# Introduction

# Methods

We followed the STROBE guideline for better observational cross-sectional study reporting in epidemiology.

## Population and study sites

## Data collection

## Outcome variables

**Patient delay**

Patient delay refers to the time elapsed from the initial symptom detection to the first doctor's consultation. Scenario tends to worsen if this delay exceeds twelve (12) weeks from symptom onset (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7131859/).

**Provider delay**

Provider delay refers to the duration between the initial interaction with a healthcare provider and the commencement of diagnosis and treatment. It is typically deemed significant if it extends beyond four (4) weeks (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4647619/).

**Total diagnosis delay**

Total diagnostic delay encompasses the period from the patient's first symptom recognition to the commencement of definitive treatment, incorporating both patient and provider delays (https://bmjopen.bmj.com/content/9/9/e030169). In this study, a total diagnostic delay is typically regarded as exceeding sixteen (16) weeks.

To construct our outcome variable (delays), we categorized each patient as "1" or "Yes" if they experienced patient delay, provider delay, or total diagnostic delay exceeding 12 weeks, 4 weeks, and 16 weeks, respectively. Otherwise, they were recorded as no delays by "0" or "No".

**Possible factors**

To find out potential risk factors associated with various types of delays, we examined a range of socioeconomic factors and the medical history of the patients as independent variables. These included the patient's age, geographic location (division), residency (urban or rural), educational attainment (illiterate, primary, and secondary) of both the patient and their spouse, household monthly income, access to portable electronic devices, exposure to mass media, lump breast pain, nipple discharge, skin changes, bone pain, breast self-examination, and family history of breast cancer.

## Statistical analysis

We conducted descriptive statistics by crosstabs, presenting counts and percentages to summarize categorical variables. Chi-square tests and Fisher's exact test were employed to investigate factors associated with different types of delays. Binary and multivariable logistic regression was utilized to identify associated risk factors. Initially, bivariable analysis assessed the relationship between delays and other factors. Univariable (unadjusted) and multivariable (adjusted) logistic regression analyses were then conducted to compare associated risk factors. In the univariable analyses, variables were individually added to the logistic regression model, while in the adjusted model, all possible variables were included simultaneously. In this study, three models were utilized to identify associated risk factors of patient delay, provider delay, and total diagnosis delay, designated as Model 1, Model 2, and Model 3, respectively. Results were reported as unadjusted/crude odds ratios (COR) and adjusted odds ratios (AOR) with their respective 95% confidence intervals and 5% level of significance. All analyses were performed using R software.

**Variable selection**

Variables were chosen through a two-stage process. Initially, bivariable analysis (chi-square test) was performed individually for each independent variable. A significance threshold of p-value ≤ 0.20 was applied arbitrarily to determine the inclusion of covariates in the multivariable models (https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0242864). In the second stage, a comprehensive multivariable model was constructed using the selected predictor variables. Additionally, we assessed multicollinearity in the final model using a cut-off value of 4.00 for the variance inflation factor (VIF) analysis (https://link.springer.com/article/10.1186/s12889-023-15617-8). At this stage, all variables were incorporated into the model since the VIF values for each variable were below 4.00.

**Model performance**

We utilized the Area under the Receiver Operating Characteristic (AUROC) curve, sensitivity, specificity, and the Hosmer–Lemeshow goodness-of-fit test to assess the accuracy of the best model. Higher AUROC values indicated superior model performance. In the ROC curve, a lower p-value suggests that the model effectively discriminates between two categories, with an area under the curve exceeding 0.50 (https://link.springer.com/article/10.1186/s12981-022-00495-8). The Hosmer–Lemeshow goodness-of-fit test evaluates the similarity between model-estimated probabilities and observed outcomes, typically through a goodness-of-fit test. A Hosmer–Lemeshow goodness-of-fit test with a p-value greater than 0.05 indicates the model's ability to accurately classify observations into outcome categories (https://www.frontiersin.org/journals/public-health/articles/10.3389/fpubh.2022.985445/full).

# Results

## *Study population*

Out of the 355 study participants, the largest proportion, 34.98%, were aged between 40 and 49 years. The highest concentration, 43.95%, resided in the Dhaka division, and a significant majority, 72.75%, hailed from rural areas, representing the largest demographic in this study. Regarding marital status, a substantial 82.75% of participants were married. Illiteracy was prevalent among a significant number of patients, comprising 42.86%, while the primary education level was predominant among spouses, accounting for 37.11%. Additionally, more than a third of participants reported a monthly family income of <5,000 BDT, marking the highest figure in this study. Access to portable electronic devices, such as mobile phones, smartphones, and computers, was nearly common among patients, with 89.86%. Moreover, 59.44% of participants hadn’t access to mass media (Table 1).

