Journal of Carcinogenesis
Covering Genesis to Therapeutics

Journal of Carcinogenesis, ISSN: 1477-3163
2025; Vol 24: Issue 1s, https://carcinogenesis.com/

Socioeconomic and Reproductive Correlates of TNBC: Insights from a Bangladeshi Cohort

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ABSTRACT

Background: Triple-negative breast cancer (TNBC) is an aggressive variety of breast cancer with limited therapeutic options, disproportionately affecting younger and socioeconomically disadvantaged women. Despite increasing incidence in South Asia, region-specific data remain scarce. This study aimed to assess the demographic, reproductive, and clinical characteristics of TNBC patients in a tertiary care center in Bangladesh. ***Methods:*** A cross-sectional study was performed at National Institute of Cancer Research & Hospital, Dhaka and Ahsania Mission Cancer and General Hospital, Dhaka, from January 2018 to December 2024. A total of 198 immunohistochemically confirmed TNBC patients were included. Data on socio-demographics, reproductive history, body mass index, family history, and clinical features were collected through structured interviews and medical records. Descriptive statistics were performed using SPSS version 25.0. ***Results:*** The mean age at diagnosis was 46.75 ± 9.10 years, with 60.6% of patients being premenopausal. Most participants were married (98.9%), multiparous (60.6%), and had breastfed (93.9%). High parity and early age at first childbirth (mean age 20.56 ± 3.96 years) were common. The majority belonged to middle (55.1%) or lower-middle (36.4%) socioeconomic classes, and 56.6% hailed from in rural settings. A positive family history of cancer was reported by 31.3% of participants, with 18.7% participants reported history of breast cancer specifically. The mean BMI was 23.74 ± 3.71 kg/m². Hypertension (68.2%) and diabetes (57.6%) were the most prevalent comorbidities. ***Conclusion:*** TNBC in this Bangladeshi cohort was more prevalent among younger, premenopausal women with high parity and limited socioeconomic resources. Despite high breastfeeding rates, the persistence of TNBC suggests the influence of genetic, metabolic, and environmental factors. These findings underscore the need for early detection strategies and region-specific risk profiling in South Asian populations.

Keywords: *Triple negative breast cancer; epidemiology; socio-demographic; breast cancer; prevalence; clinical characteristics.*

How to Cite: Kamrun Nahar Liza, Md. Rashid Un Nabi, Ashim Kumar Sengupta, Sharif Ahmed, Sadeka Sultana Ahmed, Samia Wahid Muna, Nusrat Ahmed, Tarim Mahmood, (2025). Socioeconomic and Reproductive Correlates of TNBC: Insights from a Bangladeshi Cohort, *Journal of Carcinogenesis*, *Vol.24*, *No.1s*, 75-82.

INTRODUCTION

Breast cancer (BC) remains the most common malignancy among women globally and a leading cause of cancer-related mortality. In 2020, approximately 2.3 million cases of BC were newly detected in women across the globe, and approximately 685,000 patients did not survive. [1] In Bangladesh, recent studies and institutional reports emphasize the continued burden of the disease condition, highlighting the majority of the burden particularly among pre-menopausal and socioeconomically disadvantaged populations [2,3]

Triple-negative breast cancer (TNBC) is considered as an aggressive type of malignancy, accounting for 15–25% of all BCs and is the product of impaired expression of progesterone and estrogen receptors as well as human growth factor receptor 2.[4] Regarding the socio-demographics, TNBC has a younger age of diagnosis than the other subtypes of BC, with a median age of diagnosis around 54-55 years, compared to 60 years for other types; perhaps, it is more commonly detected in under 40 years old women. While most BCs occur in women over 50, TNBC is disproportionately found in younger women, although it can affect individuals of all ages, including the elderly. [5]

Concerning gender, this subtype of BC affects mostly women; BC is men is actually rare, TNBC being rarer. This explanation would be since females possess breast cells that are more susceptible to hormones like estrogen and progesterone, these play a vital role in the higher incidence of BC, including TNBC, compared to males. [4] Other demographics would include race, where it is found that, Black women tend to have a higher prevalence of TNBC compared to other racial groups; and genetics, meaning presence of a BRCA1 mutation means the person is more prone to develop TNBC. [6]

