**Methods:**

**Statistical analysis**

Descriptive and inferential statistics were conducted to examine the study’s hypotheses. These included bar charts, cross-tabulations, chi-square tests, and logistic regression models to assess associations. Both univariate and multivariable logistic regressions were applied to evaluate the relationship between vaccine compliance and selected covariates. Results were presented using odds ratios (OR) with 95% confidence intervals, and a significance level of p < 0.05 was used. However, a more lenient p-value threshold of < 0.20 was applied during univariate analyses for variable selection to be included in the multivariable model (Hasan et al., 2020). No variables were excluded at this stage. Multicollinearity was assessed using the variance inflation factor (VIF), with a cutoff value of 4.00 (Hasan et al., 2025). Variables with VIF values below this threshold were retained in the model. The model’s performance was evaluated using sensitivity and specificity derived from the receiver operating characteristic (ROC) curve. A higher area under the curve (AUC) indicates better model performance, with an AUC above 0.50 demonstrating the model’s ability to discriminate between outcome groups (Cook & Rajbhandari, 2018; Hasan et al., 2023). Model calibration was assessed using the Hosmer-Lemeshow goodness-of-fit test. A Hosmer-Lemeshow p-value greater than 0.05 suggests that the model fits the data well, indicating its ability to correctly classify observations into outcome categories (Demler et al., 2015).

Fig 1: Geographical distribution of rabies patient



**Table 1: Summary Statistics of Key Variables Among Rabies Patients**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Minimum | Maximum | Mean | SD |
| Age | 1.00 | 70.00 | 25.88 | 15.60 |
| Family income | 10000 | 450000 | 34105.03 | 40661.61 |
| Residence to IDH | 1.00 | 110.00 | 10.42 | 9.40 |
| Travel costs to the IDH | 10.00 | 1000.00 | 147.98 | 113.14 |
| Time gap between bite to IDH visit | 0.00 | 180.00 | 3.22 | 14.78 |
| Medicine cost | 150.00 | 800.00 | 344.73 | 45.97 |

Table 1 summarizes key characteristics of rabies patients. The average age was 25.88 years (SD = 15.60), with a wide age range from 1 to 70 years. Monthly family income showed substantial variation, averaging BDT 34,105.03 (SD = 40,661.61). The mean distance from residence to the Infectious Disease Hospital (IDH) was 10.42 km (SD = 9.40), with corresponding travel costs averaging BDT 147.98 (SD = 113.14). The time gap between the bite and hospital visit averaged 3.22 days (SD = 14.78), though some patients experienced significant delays. Medicine costs were relatively consistent, averaging BDT 344.73 (SD = 45.97).

**Figure 2: Reasons for coming late in IDH to take vaccine in appropriate schedule**

Figure 2 presents the average delay (in days) between the animal bite and the patient's visit to the hospital based on different reported reasons. The most common cause of prolonged delay was **distance to the healthcare facility**, with an average time gap of **8.36 days**. Lack of awareness about the vaccination schedule also led to significant delay, averaging **4.09 days**. Other notable reasons included **sickness (3.33 days)** and **bite-induced suffering (3.11 days)**, which prevented patients from seeking immediate care. Comparatively shorter delays were associated with being **busy with other work (2.14 days)**, **difficulty in locating the Infectious Disease Hospital (1.9 days)**, and **miscellaneous reasons (1.8 days)**.