The medical history of the patients is presented in Table 2. A majority (88.45%) of patients reported lump symptoms as their initial clinical presentation. Merely 11.11% of patients practiced breast self-examination, and 9.52% had a family history of breast cancer. About 41.0% of participants encountered patient delay (>12 weeks), while 24.33% experienced provider delay (>4 weeks). In total, 55.72% of patients faced a total diagnostic delay (>16 weeks). The majority of patients visited for their first checkup at a medical facility when their cancer was in stage II (48.82%), followed by 44.09% in stage III. A smaller percentage visited during stage I and stage IV, accounting for 3.94% and 3.15%, respectively.

The physical presentations of the participants are depicted in Figure 1. The majority of patients experienced discomfort in the breast (52.06%), followed by a lump (45.86%), discomfort in the arm (34.81%), itching (33.82%), changes in breast shape (31.36%), skin changes (12.72%), nipple discharge (12.13%), and ulcer or sore skin (11.5%). According to the findings presented in Table 3, the predominant reason for delaying seeking medical attention was the perception that the problem would disappear spontaneously (79.14%) of participants. Negligence or carelessness was similarly prevalent, with 75.54% of participants attributing their delay to this factor. Financial constraints were reported by 65.47% of participants, while competing life priorities, such as familial responsibilities, were mentioned by 54.68% of participants. Embarrassment about breast examinations was noted by 44.60% of participants, followed by being too busy with other commitments (41.01%) and fear of potential cancer diagnosis or treatment (38.13%). Additional factors contributing to patient delay included difficulties in arranging transportation to medical facilities (27.34%) and a lack of information about available healthcare resources (24.46%). Moreover, 21.58% of participants encountered delays in securing appointments with healthcare providers, and 20.14% cited miscellaneous reasons not captured by the options provided above.

**Different types of delay and its associated factors**

Table 4 presents the prevalence and risk factors associated with patient delay, as determined through crosstabs, chi-square tests, and the logistic regression model. Notably, among the various risk factors assessed, the patient household monthly income, access to portable electronic devices, and presence of breast pain symptoms as significant factors associated with patient delay. The socio-economic profile of patients experiencing patient delay revealed higher prevalence rates among those who were illiterate (47.59%), had a household monthly income below 5,000 BDT (50.44%), lacked access to portable electronic devices (60.00%), and did not have access to mass media (43.94%) compared those who were not delayed. Moreover, among patients with no history of breast pain, the prevalence of patient delay was notably elevated at 44.13% compared to those who were not delayed. In the adjusted analysis, the patient's education level, family income, and presence of breast pain demonstrated associations with patient delay. Upon further examination using adjusted logistic regression modeling, it was observed that the odds of patient delay were nearly twice as high (Adjusted Odds Ratio [AOR]: 1.96, 95% Confidence Interval [CI]: 1.04-3.74) among illiterate patients compared to those with secondary or higher education levels. Additionally, patients with a monthly family income ranging from 5,000 to 10,000 BDT exhibited 1.45 times (AOR: 1.45, 95% CI: 1.22-1.90) higher odds of experiencing patient delay compared to those with incomes exceeding 20,000 BDT. On the contrary, patients experiencing breast pain exhibited 45% (AOR: 0.55, 95% CI: 0.32-0.94) lower odds of experiencing patient delay compared to those who did not report breast pain.

Table 5 outlines the significant factors influencing provider delay, with geographic location, area of residence, and the presence of nipple discharge symptoms emerging as notable contributors. The socio-economic analysis of patients experiencing provider delay revealed higher prevalence rates among those originating from the Rangpur division (64.29%) and rural areas (29.51%) compared to their non-delayed counterparts. Furthermore, among patients presenting with nipple discharge symptoms, the prevalence of provider delay notably increased to 45.00% compared to those without delay. In the adjusted analysis, the patient's geographic location, area of residence, and the symptoms of nipple discharge demonstrated associations with provider delay. Further examination via adjusted logistic regression modeling revealed that patients from the Rangpur division exhibited over 4 times (AOR: 4.60, 95% CI: 1.11-7.52) higher odds of experiencing provider delay compared to those from the Barisal division. Additionally, patients residing in rural areas demonstrated 3.07 times (AOR: 3.07, 95% CI: 1.49-6.98) higher odds of experiencing provider delay compared to their urban counterparts. Conversely, patients presenting with nipple discharge demonstrated 2.92 times (AOR: 2.92, 95% CI: 1.04-8.06) higher likelihood of experiencing provider delay compared to those without nipple discharge symptoms.