Furthermore, while menstrual and reproductive history are established risk factors for BC overall, its specific role in TNBC is not as clearly defined as for other subtypes. [7] Besides, the connection between oral contraceptive (OC) history and TNBC is not clearly determined, with some literature suggesting a potential link to increased chances of development of the condition, especially with long-term use, while others found nothing extraordinary. [8]

In addition, a family history of breast or ovarian cancer increases the chances of developing TNBC. Studies reveal that, those women with a family history of BC, especially first-degree relatives, have more likelihood of being diagnosed as a case of TNBC. [9] Moreover, previous studies have also found a link between higher body mass index (BMI) in women and an increased risk and prevalence of TNBC. [10]

Bangladesh is a country where early marriage, multiparity, variable contraceptive use, and limited early screening remain common particularly in lower and middle socio-economic backgrounds. Besides, wholesome local data linking these factors with TNBC patterns are still scarce. TNBC is a pervasive and aggressive form of BC; and these cases are often diagnosed at advanced stages of the disease, posing multiple therapeutic obstacles. Thus, our study aims to comprehensively evaluate the demographic and clinical characteristics of TNBC patients treated at a tertiary care center in Dhaka, Bangladesh. These insights are intended to inform tailored efforts for early detection, awareness, and context-appropriate management in resource-limited settings.

METHODS

Study type and settings

This single-center, descriptive, cross-sectional study was carried out in the Department of Radiation Oncology in National Institute of Cancer Research & Hospital in Ahsania Mission Cancer and General Hospital (AMCGH), a tertiary care cancer facility located in Dhaka, Bangladesh. The hospital serves a diverse population and receives referrals from throughout the country, making it an ideal setting for evaluating patient characteristics in a resource-limited context. The study was conducted over a 7-year period, from January 2018 to December 2024.

Study population

A total of 198 female patients diagnosed with TNBC were included in the study. The sampling method used in the study was convenient method.

Eligibility Criteria

Inclusion criteria

- Biopsy followed by Immunohistochemistry (IHC) confirmed cases of TNBC (defined as negative for estrogen receptor [ER], progesterone receptor [PR], and human epidermal growth factor receptor 2 [HER2]).
- Patients who received treatment and/or follow-up at AMCGH during the study period.
- Female patients aged ≥18 years.

Exclusion criteria

- Patients with incomplete clinical or histopathological data.
- Patients diagnosed with other subtypes of breast cancer (i.e., non-TNBC) were excluded.
- Patients with a history of prior treatment of BC.
- Male breast cancer patients.
- Those patients who were not willing to participate in the study.

Study procedure and data collection

The following variables were recorded:

- Age at menarche
- Age at diagnosis
- Age during first birth
- Height
- Weight
- Marital status
- Level of education
- Occupation
- Monthly household income
- Place of residence
- Parity
- Menopausal status
- History of contraceptive use
- Family history of cancer
- Breast feeding status
- Co-morbidities
- Personal history such as history of smoking, alcohol or betel nut consumption.

Data were collected using semi-structured questionnaires by using face-to-face interview and utilizing medical documents. Data were coded, compiled, cleaned, and analyzed using Statistical Package for Social Sciences (SPSS; version 25.0). Descriptive statistics were used to describe the socio-demographic and clinical characteristics. Continuous variables were expressed as means and standard deviations (SD) and categorical variables were reported in the forms of frequencies and percentages. Generated results were presented using tables.

Operational definitions and some terms

Body Mass Index: The World Health Organization (WHO) defines BMI as a statistical indicator of body fatness calculated by dividing a person's weight in kilograms by their height in meters squared (kg/m²). [11]

Classification of BMI according to WHO

- Underweight: <18.5 kg/m²
- Normal weight: 18.5–24.9 kg/m²
- Overweight ≥25.0–29.9 kg/m²
- Obese ≥30.0 kg/m²

Socio-economic level: It was assessed based on monthly household income, educational level, and occupation, following national standards adapted for local context. Participants were then categorized into four classes:

- Upper class
- Middle class
- Lower-middle class
- Lower class

Ethics

The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Approval was obtained from the ethical committee of AMCGH. Before the interview, informed written consent was obtained from each patient after informing them about the purpose of the study. Complete assurance was provided that all information given by the patients would be kept confidential.

