivity. The findings will be valuable for policymakers, healthcare providers, and patients, helping to improve access to healthcare services, reduce financial burden, and inform decision-making regarding treatment options. Ultimately, the study aims to improve the quality of life for cervical cancer patients and their families in Bangladesh.

5. Limitations of the Study

This study examined the burden of illness associated with the treatment protocol of cervical cancer in Bangladesh. However, the study has limitations such as relying on available literature, not considering other contributing factors to the burden of illness, lack of primary data collection, and not comparing results with other countries. Further research is needed to fully understand the burden of illness of cervical cancer treatment protocol in different contexts.

6. Methodology

A population-based, cross-sectional survey was conducted from January 2018 to December 2018 in four hospitals in Dhaka, Bangladesh such as Bangabandhu Sheikh Mujib Medical University (Department of Oncology), National Institute of Cancer Research and Hospital (Department of Radiation Oncology), Dhaka Medical College Hospital (Department of Radiotherapy), Ahsania Mission Cancer and General Hospital (Department of Radiation Oncology). The study collected data at a single point in time from cervical cancer patients who received treatment. A total of 101 women, aged 34 to 75 years, were interviewed using a structured questionnaire. Proportional allocation under stratified sampling method is used to get the sample size. Data on socio-demographic characteristics, treatment cost, and related other cost of cervical cancer were collected. Multivariate regression analysis was used to evaluate the association between each of the outcomes and participants'

socioeconomic and demographic characteristics. Post-hoc test was used to identify exactly which groups differ from each other. Chi-square test is used to determine whether there is a significant association between dependent and independent variables. All analyses were performed using statistical software packages SPSS version 22.0 and MS-Excel.

7. Statistical Analysis and Result

Table 1 presents the socio-demographic characteristics of patients who were admitted to different hospitals in different divisions of Bangladesh. The table shows that out of the total 101 patients, 46.5% were admitted to hospitals in Dhaka division, while only 4% were admitted to hospitals in Chittagong division. In terms of the name of the hospital, the majority of patients (44.6%) were admitted to DMCH hospital, followed by NICRH hospital (44.6%). In terms of age group, the majority of patients (85.1%) were above 40 years of age, while only 14.9% were below 40 years of age. The majority of patients (91.1%) were Muslims, and only 8.9% were Hindus, almost all patients (98%) were married, while only 2% were unmarried. Most patients (87.1%) had their menarche below the age of 14, while only 12.9% had their menarche above the age of 14, most of the patients (85.1%) were married below the age of 18, while only 14.9% were married above the age of 18, the majority of patients (69.3%) had 1-3 children, while 28.7% had four or more children, and only 2% had no children. A total of 101 women had abortions. Among them, 81.2% had only one abortion, while 11.9% had two or more abortions. Among the different divisions, Dhaka had the highest number of women who had abortions (33.7%). In terms of education qualifications, the highest proportion of women were illiterate (38.6%), followed by those with education up to SSC (29.7%) and below primary (24.8%). Only one woman (1%) had a graduate degree, and two (2%) had postgraduate degrees. The majority of women were housewives (95%), while only five women (5%) were service holders. Based on the socio-economic condition, Lower Middle Class had the highest number of women (48.5%), followed by Poor (37.6%) and Middle Class (12.9%). Among the women 30.7% had a history of tobacco consumption, while 69.3% did not have any history of tobacco consumption. “Maintaining personal hygiene” and shows that 79 out of 101 people (or 78.2%) reported maintaining healthy personal hygiene. “Taking oral contraceptives” and shows that 36 out of 101 people (or 35.6%) reported taking oral contraceptives.