Table 6 elucidates the significant factors influencing total diagnosis delay, encompassing geographic location, area of residence, current marital status, patient education level, family monthly income, access to portable electronic devices, access to mass media, and the presence of breast pain, nipple discharge, and bone pain as notable contributors. The socio-economic analysis of patients experiencing total diagnosis delay reveals the highest prevalence rates among those originating from the Rangpur division (92.86%), residing in rural areas (60.48%), being unmarried (64.91%), and having an education level of illiterate (60.96%). Additionally, patients with lower family monthly incomes (64.60%), no access to portable electronic devices (68.00%), and no access to mass media (55.78%) exhibited higher prevalence rates compared to their non-delayed counterparts. Furthermore, among patients experiencing total diagnosis delay, the prevalence of breast pain, nipple discharge, and bone pain were notably elevated at 50.00%, 70.00%, and 41.67%, respectively, compared to those without delay.

In adjusted analysis, the patient's geographic location, area of residence, current marital status, patient education level, access to mass media, and the presence of breast pain, nipple discharge, and bone pain demonstrated associations with total diagnosis delay. Further examination via adjusted logistic regression modeling revealed that patients from the Rangpur division exhibited over 6 times (AOR: 6.07, 95% CI: 1.76-8.02) higher odds of experiencing total diagnosis delay compared to those from the Barisal division. Additionally, patients residing in rural areas demonstrated 2.04 times (AOR: 2.04, 95% CI: 1.17-3.61) higher odds of experiencing total diagnosis delay compared to their urban counterparts. Unmarried patients demonstrated 1.46 times (AOR: 1.46, 95% CI: 1.14-2.94) higher odds of experiencing total diagnosis delay compared to their married counterparts. Illiterate and primary-educated patients demonstrated higher odds of experiencing total diagnosis delay compared to secondary or higher-educated patients, with 1.59 times (AOR: 1.59, 95% CI: 1.18-3.05) and 1.51 times (AOR: 1.51, 95% CI: 1.17-2.95), respectively. Patients with access to portable electronic devices had 2% lower odds of experiencing total diagnosis delay compared to their counterparts (AOR: 1.55, 95% CI: 1.18-2.52). Patients presenting with breast pain (AOR: 1.60, 95% CI: 1.34-2.05), nipple discharge (AOR: 2.19, 95% CI: 1.75-7.52), and bone pain (AOR: 1.37, 95% CI: 1.09-2.30) demonstrated higher odds of experiencing total diagnosis delay compared to their counterparts (Table 6).

# The three models employed in this study successfully passed the Hosmer and Lemeshow goodness-of-fit test, indicating a good fit. The classification accuracy was also acceptable, with AUC values of 62.43%, 58.92%, and 68.87% for Model 1, Model 2, and Model 3, respectively (Tables 7 and Figure 4). Notably, among the three models, Model 3 exhibited higher accuracy compared to the other two variables.

# Discussion

# References

# Tables

**Table 1: Background characteristics of the patients**

|  |  |  |
| --- | --- | --- |
| **Characteristics** | **n** | **%** |
| ***Age at presentation (years)*** |  |  |
| <40 | 114 | 33.24 |
| 40-49 | 120 | 34.98 |
| 50-59 | 79 | 23.03 |
| ≥60 | 30 | 8.75 |
| ***Geographic location*** |  |  |
| Barisal | 26 | 7.67 |
| Chittagong | 52 | 15.34 |
| Dhaka | 149 | 43.95 |
| Khulna | 39 | 11.50 |
| Mymensingh | 33 | 9.73 |
| Rajshahi | 21 | 6.19 |
| Rangpur | 14 | 4.13 |
| Sylhet | 5 | 1.47 |
| ***Area of residence*** |  |  |
| Rural | 251 | 72.75 |
| Urban | 94 | 27.25 |
| ***Current marital status*** |  |  |
| Single | 59 | 17.25 |
| Married | 283 | 82.75 |
| ***Patient education level*** |  |  |
| Illiterate | 147 | 42.86 |
| Primary | 115 | 33.53 |
| Secondary/higher | 81 | 23.62 |
| ***Spouse education level*** |  |  |
| Illiterate | 89 | 27.99 |
| Primary | 118 | 37.11 |
| Secondary/higher | 111 | 34.91 |
| ***Household monthly income (BDT)*** |  |  |
| <5000 | 113 | 34.88 |
| 5000-10000 | 100 | 30.86 |
| 10001-20000 | 44 | 13.58 |
| >20000 | 67 | 20.68 |
| ***Portable electronic devices access*** |  |  |
| Yes | 319 | 89.86 |
| No | 36 | 10.14 |
| ***Mass media access*** |  |  |
| Yes | 144 | 40.56 |
| No | 211 | 59.44 |

**Table 2: Medical history of the patients**

|  |  |  |
| --- | --- | --- |
| **Characteristics** | **n** | **%** |
| **First clinical presentations1** |  |  |
| Lump | 314 | 88.45 |
| Breast pain | 93 | 26.20 |
| Nipple discharge | 20 | 5.63 |
| Skin changes | 15 | 4.23 |
| Bone pain | 12 | 3.38 |
| **Breast self-examination** | 37 | 11.11 |
| **Family history of breast cancer** | 32 | 9.52 |
| **Patient delay** | 139 | 41.00 |
| **Provider delay** | 82 | 24.33 |
| **Total diagnostic delay** | 190 | 55.72 |
| **Stage of cancer** |  |  |
| Stage I | 10 | 3.94 |
| Stage II | 124 | 48.82 |
| Stage III | 112 | 44.09 |
| Stage IV | 8 | 3.15 |