**Table 2: Prevalence of vaccine compliance in recommended schedule by socio-demographic factors of rabies patient**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Maintained the recommended vaccine schedule appropriately | | |  |
|  | Yes  n (%) | No  n (%) | Total  n (%) | P-value |
| Demographic characteristics |  |  |  |  |
| Age category |  |  |  |  |
| <15 | 14 (11.5) | 108 (88.5) | 122 (26.7) | 0.055 |
| >=15 | 64 (19.1) | 271 (80.9) | 335 (73.3) |  |
| Gender |  |  |  |  |
| Female | 32 (22.5) | 110 (77.5) | 142 (31.1) | 0.037 |
| Male | 46 (14.6) | 269 (85.4) | 315 (68.9) |  |
| Profession |  |  |  |  |
| Student | 23 (14.1) | 140 (85.9) | 163 (35.7) | 0.027 |
| Job/Business | 17 (12.9) | 115 (87.1) | 132 (28.9) |  |
| Housewife | 19 (23.2) | 63 (76.8) | 82 (17.9) |  |
| Children | 4 (13.3) | 26 (86.7) | 30 (6.6) |  |
| Others | 15 (30.0) | 35 (70.0) | 50 (10.9) |  |
| Income Category |  |  |  |  |
| <30000 | 59 (28.4) | 149 (71.6) | 208 (45.5) | <0.001 |
| >= 30000 | 19 (7.6) | 230 (92.4) | 249 (54.5) |  |
| Highest Education |  |  |  |  |
| No education or below the primary | 16 (29.6) | 38 (70.4) | 54 (11.8) | 0.114 |
| Primary | 14 (13.7) | 88 (86.3) | 102 (22.3) |  |
| Secondary | 25 (16.1) | 130 (83.9) | 155 (33.9) |  |
| Higher Secondary | 10 (13.9) | 62 (86.1) | 72 (15.8) |  |
| Above higher secondary | 13 (17.6) | 61 (82.4) | 74 (16.2) |  |
| Residence |  |  |  |  |
| Dhaka North | 42 (15.1) | 178 (84.9) | 279 (61.1) | 0.303 |
| Dhaka South | 25 (19.2) | 111 (80.8) | 130 (28.4) |  |
| Outside Dhaka | 11 (22.9) | 37 (77.1) | 48 (10.5) |  |
| Distance residence to IDH |  |  |  |  |
| <10 (below avg) | 55 (22.1) | 194 (77.9) | 249 (54.5) | 0.002 |
| >=10 (above avg) | 23 (11.1) | 185 (88.9) | 208 (45.5) |  |
| Know about IDH before |  |  |  |  |
| Yes | 46 (13.4) | 297 (86.6) | 343 (75.1) | <0.001 |
| No | 32 (28.1) | 82 (71.9) | 114 (24.9) |  |
| Hear about IDH |  |  |  |  |
| Doctor | 9 (15.5) | 49 (84.5) | 58 (12.7) | <0.001 |
| Neighbor | 32 (12.2) | 231 (87.8) | 263 (57.5) |  |
| Relative | 25 (25.0) | 75 (75.0) | 100 (21.9) |  |
| Others | 12 (33.3) | 24 (66.7) | 36 (7.9) |  |
| Characteristics of animals’ exposure |  |  |  |  |
| Animal Bite/scratch |  |  |  |  |
| Dog | 51 (21.9) | 182 (78.1) | 233 (51.0) | 0.020 |
| Cat | 26 (12.1) | 189 (87.9) | 215 (47.0) |  |
| Others | 1 (11.1) | 8 (88.9) | 9 (2.0) |  |
| Exposure type |  |  |  |  |
| Bite | 56 (21.1) | 209 (78.9) | 265 (58.0) | 0.008 |
| Scratch | 22 (11.5) | 170 (88.5) | 192 (42.0) |  |
| Number of bites/scratches |  |  |  |  |
| Single | 49 (14.8) | 282 (85.2) | 331 (72.4) | 0.037 |
| Multiple | 29 (23.0) | 97 (77.0) | 126 (27.6) |  |
| Type of animal |  |  |  |  |
| Stray | 51 (20.8) | 194 (79.2) | 245 (53.6) | 0.055 |
| Community own | 8 (8.5) | 86 (91.5) | 94 (20.6) |  |
| Own pet | 18 (15.8) | 96 (84.2) | 114 (24.9) |  |
| Wild | 1 (25.0) | 3 (75.0) | 4 (0.9) |  |
| Reason of bite |  |  |  |  |
| Provoked by patient | 27 (14.2) | 163 (85.8) | 190 (41.6) | 0.004 |
| Provoked by animals | 4 (6.2) | 61 (93.8) | 65 (14.2) |  |
| Unprovoked | 45 (22.5) | 155 (77.5) | 200 (43.8) |  |
| Category of wound |  |  |  |  |
| Cat-I | 3 (75.0) | 1 (25.0) | 4 (0.9) | 0.007 |
| Cat-II | 24 (15.0) | 136 (85.0) | 160 (35.0) |  |
| Cat-III | 51 (17.4) | 242 (82.6) | 293 (64.1) |  |
| Measures taken |  |  |  |  |
| Wash with water only | 12 (18.5) | 53 (81.5) | 65 (14.2) | <0.001 |
| Wash with water and soap | 48 (15.1) | 270 (84.9) | 318 (69.6) |  |
| Did nothing | 8 (13.6) | 51 (86.4) | 59 (12.9) |  |
| Others | 10 (66.7) | 5 (33.3) | 15 (3.3) |  |

Table 2 presents the prevalence of compliance with the recommended rabies vaccination schedule across various socio-demographic and exposure-related factors. Overall, vaccine compliance was significantly associated with several variables.