“Duration of under treatment” and shows that 44 out of 101 people (or 43.6%) reported being under treatment for a long time, while 57 out of 101 people (or 56.4%) reported being under treatment for a curable duration. “Duration of treatment” and shows that 61 out of 101 people (or 60.4%) reported being under treatment for days, while 40 out of 101 people (or 39.6%) reported being under treatment for weeks. “Treatment cost (per month)” shows that 50 out of 101 people (or 49.5%) reported their treatment cost to be less than 100,000 takas per month, 41 out of 101 people (or 40.6%) reported their treatment cost to be between

100,000 and 200,000 taka per month, and 10 out of 101 people (or 9.9%) reported their treatment cost to be more than 200,000 takas per month. "Related other cost" and shows that 36 out of 101 people (or 35.6%) reported their related other cost to be less than 100,000 takas, 54 out of 101 people (or 53.5%) reported their related other cost to be between 100,000 and 200,000 takas, and 10 out of 101 people (or 9.9%) reported their related other cost to be more than 200,000 takas.

Table 1. Division-wise socio-demographic characters of patients.

Socio-demographic characteristics	Division								
	Dhaka	Chittagong	Barishal	Khulna	Rajshahi	Mymensingh	Sylhet	Rangpur	Total
	<i>N (%)</i>	<i>N (%)</i>	<i>N (%)</i>	<i>N (%)</i>	<i>N (%)</i>	<i>N (%)</i>	<i>N (%)</i>	<i>N (%)</i>	<i>N (%)</i>
Number of Patients	47 (46.5)	4 (4)	19 (18.8)	9 (8.9)	7 (6.9)	8 (7.9)	3 (3)	4 (4)	101 (100)
Name of the hospital									
BSMMU	7 (6.9)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	7 (6.9)
NICRH	15 (14.9)	4 (4)	9 (8.9)	6 (5.9)	2 (2)	4 (4)	3 (3)	3 (3)	45 (44.6)
DMCH	23 (22.8)	0 (0)	7 (6.9)	2 (2)	2 (2)	3 (3)	2 (2)	1 (1)	39 (38.6)
AMCGH	2 (2)	0 (0)	3 (3)	1 (1)	3 (3)	1 (1)	1 (1)	0 (0)	10 (9.9)
Age Group									
Less than 40 (<40)	2 (2)	0 (0)	5 (5)	4 (4)	1 (1)	0 (0)	1 (1)	2 (2)	15 (14.9)
More than 40 (>40)	45 (44.6)	4 (4)	14 (13.9)	5 (5)	6 (5.9)	8 (7.9)	2 (2)	2 (2)	86 (85.1)
Religion									
Muslim	44 (43.6)	4 (4)	19 (18.8)	6 (5.9)	7 (6.9)	5 (5)	3 (3)	4 (4)	92 (91.1)
Hinduism	3 (3)	0 (0)	0 (0)	3 (3)	0 (0)	3 (3)	0 (0)	0 (0)	9 (8.9)
Marital Status									
Married	45 (44.6)	4 (4)	19 (18.8)	9 (8.9)	7 (6.9)	8 (7.9)	3 (3)	4 (4)	99 (98)
Unmarried	2 (2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (2)
Age of menarche									
Less than 14 (<14)	45 (44.6)	1 (1)	16 (15.38)	8 (7.9)	5 (5)	7 (6.9)	3 (3)	3 (3)	88 (87.1)
More than 14 (>14)	2 (2)	3 (3)	3 (3)	1 (1)	2 (2)	1 (1)	0 (0)	1 (1)	13 (12.9)
Age of Marriage									
Less than 18 (>18)	35 (34.7)	4 (4)	17 (16.8)	8 (7.9)	7 (6.9)	8 (7.9)	3 (3)	4 (4)	86 (85.1)
More than 18 (<18)	12 (11.9)	0 (0)	2 (2)	1 (1)	0 (0)	0 (0)	0 (0)	0 (0)	15 (14.9)
Number of children									
1 - 3 children	31 (30.7)	4 (4)	14 (13.9)	8 (7.9)	3 (3)	6 (5.9)	1 (1)	3 (3)	70 (69.3)
4 or more children	16 (15.8)	0 (0)	3 (3)	1 (1)	4 (4)	2 (2)	2 (2)	1 (1)	29 (28.7)
No children	0 (0)	0 (0)	2 (2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (2)
Number of abortion									
No	34 (33.7)	4 (4)	16 (15.8)	8 (7.9)	7 (6.9)	7 (6.9)	3 (3)	3 (3)	82 (81.2)
One	6 (5.9)	0 (0)	3 (3)	1 (1)	0 (0)	1 (1)	0 (0)	1 (1)	12 (11.9)
Two or more	7 (6.9)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	7 (6.9)