1 multiple answer

Table 3: Summary of patient delay, provider delay, and diagnosis delay (in weeks)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Patient delay | | | | |  |
| Stage of cancer | Mean | SD | Median | Minimum | Maximum | P-value |
| Stage I | 3.73 | 7.58 | 0.28 | 0.00 | 24.00 | 0.023 |
| Stage II | 20.40 | 34.14 | 8.00 | 0.00 | 194.68 |
| Stage III | 25.32 | 40.87 | 12.00 | 0.00 | 243.32 |
| Stage IV | 12.84 | 15.19 | 10.00 | 0.00 | 48.68 |
| Total | 21.74 | 36.39 | 8.00 | 0.00 | 243.32 |  |
|  | Provider delay | | | | |  |
| Stage I | 7.19 | 10.22 | 2.14 | 0.00 | 26.28 | 0.971 |
| Stage II | 6.93 | 9.98 | 2.12 | 0.00 | 28.80 |
| Stage III | 5.58 | 8.41 | 1.94 | 0.00 | 28.52 |
| Stage IV | 4.88 | 8.15 | 1.60 | 0.00 | 24.00 |
| Total | 5.64 | 8.88 | 1.60 | 0.00 | 28.80 |  |
|  | Total diagnosis delay | | | | |  |
| Stage I | 10.92 | 15.72 | 3.74 | 0.00 | 50.28 | 0.125 |
| Stage II | 27.33 | 34.03 | 22.54 | 0.00 | 194.68 |
| Stage III | 30.90 | 40.58 | 23.66 | 0.00 | 245.32 |
| Stage IV | 17.72 | 16.04 | 14.68 | 0.00 | 48.16 |
| Total | 27.38 | 36.56 | 8.00 | 0.00 | 243.32 |  |

**Table 3: Factors contributing to patient delay based on family history of breast cancer1**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | **Family History** | |
|  | **Total** | **Yes** | **No** |
| **Characteristics** | **n (%)** | **n (%)** | **n (%)** |
| Thought the problem would disappear by itself | 110 (79.14) | 9 (8.49) | 97 (91.51) |
| Negligence or carelessness | 105 (75.54) | 8 (7.92) | 93 (92.08) |
| Financial constraints | 91 (65.47) | 8 (8.99) | 81 (91.01) |
| Competing life priorities (taking care of family) | 76 (54.68) | 7 (9.59) | 66 (90.41) |
| Embarrassment about having a breast examination | 62 (44.60) | 5 (8.06) | 57 (91.94) |
| Too busy (other reason) | 57 (41.01) | 6 (11.11) | 48 (88.89) |
| Fear of cancer diagnosis and/or treatment | 53 (38.13) | 5 (9.43) | 48 (90.57) |
| Difficult to arrange transport | 38 (27.34) | 4 (10.53) | 34 (89.47) |
| Lack of information | 34 (24.46) | 4 (11.76) | 30 (88.24) |
| Appointment delay | 30 (21.58) | 4 (13.33) | 26 (86.67) |
| Other reason | 28 (20.14) | 3 (10.71) | 25 (89.29) |