**Age** and **gender** showed notable differences in compliance, with patients aged ≥15 years having higher compliance than those under 15 (p = 0.055), and females demonstrating better adherence than males (22.5% vs. 14.6%, p = 0.037). Among different professions, housewives (23.2%) and individuals in the "others" category (30.0%) exhibited higher compliance compared to students and those engaged in jobs/businesses (p = 0.027).

Patients from lower-income households (< BDT 30,000) were significantly more likely to adhere to the vaccination schedule compared to those from higher-income brackets (28.4% vs. 7.6%, p < 0.001). Although educational level did not show a statistically significant association (p = 0.114), a trend toward higher compliance was observed among those with no or only primary education.

Geographic and accessibility factors also influenced adherence. Patients residing less than 10 km from the IDH were more likely to comply with vaccination (22.1% vs. 11.1%, p = 0.002). Prior knowledge of the IDH was strongly associated with compliance; those unaware of the IDH beforehand had a significantly higher compliance rate (28.1% vs. 13.4%, p < 0.001). Additionally, the source of information about the IDH played a role—patients informed by relatives or others had higher compliance than those informed by doctors or neighbors (p < 0.001).

In terms of animal exposure, patients bitten by **dogs** showed significantly greater adherence (21.9%) than those bitten by cats or other animals (p = 0.020). Similarly, **bite wounds** were more likely to prompt compliance than scratches (21.1% vs. 11.5%, p = 0.008). Multiple bites were associated with better adherence than single exposures (23.0% vs. 14.8%, p = 0.037). Exposure to **stray animals** was also linked to better compliance than community-owned or pet animals (p = 0.055).

The **reason for the bite** and **wound category** influenced compliance; unprovoked bites (22.5%) and more severe wounds (Category III: 17.4%) were associated with greater adherence (p = 0.004 and p = 0.007, respectively). Among post-bite actions, patients who washed the wound with both **water and soap** had higher compliance (15.1%) compared to those who used water only, did nothing, or followed other measures (p < 0.001).