Continued

Education Qualifications									
Illiterate	21 (20.8)	0 (0)	9 (8.9)	1 (1)	2 (2)	3 (3)	1 (1)	2 (2)	39 (38.6)
Below Primary	6 (5.9)	4 (4)	3 (3)	5 (5)	3 (3)	3 (3)	0 (0)	1 (1)	25 (24.8)
Above Primary up to SSC	17 (16.8)	0 (0)	5 (5)	3 (3)	2 (2)	2 (2)	0 (0)	1 (1)	30 (29.7)
HSC	0 (0)	0 (0)	2 (2)	0 (0)	0 (0)	0 (0)	2 (2)	0 (0)	4 (4)
Graduate	1 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)
Postgraduate	2 (2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (2)
Occupation									
House Wife	44 (43.6)	4 (4)	17 (16.8)	9 (8.9)	7 (6.9)	8 (7.9)	3 (3)	4 (4.0)	96 (95)
Service Holder	3 (3)	0 (0)	2 (2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	5 (5)
Socio-economic condition									
Poor	22 (21.8)	0 (0)	7 (6.9)	3 (3)	2 (2)	3 (3)	1 (1)	0 (0)	38 (37.6)
Lower Middle Class	17 (16.8)	2 (2)	11 (10.9)	5 (5)	5 (5)	3 (3)	2 (2)	4 (4)	49 (48.5)
Middle Class	7 (6.9)	2 (2)	1 (1)	1 (1)	0 (0)	2 (2)	0 (0)	0 (0)	13 (12.9)
Group V	1 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)
History of tobacco consumption									
Yes	15 (14.9)	2 (2)	8 (7.9)	3 (3)	1 (1)	1 (1)	1 (1)	0 (0)	31 (30.7)
No	32 (31.7)	2 (2)	11 (10.9)	6 (5.9)	6 (5.9)	7 (6.9)	2 (2)	4 (4)	70 (69.3)
Maintaining personal hygiene									
Healthy	34 (33.7)	4 (4)	16 (15.8)	7 (6.9)	6 (5.9)	5 (5)	3 (3)	4 (4)	79 (78.2)
Unhealthy	13 (12.9)	0 (0)	3 (3)	2 (2)	1 (1)	3 (0)	0 (0)	0 (0)	22 (21.8)
Taking oral contraceptives									
Yes	20 (19.8)	0 (0)	6 (5.9)	3 (3)	0 (0)	2 (2)	2 (2)	3 (3)	36 (35.6)
No	27 (26.7)	4 (4)	13 (12.9)	6 (5.9)	7 (6.9)	6 (5.9)	1 (1)	1 (1)	65 (64.4)
Duration of under treatment									
For long time	27 (26.7)	0 (0)	3 (3)	3 (3)	3 (3)	3 (3)	3 (3)	2 (2)	44 (43.6)
Curable	20 (19.8)	4 (4)	16 (15.8)	6 (5.9)	4 (4)	5 (5)	0 (0)	2 (2)	57 (56.4)
Duration of treatment									
Days	27 (26.7)	1 (1)	13 (12.9)	6 (5.9)	5 (5)	4 (4)	3 (3)	2 (2)	61 (60.4)
Weeks	20 (19.8)	3 (3)	6 (5.9)	3 (3)	2 (2)	4 (4)	0 (0)	2 (2)	40 (39.6)
Treatment cost (per month)									
Less than 100,000 BDT	26 (25.7)	1 (1)	8 (7.9)	4 (4)	3 (3)	4 (4)	2 (2)	2 (2)	50 (49.5)
100,000 - 200,000 BDT	19 (18.8)	3 (3)	8 (7.9)	4 (4)	1 (1)	3 (3)	1 (1)	2 (2)	41 (40.6)
More than 200,000 BDT	2 (2)	0 (0)	3 (3)	1 (1)	3 (3)	1 (1)	1 (1)	0 (0)	10 (9.9)
Related other cost									
Less than 100,000 BDT	20 (19.8)	2 (2)	5 (5)	2 (2)	3 (3)	3 (3)	1 (1)	0 (0)	36 (35.6)
100,000 - 200,000 BDT	23 (22.8)	2 (2)	12 (11.9)	6 (5.9)	1 (1)	4 (4)	2 (2)	4 (4)	54 (53.5)
More than 200,000 BDT	4 (4)	0 (0)	2 (2)	1 (1)	3 (3)	1 (1)	0 (0)	0 (0)	10.95