1 multiple answer

**Table 4: Prevalence and associated risk factors of patient delay**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Patient delay** | | | | | |
| **Characteristics** | **Chi-square test** | | **Unadjusted model** | | **Adjusted model** | |
| **n (%)** | ***P-value*** | **COR (95% CI)** | ***P-value*** | **AOR (95% CI)** | ***P-value*** |
| **Socioeconomic characteristics** |  |  |  |  |  |  |
| ***Age at presentation (years)*** |  |  |  |  |  |  |
| <40 | 44 (39.29) | 0.839 | 1.12 (0.49 – 2.64) | 0.794 |  |  |
| 40-49 | 52 (44.07) |  | 1.36 (0.60 – 3.19) | 0.465 |  |  |
| 50-59 | 31 (40.26) |  | 1.16 (0.49 – 2.85) | 0.733 |  |  |
| ≥60 | 11 (36.67) |  | Reference |  |  |  |
| ***Geographic location*** |  |  |  |  |  |  |
| Chittagong | 22 (43.14) | 0.669 | 1.21 (0.47 – 3.25) | 0.694 |  |  |
| Dhaka | 61 (40.94) |  | 1.11 (0.48 – 2.68) | 0.812 |  |  |
| Khulna | 19 (50.00) |  | 1.60 (0.59 – 4.51) | 0.364 |  |  |
| Mymensingh | 9 (27.27) |  | 0.60 (0.20 – 1.80) | 0.363 |  |  |
| Rajshahi | 8 (40.00) |  | 1.07 (0.32 – 3.54) | 0.916 |  |  |
| Rangpur | 5 (35.71) |  | 0.89 (0.22 – 3.39) | 0.864 |  |  |
| Sylhet | 3 (60.00) |  | 2.40 (0.34 – 20.77) | 0.380 |  |  |
| Barisal | 10 (38.46) |  | Reference |  |  |  |
| ***Area of residence*** |  |  |  |  |  |  |
| Rural | 106 (42.91) | 0.270 | 1.32 (0.81 – 2.19) | 0.271 |  |  |
| Urban | 33 (36.26) |  | Reference |  |  |  |
| ***Current marital status*** |  |  |  |  |  |  |
| Single | 111 (48.21) | 0.226 | 1.42 (0.80 – 2.54) | 0.226 |  |  |
| Married | 27 (39.50) |  | Reference |  |  |  |
| ***Patient education level*** |  |  |  |  |  |  |
| Illiterate | 69 (47.59) | 0.042 | 1.82 (1.03 – 3.25) | 0.021 | 1.96 (1.04 – 3.74) | 0.039 |
| Primary | 43 (37.72) |  | 1.21 (0.66 – 2.23) | 0.534 | 1.45 (0.75 – 2.85) | 0.270 |
| Secondary/Higher | 26 (33.33) |  | Reference |  |  |  |
| ***Spouse education level*** |  |  |  |  |  |  |
| Illiterate | 39 (44.32) | 0.637 | 1.29 (0.73 – 2.28) | 0.383 |  |  |
| Primary | 45 (38.79) |  | 1.03 (0.60 – 1.76) | 0.925 |  |  |
| Secondary/Higher | 42 (38.18) |  | Reference |  |  |  |
| ***Household monthly income (BDT)*** |  |  |  |  |  |  |
| <5000 | 57 (50.44) | 0.011 | 1.42 (0.77 – 2.62) | 0.262 | 1.15 (0.58 – 2.29) | 0.693 |
| 5000-10000 | 27 (27.84) |  | 1.54 (1.28 – 2.04) | 0.034 | 1.45 (1.22 – 1.90) | 0.025 |
| 10001-20000 | 19 (43.18) |  | 1.06 (0.49 – 2.29) | 0.885 | 1.05 (0.47 – 2.33) | 0.901 |
| >20000 | 28 (41.79) |  | Reference |  |  |  |
| ***Portable electronic devices*** |  |  |  |  |  |  |
| Yes | 124 (39.49) | 0.045 | 0.44 (0.18 – 0.99) | 0.049 | 0.46 (0.17 – 1.18) | 0.108 |
| No | 15 (60.00) |  | Reference |  | Reference |  |
| ***Mass media access*** |  |  |  |  |  |  |
| Yes | 52 (36.88) | 0.193 | 0.75 (0.48 – 1.16) | 0.193 | 0.79 (0.47 – 1.33) | 0.375 |
| No | 87 (43.94) |  | Reference |  | Reference |  |
| **Medical history of the patients** |  |  |  |  |  |  |
| ***Lump*** |  |  |  |  |  |  |
| Yes | 128 (41.16) | 0.847 | 1.08 (0.50 – 2.45) | 0.847 |  |  |
| No | 11 (39.39) |  | Reference |  |  |  |
| ***Breast pain*** |  |  |  |  |  |  |
| Yes | 30 (32.61) | 0.045 | 0.61 (0.37 – 0.97) | 0.046 | 0.55 (0.32 – 0.94) | 0.032 |
| No | 109 (44.13) |  | Reference |  | Reference |  |
| ***Nipple discharge*** |  |  |  |  |  |  |
| Yes | 8 (42.11) | 0.920 | 1.05 (0.40 – 2.66) |  |  |  |
| No | 131 (40.94) |  | Reference |  |  |  |
| ***Skin changes*** |  |  |  |  |  |  |
| Yes | 7 (46.67) | 0.648 | 1.27 (0.44 – 3.63) | 0.649 |  |  |
| No | 132 (40.74) |  | Reference |  |  |  |
| ***Bone pain*** |  |  |  |  |  |  |
| Yes | 4 (33.33) | 0.582 | 0.71 (0.19 – 2.31) | 0.584 |  |  |
| No | 135 (41.28) |  | Reference |  |  |  |
| ***Breast self-examination*** |  |  |  |  |  |  |
| Yes | 15 (40.54) | 0.975 | 1.01 (0.50 – 2.02) | 0.975 |  |  |
| No | 118 (40.27) |  | Reference |  |  |  |
| ***Family history of breast cancer*** |  |  |  |  |  |  |
| Yes | 11 (34.38) | 0.450 | 0.75 (0.34 – 1.57) | 0.451 |  |  |
| No | 123 (41.28) |  | Reference |  |  |  |