RESULTS

Table 1: Age-related information of the participants.

Variables based on age	Frequency/Percentage (n/%)	Mean ± SD
Age at diagnosis (in years) [n=198]		
25-30	5 (2.5)	-
31-40	76 (38.3)	-
41-50	102 (51.5)	-
51-60	11 (5.5)	-
61-72	4 (2.0)	-
Mean age ± SD	-	46.75 ± 9.10
Age at menarche (in years) [n=198]		
10-12	45 (22.7)	-
13-14	145 (73.2)	-
15-16	8 (4.0)	-
Mean age ± SD	-	13.48 ± 1.65
Age at first childbirth (in years) [n=196]		
18-25	176 (88.8)	-
25-35	22 (11.1)	-
Mean age ± SD	-	20.56 ± 3.96

*****SD: Standard deviation

Table 1 describes the age-related characteristics of the study participants. The mean age at diagnosis among the TNBC patients was 46.75 ± 9.10 years, with the majority (51.5%) aged between 41–50 years, followed by 38.3% between 31–40 years. It was also evident that, the average age at menarche was 13.48 ± 1.65 years, with most patients (73.2%) reporting menarche between 13–14 years. Lastly, the mean age at first childbirth was 20.56 ± 3.96 years, and a significant majority (88.8%) had their first child between the ages of 18–25 years.

Table 2: Socio-demographic characteristics of the respondents (n=198)

Characteristics	Frequency/Percentage (n/%)	Mean ± SD
Religion		
Islam	195 (98.5)	-
Hinduism	3 (1.5)	-
Marital status		
Married	196 (98.9)	-
Never married	2 (1.1)	-
Level of education		
No formal education	13 (6.6)	-
SSC	76 (38.4)	-
HSC	103 (52.0)	-
Graduate	6 (3.0)	-
Occupation		
Housewife	139 (70.2)	-
Job holder	59 (29.8)	-
Area of residence		
Rural	112 (56.6)	-
Urban	86 (43.4)	-
Socio-economic status		
Upper class	8 (4.0)	-
Middle class	109 (55.1)	-
Lower-middle class	72 (36.4)	-
Lower class	9 (4.5)	-
BMI		
Mean BMI (kg/m^2)	-	23.74 ± 3.71

*SSC: Secondary School Certificate; HSC: Higher Secondary Certificate; BMI: Body Mass Index.

Table 2 illustrates the demographic attributes of the respondents. It was found that, the vast majority were Muslims (98.5%), while only 1.5% were identified as Hindus. Most patients were married (98.9%), with only 2 (1.1%) being never married.

In terms of educational attainment, over half of the patients (52.0%) had completed HSC level education, followed by 38.4% who completed upto SSC level. Furthermore, occupational data revealed that, 70.2% of the participants were housewives; while 29.8% were employed in various jobs. Regarding place of residence, 56.6% of the patients hailed from rural areas, reflecting a predominantly rural patient population. Socio-economically, the majority were from the middle class (55.1%), followed by lower-middle class (36.4%). Lastly, the mean BMI of the study participants was 23.74 ± 3.71 kg/m², which falls within the normal weight range of WHO.

Table 3: Personal, family and clinical history of the participants (n=198).

Characteristics	Frequency/Percentage (n/%)
Personal history	
History of smoking	
Present	12 (6.1)
Absent	186 (93.9)
History of betel nut consumption	
Present	17 (8.6)
Absent	181 (91.4)
History of alcohol intake	
Present	4 (2.0)
Absent	194 (98.0)
Family history	
Family history of any cancer	
Present	62 (31.3)
Absent	136 (68.7)
Family history of breast cancer/TNBC	
Present	37 (18.7)
Clinical history	
Co-morbidities	
Hypertension	135 (68.2)
Diabetes mellitus	114 (57.6)
IHD	57 (28.8)
CKD	21 (10.6)
Status of menopause at the time of diagnosis	
Not menopausal/pre-menopausal	120 (60.6)
Menopausal/Post-menopausal	78 (39.4)

*IHD: Ischemic heart disease; CKD: Chronic kidney disease.