Table 2 shows the total monthly treatment cost for different income groups and the number and percentage of families in each income group. For Poor, there are 26 families, which is 25.7% of the total families. For Lower Middle Class, there are 22 families, which is 21.8% of the total families. For Middle Class, there are only 2 families, which is 2.0% of the total families. And finally, for Rich, there is only 1 family, which is 1.0% of the total families. In terms of the monthly total treatment cost, for families with a monthly income less than 100,000 Taka, the total cost is 50, which is 49.5% of the total cost. For families with a monthly income between 100,000 to 200,000 Taka, the total cost is 41, which is 40.6% of the total cost. And for families with a monthly income greater than 200,000 Taka, the total cost is only 10, which is 9.9% of the total cost. Overall, the table suggests that families with lower incomes have a higher percentage of total treatment cost compared to families with higher incomes.

Table 2. Monthly family income-wise treatment cost.

Monthly Family Income	Monthly total treatment cost					
	Less than 100,000		100,000 - 200,000		More than 200,000	
	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
Poor (BDT < 10,000 BDT)	26	25.7%	10	9.9%	2	2.0%
Lower Middle Class (BDT 10,000 - 30,000 BDT)	22	21.8%	19	18.8%	8	7.9%
Middle Class (BDT 30,000 - 40,000 BDT)	2	2.0%	11	10.9%	0	0.0%
Rich (BDT > 40,000 BDT)	0	0.0%	1	1.0%	0	0.0%
Total	50	49.5%	41	40.6%	10	9.9%

Table 3 shows the number and percentage of families in each income group. For Poor, there are 21 families, which is 20.8% of the total families. For Lower Middle Class, there are 15 families, which is 14.9% of the total families. For Middle Class, there are no families with a monthly income less than 40,000 Taka. And finally, for Rich, there is no family in the other two income groups. In terms of the total related other cost, for families with a monthly income less than 100,000 Taka, the total cost is 36, which is 35.6% of the total cost. For families with a monthly income between 100,000 to 200,000 Taka, the total cost is 54, which is 53.5% of the total cost. And for families with a monthly income greater than 200,000 Taka, the total cost is only 11, which is 10.9% of the total cost. Overall, the table suggests that families with higher income have a higher percentage of total related other cost compared to families with lower income.

Table 4 shows the number and percentage of families in each income group. For Poor, there are 34 families, which is 33.7% of the total families. For Lower Middle Class, there are 34 families, which is also 33.7% of the total families. For Middle Class, there are 2 families, which is 2.0% of the total families. And finally, for Rich, there is no family in the other three income groups. In terms of the total

cost, for families with a monthly income less than 250,000 Taka, the total cost is 70, which is 69.3% of the total cost. For families with a monthly income between 250,000 to 350,000 Taka, the total cost is 15, which is 14.9% of the total cost. And for families with a monthly income greater than 350,000 Taka, the total cost is 16, which is 15.8% of the total cost. **Table 4** suggests that families with lower incomes have a higher percentage of total costs than families with higher incomes. Additionally, the majority of families fall under Poor and Lower Middle Class, indicating that the majority of the population has a monthly income less than 30,000 Taka.

Table 3. Monthly family income wise related other cost.