AOR: adjusted odds ratio, CI: confidence interval, COR: crude odds ratio

**Table 5: Prevalence and associated risk factors of provider delay**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Provider delay** | | | | | |
| **Characteristics** | **Chi-square test** | | **Unadjusted model** | | **Adjusted model** | |
| **n (%)** | ***P-value*** | **COR (95% CI)** | ***P-value*** | **AOR (95% CI)** | ***P-value*** |
| **Socioeconomic characteristics** |  |  |  |  |  |  |
| ***Age at presentation (years)*** |  |  |  |  |  |  |
| <40 | 23 (20.54) | 0.613 | 0.57 (0.23 – 1.48) | 0.233 |  |  |
| 40-49 | 29 (24.37) |  | 0.72 (0.30 – 1.81) | 0.463 |  |  |
| 50-59 | 20 (26.67) |  | 0.81 (0.32 – 2.13) | 0.656 |  |  |
| ≥60 | 9 (1.03) |  | Reference |  |  |  |
| ***Geographic location*** |  |  |  |  |  |  |
| Chittagong | 14 (26.08) | 0.030 | 1.23 (0.42 – 3.91) | 0.714 | 1.17 (0.38 – 3.85) | 0.789 |
| Dhaka | 27 (18.49) |  | 0.76 (0.29 – 2.23) | 0.585 | 0.82 (0.30 – 2.49) | 0.704 |
| Khulna | 10 (26.32) |  | 1.19 (0.38 – 4.00) | 0.769 | 1.13 (0.35 – 3.94) | 0.838 |
| Mymensingh | 8 (25.00) |  | 1.11 (0.33 – 3.88) | 0.865 | 1.14 (0.33 – 4.14) | 0.837 |
| Rajshahi | 6 (30.00) |  | 1.43 (0.37 – 5.49) | 0.597 | 1.48 (0.37 – 5.92) | 0.575 |
| Rangpur | 9 (64.29) |  | 6.00 (1.51 – 7.06) | 0.014 | 4.60 (1.11 – 7.52) | 0.041 |
| Sylhet | 1 (20.00) |  | 0.83 (0.04 – 7.14) | 0.880 | 0.85 (0.04 – 7.58) | 0.894 |
| Barisal | 6 (23.08) |  | Reference |  | Reference |  |
| ***Area of residence*** |  |  |  |  |  |  |
| Rural | 72 (29.51) | <0.001 | 3.86 (1.93 – 8.62) | <0.001 | 3.07 (1.49 – 6.98) | 0.004 |
| Urban | 9 (9.78) |  | Reference |  | Reference |  |
| ***Current marital status*** |  |  |  |  |  |  |
| Single | 17 (30.36) | 0.213 | 1.49 (0.78 – 2.79) | 0.215 |  |  |
| Married | 63 (22.58) |  | Reference |  |  |  |
| ***Patient education level*** |  |  |  |  |  |  |
| Illiterate | 36 (24.66) | 0.916 | 1.14 (0.59 – 2.23) | 0.704 |  |  |
| Primary | 28 (24.78) |  | 1.14 (0.58 – 2.31) | 0.703 |  |  |
| Secondary/Higher | 17 (22.37) |  | Reference |  |  |  |
| ***Spouse education level*** |  |  |  |  |  |  |
| Illiterate | 18 (20.22) | 0.283 | 0.94 (0.46 – 1.87) | 0.854 |  |  |
| Primary | 33 (28.70) |  | 1.49 (0.81 – 2.77) | 0.204 |  |  |
| Secondary/Higher | 23 (21.30) |  | Reference |  |  |  |
| ***Household monthly income (BDT)*** |  |  |  |  |  |  |
| <5000 | 28 (24.78) | 0.791 | 1.05 (0.52 – 2.16) | 0.892 |  |  |
| 5000-10000 | 27 (27.55) |  | 1.21 (0.60 – 2.52) | 0.598 |  |  |
| 10001-20000 | 8 (19.51) |  | 0.77 (0.28 – 1.97) | 0.597 |  |  |
| >20000 | 16 (23.88) |  | Reference |  |  |  |
| ***Portable electronic devices*** |  |  |  |  |  |  |
| Yes | 78 (24.76) | 0.487 | 1.48 (0.53 – 5.24) | 0.489 |  |  |
| No | 4 (18.18) |  | Reference |  |  |  |
| Mass media access |  |  |  |  |  |  |
| Yes | 38 (26.76) | 0.375 | 1.25 (0.76 – 2.07) | 0.376 |  |  |
| No | 44 (22.56) |  | Reference |  |  |  |
| ***Medical history of the patients*** |  |  |  |  |  |  |
| Lump |  |  |  |  |  |  |
| Yes | 75 (24.04) | 0.657 | 0.81 (0.34 – 2.16) | 0.657 |  |  |
| No | 7 (28.00) |  | Reference |  |  |  |
| ***Breast pain*** |  |  |  |  |  |  |
| Yes | 28 (30.43) | 0.110 | 1.55 (0.90 – 2.64) | 0.111 | 1.36 (0.76 – 2.41) | 0.296 |
| No | 54 (22.04) |  | Reference |  | Reference |  |
| ***Nipple discharge*** |  |  |  |  |  |  |
| Yes | 9 (45.00) | 0.026 | 2.73 (1.06 – 6.86) | 0.032 | 2.92 (1.04 – 8.06) | 0.037 |
| No | 73 (23.03) |  | Reference |  | Reference |  |
| ***Skin changes*** |  |  |  |  |  |  |
| Yes | 2 (13.33) | 0.310 | 0.46 (0.07 – 1.73) | 0.321 |  |  |
| No | 80 (24.84) |  | Reference |  |  |  |
| ***Bone pain*** |  |  |  |  |  |  |
| Yes | 1 (8.33) | 0.188 | 0.27 (0.01 – 1.44) | 0.218 |  |  |
| No | 81 (24.92) |  | Reference |  |  |  |
| ***Breast self-examination*** |  |  |  |  |  |  |
| Yes | 8 (21.62) | 0.638 | 0.82 (0.38 – 1.80) | 0.638 |  |  |
| No | 74 (25.17) |  | Reference |  |  |  |
| ***Family history of breast cancer*** |  |  |  |  |  |  |
| Yes | 7 (21.88) | 0.750 | 0.87 (0.33 – 2.00) | 0.750 |  |  |
| No | 73 (24.41) |  | Reference |  |  |  |