Table 3 elaborates the personal, family and clinical characteristics of the study subjects. A small proportion of participants reported a history of smoking (6.1%), betel nut consumption (8.6%), or alcohol intake (2.0%). Regarding family history, 31.3% displayed a family history of any cancer, while 18.7% specifically reported a family history of BC or TNBC. Among clinical comorbidities, hypertension was the most prevalent (68.2%), followed by diabetes mellitus (57.6%). At the time of diagnosis, the majority of patients were either non-menopausal or pre-menopausal (60.6%).

Table 4: Contraceptive and reproductive history of the participants (n=198)

Attributes	Frequency/Percentage (n/%)
Contraceptive history	
Use of contraceptives	
Yes	126 (63.6)
No	72 (36.4)
Type of contraceptive	
Hormonal	104 (52.5)
Non-hormonal	22 (11.0)
Reproductive history	
Parity	
1-2	78 (39.4)
≥3	120 (60.6)
Breastfeeding history	
Yes	186 (93.9)
No	12 (6.1)

As displayed in Table 4, 63.6% of participants reported using contraceptives, while 36.4% presented no history of contraceptive use. Among those who used contraceptives, hormonal methods were more commonly used (52.5%) compared to non-hormonal methods (11.0%). Regarding reproductive history, majority of participants (60.6%) had three or more children; while 39.4% gave birth to one to two children. Lastly, breastfeeding was reported by 93.9% of participants.

DISCUSSION

Our cohort's mean age at diagnosis, 46.8 ± 9.1 years, accentuates that TNBC tends to arise in relatively younger women in Bangladesh. This finding is in alignment with recent Bangladeshi study which also indicated younger onset. The Dhaka-based study found the mean age at diagnosis to be 43 ± 9.7 years. [12] In our study, we found the mean age of menarche was 13.48 ± 1.65 years. Previous study is also harmonious with this finding; it found that the median age at menarche was 13 years. [13] Furthermore, our mean age at first childbirth came out to be 20.56 ± 3.96 years. Relevant study highlighted that the protective effect of a first pregnancy is more pronounced for luminal breast cancers and less so for TNBC, suggesting that the underlying biological mechanisms differ by subtype. [14] However, a review article stated that early menarche and young age at first childbirth are of the common risk factors of TNBC. [15]

We found the majority of our participants to be of Islamic backgrounds. TNBC is widely recognized to have a higher prevalence among women of African descent. Several large-scale, population-based studies have consistently confirmed that TNBC is more commonly observed in African and African-American women compared to women of other racial and ethnic backgrounds. [15]

Regarding marital status, majority were married. This reflects the societal norms rather than an independent risk factor. However, early marriage, particularly common in South Asian regions, is often associated with early parity, which may interact with other reproductive factors in development of TNBC. [15]

In our study, most patients had secondary or higher secondary education. Relevant study had similar findings, where majority (41.3%) had completed secondary education. [13] Furthermore, we found that, 70.2% of TNBC patients were housewives, while 29.8% were job holders. Previous study reported that, 95.0% of the participants were housewives, suggesting reduced exposure to health information and less autonomy in healthcare decisions, particularly in rural and lower-income settings. [13]

In the present study, the majority of respondents were rural and belonged middle to lower-middle socioeconomic class. Data on rural–urban differences in TNBC incidence remain underrepresented in updated literature of our region. However, research from India indicates that although the overall incidence of TNBC is similar between urban and rural settings, rural patients often present with more advanced-stage disease, likely due to barriers in healthcare access and diagnostic resources. [16] In contrast, comprehensive U.S. population-based analyses [17] have demonstrated that, TNBC incidence is significantly higher among Black women, particularly in certain urbanized states, and varies considerably by geography, emphasizing the impact of broader social determinants such as race, income inequities, structural segregation, and area-level socioeconomic conditions.