Monthly Family Income	Total related other cost					
	Less than 100,000		100,000 - 200,000		More than 200,000	
	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
Poor (<10,000 BDT)	21	20.8%	16	15.8%	1	1.0%
Lower Middle Class (10,000 - 30,000 BDT)	15	14.9%	29	28.7%	5	5.0%
Middle Class (30,000 - 40,000 BDT)	0	0.0%	9	8.9%	4	4.0%
Rich (>40,000 BDT)	0	0.0%	0	0.0%	1	1.0%
Total	36	35.6%	54	53.5%	11	10.9%

Table 4. Monthly family income wise total cost.

Monthly Family Income	Total Cost (Treatment cost + related other cost)					
	Less than 250,000		250,000 - 350,000		More than 350,000	
	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
Poor < 10,000 BDT	34	33.7%	2	2.0%	2	2.0%
Lower Middle-Class 10,000 - 30,000 BDT	34	33.7%	7	6.9%	8	7.9%
Middle Class 30,000 - 40,000 BDT	2	2.0%	6	5.9%	5	5.0%
Rich > 40,000 BDT	0	0.0%	0	0.0%	1	1.0%
Total	70	69.3%	15	14.9%	16	15.8%

Table 5 presents the hospital-wise cost for treatment cost, related other cost, and total cost. For the treatment cost, the mean and standard deviation (SD) for BSMMU is 125,714.28 and 49,617.58, respectively. For NICRH, the mean and SD are 115,711.11 and 18,409.01, respectively. For DMCH, the mean and SD are 101,025.64 and 13,187.88, respectively. Finally, for AMCGH, the mean and SD are 333,000 and 33,681.51, respectively. For the related other costs, the mean and SD for BSMMU are 147,142.85 and 63,975.06, respectively. For NICRH, the mean and SD are 132,711.11 and 46,221.11, respectively. For DMCH, the mean and SD are 103,666.66 and 23,809.64, respectively. Finally, for AMCGH, the mean and SD are 199,400 and 34,648.07, respectively. For the total cost, which is the sum of

treatment cost and related other costs, the mean and SD for BSMMU are 272,857.14 and 108,425.74, respectively. For NICRH, the mean and SD are 248,422.22 and 59,386.82, respectively. For DMCH, the mean and SD are 204,692.31 and 29,126.67, respectively. Finally, for AMCGH, the mean and SD are 199,400 and 51,629.44, respectively. Overall, the table indicates that BSMMU has the highest mean cost for both treatment and related other costs as well as the highest mean total cost among the four hospitals. On the other hand, DMCH has the lowest mean cost for both treatment and related other costs as well as the lowest mean total cost among the four hospitals.

Table 5. Hospital wise cost (Mean \pm SD).

Name of Hospital	Treatment Cost (Mean \pm SD)	Related other cost (Mean \pm SD)	Total cost (Mean \pm SD)
BSMMU	125,714.28 \pm 49,617.58	147,142.85 \pm 63,975.06	272,857.14 \pm 108,425.74
NICRH	115,711.11 \pm 18,409.01	132,711.11 \pm 46,221.11	248,422.22 \pm 59,386.82
DMCH	101,025.64 \pm 13,187.88	103,666.66 \pm 23,809.64	204,692.31 \pm 29,126.67
AMCGH	333,000 \pm 33,681.51	199,400 \pm 34,648.07	199,400 \pm 51,629.44

From **Table 6**, the **Pillai's Trace test and the Wilk's lambda** is used to know the overall significance of the relationship between the groups of variables. And the test indicates that there is a significant relationship between the sets of variables. That means the socio-economic condition has a significant effect on treatment cost and related other cost.

Table 6. Multivariate regression analysis.

Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	0.844	259.332b	2	96	0.000
	Wilks' Lambda	0.156	259.332b	2	96	0.000
	Hotelling's Trace	5.403	259.332b	2	96	0.000
	Roy's Largest Root	5.403	259.332b	2	96	0.000
Socio –economic condition	Pillai's Trace	0.506	10.959	6	194	0.000
	Wilks' Lambda	0.51	12.816b	6	192	0.000
	Hotelling's Trace	0.93	14.721	6	190	0.000
	Roy's Largest Root	0.894	28.919c	3	97	0.000

a) Design: Intercept + Socio-economic condition; b) Exact statistic; c) The statistic is an upper bound on F that yields a lower bound on the significance level.