AOR: adjusted odds ratio, CI: confidence interval, COR: crude odds ratio

**Table 6: Prevalence and associated risk factors of total diagnosis delay**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Total diagnosis delay** | | | | | |
| **Characteristics** | **Chi-square test** | | **Unadjusted model** | | **Adjusted model** | |
| **n (%)** | ***P-value*** | **COR (95% CI)** | ***P-value*** | **AOR (95% CI)** | ***P-value*** |
| **Socioeconomic characteristics** |  |  |  |  |  |  |
| ***Age at presentation (years****)* |  |  |  |  |  |  |
| <40 | 62 (55.36) | 0.960 | 0.82 (0.36 – 1.86) | 0.649 |  |  |
| 40-49 | 65 (54.62) |  | 0.80 (0.35 – 1.80) | 0.597 |  |  |
| 50-59 | 44 (56.41) |  | 0.86 (0.35 – 2.02) | 0.736 |  |  |
| ≥60 | 18 (60.00) |  | Reference |  |  |  |
| ***Geographic location*** |  |  |  |  |  |  |
| Chittagong | 33 (63.46) | 0.024 | 2.03 (1.78 – 5.35) | 0.014 | 2.85 (0.99 – 8.39) | 0.052 |
| Dhaka | 78 (52.35) |  | 1.28 (0.56 – 3.00) | 0.560 | 1.51 (0.60 – 3.89) | 0.387 |
| Khulna | 25 (65.79) |  | 2.24 (1.81 – 6.36) | 0.012 | 2.91 (1.95 – 9.25) | 0.044 |
| Mymensingh | 13 (39.39) |  | 0.76 (0.27 – 2.15) | 0.602 | 0.87 (0.28 – 2.71) | 0.807 |
| Rajshahi | 10 (50.00) |  | 1.67 (0.36 – 3.79) | 0.796 | 1.51 (0.43 – 5.39) | 0.520 |
| Rangpur | 13 (92.86) |  | 5.17 (2.46 – 6.41) | 0.014 | 6.07 (1.76 – 8.02) | 0.030 |
| Sylhet | 3 (60.00) |  | 1.75 (0.25 – 5.03) | 0.573 | 1.47 (0.14 – 5.55) | 0.735 |
| Barisal | 12 (46.15) |  | Reference |  | Reference |  |
| ***Area of residence*** |  |  |  |  |  |  |
| Rural | 150 (60.48) | <0.001 | 2.08 (1.28 – 3.40) | 0.003 | 2.04 (1.17 – 3.61) | 0.013 |
| Urban | 39 (42.39) |  | Reference |  | Reference |  |
| ***Current marital status*** |  |  |  |  |  |  |
| Single | 37 (64.91) | 0.011 | 1.60 (1.10 – 2.95) | 0.017 | 1.46 (1.14 – 2.94) | 0.027 |
| Married | 151 (53.55) |  | Reference |  | Reference |  |
| ***Patient education level*** |  |  |  |  |  |  |
| Illiterate | 89 (60.96) | 0.012 | 1.77 (1.02 – 3.09) | 0.043 | 1.59 (1.18 – 3.05) | 0.015 |
| Primary | 62 (54.39) |  | 1.35 (0.76 – 2.41) | 0.303 | 1.51 (1.17 – 2.95) | 0.022 |
| Secondary/Higher | 37 (46.84) |  | Reference |  | Reference |  |
| ***Spouse education level*** |  |  |  |  |  |  |
| Illiterate | 52 (58.43) | 0.683 | 1.28 (0.73 – 2.26) | 0.383 |  |  |
| Primary | 64 (55.17) |  | 1.12 (0.67 – 1.90) | 0.659 |  |  |
| Secondary/Higher | 58 (52.25) |  | Reference |  |  |  |
| ***Household monthly income (BDT)*** |  |  |  |  |  |  |
| <5000 | 73 (64.60) | <0.001 | 1.48 (0.95 – 2.75) | 0.121 | 1.26 (0.59 – 2.68) | 0.551 |
| 5000-10000 | 47 (47.96) |  | 1.74 (1.40 – 2.39) | 0.036 | 1.55 (0.99 – 2.11) | 0.101 |