The present study found the mean BMI to be 23.74 ± 3.71 kg/m^2. Previous study also expressed similar findings; their mean BMI was reported to be 24.54 ± 4.53 kg/m^2. [13] The association between BMI and TNBC remains complex and appears to differ by menopausal status and ethnicity. While high BMI has been consistently linked to increased risk of hormone receptor-positive breast cancer, studies suggest that obesity may also elevate TNBC risk in premenopausal women, possibly via non-hormonal pathways such as inflammation and insulin resistance. [18]

In our study, only a small proportion of TNBC patients reported smoking (6.1%), alcohol intake (2.0%), or betel nut consumption (8.6%). While these rates appear low, they may reflect underreporting due to cultural stigma, especially among women. Literature indicates that smoking is modestly associated with increased TNBC risk, particularly among premenopausal women, while alcohol's role in TNBC appears negligible, unlike in ER-positive cancers. [19] Betel nut chewing, though not widely studied in the context of BC, warrants further research in South Asian populations due to its carcinogenic potential and cultural prevalence. [20]

The current study found that, 31.3% of TNBC patients had a family history of any cancer and family history of BC was present in 18.7% of participants. Previous study reflected that 31.25% respondents reported family history of BC. [13] It is a well-established fact that, hereditary predisposition is a common phenomenon, particularly those with BRCA1 mutation, for the development of TNBC. Even in the absence of known genetic mutations, studies suggest that familial clustering of BC significantly elevates TNBC risk. [21]

High rates of comorbidities-hypertension (68.2%), diabetes (57.6%), were reported. While these are not established risk factors for the development of TNBC, they reflect the broader noncommunicable disease burden and may complicate prognosis and treatment outcomes. [15]

Furthermore, in our study, 60.6% of TNBC patients were premenopausal at diagnosis, supporting the regional trend in studies conducted in Bangladesh, displaying a higher proportion of TNBC in premenopausal women. [12] This age-related trend reflects TNBC's unique pathophysiology, which is largely independent of estrogen or progesterone exposure and instead influenced by genetic and metabolic factors.

In our study, 63.6% of participants reported contraceptive use, with 52.5% using hormonal methods. Meta-analyses published through 2020 indicate that oral contraceptive (OC) use is associated with a significantly increased risk of TNBC. For example, a pooled analysis of case-control studies revealed OR = 1.37 (95% CI: 1.13–1.67) for TNBC among OC users compared to non-users. [22]

We found that, 60.6% of patients had ≥3 children, and 93.9% had a history of breastfeeding. This reflects cultural norms in Bangladesh, where breastfeeding is common and prolonged. Previous study reported 97.3% participants had history of breastfeeding. [13] The high prevalence of breastfeeding among our study population indicates that the expected protective effect may be hindered by other factors such as early parity, underlying genetic predispositions, and metabolic influences.

This study's strengths include detailed demographic and clinical profiling of TNBC in a large Bangladeshi cohort over seven years, a relatively recent timeframe. It is among the few studies in Bangladesh providing granular insights into reproductive behavior, contraceptive use, and comorbidities in TNBC patients. Limitations include the cross-sectional design and convenience sampling, which limit inferences about causality and generalizability. Additionally, absence of longitudinal follow-up prevents correlation with survival and treatment outcomes.

CONCLUSION

TNBC in our study population predominantly affected premenopausal, multiparous, and rural women from lower to middle socioeconomic backgrounds. Despite high rates of breastfeeding and early childbirth, TNBC was prevalent, suggesting that genetic and metabolic factors may outweigh traditionally protective reproductive behaviors. These findings highlight the need for targeted awareness, early detection programs, and risk-based screening approaches tailored to the Bangladeshi context. Further research is recommended to explore the underlying biological and socioeconomic determinants of TNBC in South Asian populations.

Conflict of interest disclosure: *The authors disclose no conflict of interest.*
Funding or sponsorship details: *None.*

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