In Multivariate regression analysis **Hotelling's Trace test and Roy Largest Root test** is used to know the difference between the mean vectors of two groups of variables. The two test indicates that the significant difference between the mean vectors of two groups of variables. That means the socio-economic condition has significant effect on the treatment cost of the patients.

Table 7 shows the individual **p-values** for both treatment cost and other related costs. The p-value for Treatment cost is **0.192** these values is greater than **0.05** it

means that Socio-economic condition has not statistically significant effect on treatment cost **but** the p-value for related other cost is **0.000** these values is less than **0.05** it means that the Socio-economic condition has statistically significant effect on related other cost.

Table 7. Tests of between-subjects effects.

	Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	Treatment Cost	23,695,955,096.369 ^a	3	7.90E+09	1.608	0.192
	Related Other Cost	84,940,925,404.033 ^b	3	2.83E+10	19.142	0.000
Intercept	Treatment Cost	5.13E+11	1	5.13E+11	104.448	0.000
	Related Other Cost	7.07E+11	1	7.07E+11	477.657	0.000
Socio economic condition	Treatment Cost	2.37E+10	3	7.90E+09	1.608	0.192
	Related Other Cost	8.49E+10	3	2.83E+10	19.142	0.000

a. R Squared = 0.047 (Adjusted R Squared = 0.018). b. R Squared = 0.372 (Adjusted R Squared = 0.352).

Table 8 displays the Tukey post hoc comparisons for each socio-economic condition.

Table 8. Post hoc tests.

Multiple Comparisons							
Dependent Variable	(I) Monthly family income	(J) Monthly family income	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Treatment Cost	<10,000 BDT	10,000 - 30,000 BDT	-3.03E+04	1.51E+04	0.194	-6.99E+04	9.27E+03
		30,000 - 40,000 BDT	-2.21E+04	2.32E+04	0.775	-8.28E+04	3.85E+04
		>40,000 BDT	-6.13E+04	5.08E+04	0.625	-1.94E+05	7.16E+04
	10,000 - 30,000 BDT	<10,000 BDT	3.03E+04	1.51E+04	0.194	-9.27E+03	6.99E+04
		30,000 - 40,000 BDT	8.19E+03	2.26E+04	0.984	-5.08E+04	6.72E+04
		>40,000 BDT	-3.10E+04	5.06E+04	0.928	-1.63E+05	1.01E+05
	30,000 - 40,000 BDT	<10,000 BDT	2.21E+04	2.32E+04	0.775	-3.85E+04	8.28E+04
		10,000 - 30,000 BDT	-8.19E+03	2.26E+04	0.984	-6.72E+04	5.08E+04
		>40,000 BDT	-3.92E+04	5.35E+04	0.884	-1.79E+05	1.01E+05
	>40,000 BDT	BDT <10,000	6.13E+04	5.08E+04	0.625	-7.16E+04	1.94E+05
		BDT 10,000 - 30,000 BDT	3.10E+04	5.06E+04	0.928	-1.01E+05	1.63E+05
		BDT 30,000 - 40,000 BDT	3.92E+04	5.35E+04	0.884	-1.01E+05	1.79E+05
H Related Other Cost	<10,000 BDT	10,000 - 30,000 BDT	-24,442.53 [*]	8.31E+03	0.021	-4.62E+04	-2.71E+03
		30,000 - 40,000 BDT	-77,122.81 [*]	1.27E+04	0.000	-1.10E+05	-4.38E+04
		>40,000 BDT	-144,789.47 [*]	2.79E+04	0.000	-2.18E+05	-7.19E+04
	10,000 - 30,000 BDT	BDT < 10,000	24,442.53 [*]	8.31E+03	0.021	2.71E+03	4.62E+04
		30,000 - 40,000 BDT	-52,680.27 [*]	1.24E+04	0.000	-8.51E+04	-2.03E+04
		>40,000 BDT	-120,346.94 [*]	2.77E+04	0.000	-1.93E+05	-4.78E+04