| 10001-20000 | 23 (52.27) |  | 1.19 (0.41 – 1.91) | 0.760 | 1.21 (0.35 – 1.87) | 0.618 |
| >20000 | 37 (55.22) |  | Reference |  | Reference |  |
| ***Portable electronic devices*** |  |  |  |  |  |  |
| Yes | 173 (54.75) | 0.019 | 1.56 (1.23 – 2.32) | 0.020 | 1.55 (1.18 – 2.52) | 0.025 |
| No | 17 (68.00) |  | Reference |  | Reference |  |
| ***Mass media access*** |  |  |  |  |  |  |
| Yes | 79 (55.63) | 0.009 | 0.79 (0.94 – 1.12) | 0.070 | 0.98 (0.81 – 1.38) | 0.240 |
| No | 111 (55.78) |  | Reference |  | Reference |  |
| **Medical history of the patients** |  |  |  |  |  |  |
| ***Lump*** |  |  |  |  |  |  |
| Yes | 174 (55.59) | 0.874 | 0.94 (0.42 – 2.04) | 0.874 |  |  |
| No | 16 (57.14) |  | Reference |  |  |  |
| ***Breast pain*** |  |  |  |  |  |  |
| Yes | 46 (50.00) | 0.019 | 1.73 (1.45 – 2.18) | 0.019 | 1.60 (1.34 – 2.05) | 0.016 |
| No | 144 (47.83) |  | Reference |  | Reference |  |
| ***Nipple discharge*** |  |  |  |  |  |  |
| Yes | 14 (70.00) | 0.018 | 1.92 (1.75 – 5.54) | 0.018 | 2.19 (1.73 – 7.52) | 0.018 |
| No | 176 (54.83) |  | Reference |  | Reference |  |
| ***Skin changes*** |  |  |  |  |  |  |
| Yes | 9 (60.00) | 0.733 | 1.20 (0.42 – 3.66) | 0.733 |  |  |
| No | 181 (55.52) |  | Reference |  |  |  |
| ***Bone pain*** |  |  |  |  |  |  |
| Yes | 5 (41.67) | 0.031 | 1.56 (1.16 – 2.77) | 0.032 | 1.37 (1.09 – 2.30) | 0.012 |
| No | 185 (36.23) |  | Reference |  | Reference |  |
| ***Breast self-examination*** |  |  |  |  |  |  |
| Yes | 20 (54.05) | 0.859 | 0.94 (0.47 – 1.88) | 0.859 |  |  |
| No | 164 (55.59) |  | Reference |  |  |  |
| ***Family history of breast cancer*** |  |  |  |  |  |  |
| Yes | 15 (46.88) | 0.306 | 0.68 (0.33 – 1.42) | 0.308 |  |  |
| No | 169 (56.33) |  | Reference |  |  |  |

AOR: adjusted odds ratio, CI: confidence interval, COR: crude odds ratio

**Table 7: Goodness of fit test and classification accuracy of the final models**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Hosmer and Lemeshow's goodness of fit test** | | | **Area Under Receiver Operating Characteristic Curve** | | |
|  | **X-squared** | **DF** | ***P-value*** | **AUC scores** | **95% CI** | ***P-value*** |
| **Model 1** | 6.01 | 8 | 0.646 | 62.43% | 59.80%-72.05% | <0.001 |
| **Model 2** | 5.35 | 6 | 0.500 | 58.92% | 51.48%-65.14% | <0.001 |
| **Model 3** | 6.93 | 8 | 0.544 | 68.87% | 65.46%-76.99% | <0.001 |

# Figures



Figure 1: Physical presentations of the patients



Figure 2: Breast cancer treatment delays at various stages



Figure 2: Model evaluations using the receiver operating characteristic curve (ROC curve) for adjusted models.