Continued

30,000 - 40,000 BDT	<10,000 BDT	77,122.81*	1.27E+04	0.000	4.38E+04	1.10E+05
	10,000 - 30,000 BDT	52,680.27*	1.24E+04	0.000	2.03E+04	8.51E+04
	>40,000 BDT	-6.77E+04	2.94E+04	0.104	-1.44E+05	9.12E+03
>40,000 BDT	<10,000 BDT	144,789.47*	2.79E+04	0.000	7.19E+04	2.18E+05
	10,000 - 30,000 BDT	120,346.94*	2.77E+04	0.000	4.78E+04	1.93E+05
	30,000 - 40,000 BDT	6.77E+04	2.94E+04	0.104	-9.12E+03	1.44E+05

Based on observed means. The error term is Mean Square (Error) = 1,479,150,355.639. *. The mean difference is significant at the .05 level.

From the table we can observe the following:

1) The Treatment Cost for individuals with BDT < 10,000 is not significantly different than the Treatment Cost for individuals with BDT 10,000 - 30,000) | p-value = 0.194.

2) The Treatment Cost for individuals with BDT 10,000 - 30,000 is not significantly different than the Treatment Cost for individuals with BDT 10,000 - 30,000) | p-value = 0.984.

3) The Treatment Cost for individuals with BDT 30,000 - 40,000 BDT is not significantly different than the Treatment Cost for individuals with >40,000/) | p-value = 0.775.

4) The Treatment Cost for individuals with BDT > 40,000 is not significantly different than the Treatment Cost for individuals with BDT > 40,000/) | p-value = 0.625.

5) The Related Other Cost for individuals with BDT<10,000 is significantly different than the Treatment Cost for individuals with 10,000 - 30,000 BDT p-value = 0.021.

6) The Related Other Cost for individuals with 30,000 - 40,000 BDT is significantly different than the Treatment Cost for individuals with BDT 10,000 - 30,000 | p-value = 0.104.

7) The Related Other Cost for individuals with BDT > 40,000 is significantly different than the Treatment Cost for individuals with 10,000 - 30,000 BDT p-value = 0.000.

From **Table 9**, we can see that there is a relation between Education Qualifications and Occupation $p(0.001) < 0.05$, Way of Maintaining Personal Hygiene $p(0.000) < 0.05$, History of Taking Oral Contraceptives: (More than 5 Years) $p(0.001) < 0.015$, Age of Marriage $p(0.003) < 0.05$. The value of Cramer's V/Effect size (ES) ≤ 0.2 at Marital Status that's mean the fields are only weakly associated. The value of Cramer's V/Effect size (ES) $0.2 < ES \leq 0.6$ at Occupation, History of tobacco consumption, Way of Maintaining Personal Hygiene, History of Taking Oral Contraceptives: (More than 5 Years), Age of Marriage that's mean the fields are moderately associated.

Table 9. Chi-square test.

Variables	Educational Qualification						χ^2 -value	df	p-value	Cramer's V
	Illiterate	Below Primary	Above Primary up to SSC	HSC	Graduate	Postgraduate				
	Occupation									
House Wife	36	25	30	2	1	2	20.896 ^a	5	0.001	0.455
Service Holder	3	0	0	2	0	0				
	Marital Status									
Married	37	25	30	4	1	2	3.244 ^a	5	0.662	0.179
Unmarried	2	0	0	0	0	0				
	History of tobacco consumption									
Yes	16	4	8	2	1	0	8.568 ^a	5	0.128	0.291
No	23	21	22	2	0	2				
	Way of Maintaining Personal Hygiene									
Healthy	20	23	29	4	1	2	27.338 ^a	5	0.000	0.520
Unhealthy	19	2	1	0	0	0				
	History of Taking Oral Contraceptives: (More than 5 Years)									
Yes	20	7	5	2	0	2	14.029 ^a	5	0.015	0.373
No	19	18	25	2	1	0				
	Age of Marriage									
Less than 18	32	23	28	2	1	0	18.362 ^a	5	0.003	0.426
More than 18	7	2	2	2	0	2				

8. Discussion

This study highlights the significant economic burden of cervical cancer treatment in Bangladesh, with low-income families facing substantial financial challenges. The research, conducted through a population-based, cross-sectional approach, reveals that cervical cancer patients, most of whom are illiterate housewives married before age 18, bear heavy treatment costs that are closely linked to their socio-economic status. The study's multivariate regression analysis shows that while socio-economic conditions do not have a statistically significant impact on direct treatment costs, they do influence related costs, indicating that poorer families face a disproportionate financial burden. With most patients spending between 100,000 to 200,000 Taka per month on treatment, the findings underscore the need for government intervention to improve access to affordable healthcare, promote early diagnosis through awareness campaigns, and invest in specialized healthcare resources. These steps would alleviate the dual financial and emotional strain on families and enhance patient outcomes in Bangladesh.

9. Recommendation

1) Increase awareness about the cervical cancer diseases. For this purpose, organize educational program and campaigns in the both rural and urban area.

2) Regular screening and early diagnosis are crucial for the effective management of cervical cancer. The government and healthcare organizations should take necessary steps on it.

3) Need to improve treatment facilities for cervical cancer in Bangladesh. Such as specialized medical equipment, medicines and trained healthcare professionals etc.

4) The cost of cervical cancer treatment can be a significant burden on patients and their families, especially those from low-income households. The government and healthcare organizations can work together to reduce the cost of treatment, increase access to affordable medicines, and provide financial support to those in need.

5) Research is essential to understand the epidemiology, risk factors, and treatment outcomes of cervical cancer in Bangladesh. So promoting research and development in this field can lead to the development of more effective prevention and treatment strategies.

10. Conclusion

Based on the available information, it can be concluded that the burden of cervical cancer in Bangladesh is significant. The high burden of cervical cancer in Bangladesh is primarily due to a lack of awareness about the disease, inadequate diagnosis, shortage of healthcare facilities, and poor health infrastructure and socio-economic condition of the respondent. In this study, most of the cervical cancer patients in Dhaka division (46.5%) The treatment protocols for cervical cancer in Bangladesh typically involve a combination of external beam radiation therapy, brachytherapy, chemotherapy and radiation therapy. Nowadays these treatments are more expensive. For this reason, most of the women in Bangladesh may not receive appropriate treatment, which can further increase the burden of illness associated with cervical cancer. In this research we use Multivariate regression analysis to carry out the association between socio economic effect on treatment cost and other related cost which is significant. Also proposed a model to find out the total cost with the help of the independent variable. Overall, it can be concluded that cervical cancer is a significant public health concern in Bangladesh, and efforts are needed to improve awareness, diagnosis, and treatment of this disease to reduce the burden of illness associated with it.

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Data Availability

All data relevant to the paper is included in the main text.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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List of Abbreviations

LMICs = Low- and Middle-Income Countries, NICRH = National Institute of Cancer Research and Hospital, NCCN = National Comprehensive Cancer Net, EBRT = External Beam Radiation Therapy, BT = Brachy Therapy, CEA = Cost-Effectiveness Analysis, WHO = World Health Organization's, ICF = International Classification of Functioning, SDOH = Social Determinants of Health, HPV = Human Papillomavirus, DNA = Deoxyribonucleic Acid, VIA = Visual Inspection With Acetic Acid, LEEP = Cryotherapy and Loop Electrosurgical Excision Procedure, BSMMU = Bangabandhu Sheikh Mujib Medical University, DMCH = Dhaka Medical College Hospital, AMCGH = Ahsania Mission Cancer and General Hospital, SPSS = Statistical Package for Social Sciences, SSC = Secondary School Certificate, HSC = Higher Secondary Certificate, DF = Degrees of Freedom, ES = Effective Size.