**Table 3: Factor associated with vaccine compliance in recommended scheduling of rabies patient**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Maintained the recommended vaccine schedule appropriately | | |  |
|  | COR (95% CI) | P-value | AOR (95% CI) | P-value |
| Demographic characteristics |  |  |  |  |
| Age category |  |  |  |  |
| <15 | 1.82 (0.98 – 3.39) | 0.058 | 1.46 (0.51 – 4.15) | 0.481 |
| >=15 | Reference |  | Reference |  |
| Gender |  |  |  |  |
| Female | 0.59 (0.36 – 0.97) | 0.038 | 0.63 (0.28 – 0.91) | 0.025 |
| Male | Reference |  | Reference |  |
| Profession |  |  |  |  |
| Student | 0.90 (0.46 – 1.77) | 0.759 | 0.73 (0.30 – 1.83) | 0.506 |
| Job/Business | 1.84 (0.93 – 3.61) | 0.078 | 0.85 (0.26 – 2.77) | 0.788 |
| Housewife | 0.94 (0.30 – 2.93) | 0.910 | 0.48 (0.08 – 2.95) | 0.431 |
| Children | 2.61 (1.23 – 5.52) | 0.012 | 1.12 (0.36 – 3.47) | 0.847 |
| Others | Reference |  | Reference |  |
| Income Category |  |  |  |  |
| <30000 | 4.79 (2.75 – 8.36) | <0.001 | 4.18 (2.07 – 8.47) | <0.001 |
| >= 30000 | Reference |  | Reference |  |
| Highest Education |  |  |  |  |
| No education or below the primary | 2.61 (1.08 – 6.34) | 0.034 | 2.01 (0.47 – 8.58) | 0.348 |
| Primary | 0.99 (0.41 – 2.36) | 0.980 | 0.90 (0.26 – 3.15) | 0.870 |
| Secondary | 1.19 (0.54 – 2.64) | 0.664 | 1.12 (0.41 – 3.06) | 0.818 |
| Higher Secondary | 1.32 (0.54 – 3.24) | 0.543 | 1.95 (0.62 – 6.11) | 0.250 |
| Above higher secondary | Reference |  | Reference |  |
| Location |  |  |  |  |
| Dhaka North | 1.34 (0.78 – 2.32) | 0.289 | 2.25 (1.06 – 4.75) | 0.034 |
| Dhaka South | 1.68 (0.79 – 3.55) | 0.176 | 3.39 (1.01 – 5.38) | 0.048 |
| Outside Dhaka | Reference |  | Reference |  |
| Distance residence to IDH |  |  |  |  |
| <10 | 2.28 (1.35 – 3.86) | 0.002 | 3.82 (1.64 – 8.93) | 0.002 |
| >=10 | Reference |  | Reference |  |
| Hear about IDH |  |  |  |  |
| Doctor | 0.37 (0.14 – 0.99) | 0.048 | 0.53 (0.14 – 2.03) | 0.356 |
| Neighbor | 0.28 (0.13 – 0.61) | <0.001 | 0.64 (0.22 – 1.84) | 0.408 |
| Relative | 0.67 (0.29 – 1.53) | 0.337 | 1.17 (0.39 – 3.50) | 0.784 |
| Others | Reference |  | Reference |  |
| Know about IDH |  |  |  |  |
| Yes | 0.40 (0.24 – 0.66) | <0.001 | 0.33 (0.17 – 0.65) | <0.001 |
| No | Reference |  | Reference |  |
| Characteristics of animals’ exposure |  |  |  |  |
| Animal Bite |  |  |  |  |
| Dog | 0.49 (0.29 – 0.82) | 0.007 | 0.59 (0.25 – 0.94) | 0.022 |
| Cat | 0.45 (0.16 – 3.65) | 0.452 | 0.19 (0.15 – 3.66) | 0.274 |
| Others | Reference |  | Reference |  |
| Exposure type |  |  |  |  |
| Scratch | 2.07 (1.22 – 3.53) | 0.007 | 1.77 (1.16 – 3.66) | 0.012 |
| Bite | Reference |  | Reference |  |
| Number of bites/scratches |  |  |  |  |
| Single | 0.58 (0.35 – 0.97) | 0.038 | 0.41 (0.20 – 0.81) | 0.010 |
| Multiple | Reference |  | Reference |  |
| Type of animal |  |  |  |  |
| Stray | 0.35 (0.16 – 0.78) | 0.010 | 0.36 (0.13 – 0.95) | 0.039 |
| Community own | 0.71 (0.40 – 1.29) | 0.262 | 0.48 (0.20 – 1.18) | 0.112 |
| Own pet | 1.27 (0.13 – 2.45) | 0.839 | 1.90 (0.13 – 2.94) | 0.754 |
| Wild | Reference |  | Reference |  |
| Reason of bite |  |  |  |  |
| Provoked by patient | 0.40 (0.13 – 1.18) | 0.096 | 0.46 (0.13 – 1.67) | 0.236 |
| Provoked by animals | 1.75 (1.04 – 2.96) | 0.036 | 1.49 (0.74 – 2.98) | 0.265 |
| Unprovoked | Reference |  | Reference |  |
| Category of wound |  |  |  |  |
| Cat-I | 4.24 (1.45 – 13.62) | 0.023 | 8.48 (0.75 – 14.28) | 0.074 |
| Cat-II | 0.84 (0.49 – 1.42) | 0.511 | 0.81 (0.40 – 1.66) | 0.573 |
| Cat-III | Reference |  | Reference |  |
| Measures taken |  |  |  |  |
| Wash with water and soap | 0.21 (0.13 – 0.49) | 0.001 | 0.48 (0.17 – 1.98) | 0.248 |
| Wash with water only | 0.19 (0.13 – 0.37) | <0.001 | 0.29 (0.14 – 0.91) | 0.024 |
| Others | 0.18 (0.12 – 0.39) | <0.001 | 0.22 (0.12 – 0.84) | 0.022 |
| Did nothing | Reference |  | Reference |  |

After adjusting for other variables, individuals from lower-income households (<30,000 BDT) had 4.18 times higher odds (AOR: 4.18, 95% CI: 2.07–8.47) of maintaining the recommended vaccine schedule compared to those from higher-income groups. Female patients had 0.63 times lower odds (AOR: 0.63, 95% CI: 0.28–0.91) of non-compliance than males.

Participants living within 10 kilometers of the IDH were 3.82 times more likely (AOR: 3.82, 95% CI: 1.64–8.93) to comply with the vaccine schedule compared to those living farther. Those who knew about the IDH beforehand had 0.33 times the odds (AOR: 0.33, 95% CI: 0.17–0.65) of being non-compliant than those who did not.

Exposure-related factors also showed significant associations. Patients exposed by scratches rather than bites had 1.77 times higher odds (AOR: 1.77, 95% CI: 1.16–3.66) of compliance. Those with a single bite or scratch had 0.41 times lower odds (AOR: 0.41, 95% CI: 0.20–0.81) of non-compliance than those with multiple exposures. Additionally, exposure to stray animals was associated with 0.36 times lower odds (AOR: 0.36, 95% CI: 0.13–0.95) of non-compliance compared to exposure to wild animals.

In terms of post-exposure wound care, individuals who washed the wound with water only had 0.29 times the odds (AOR: 0.29, 95% CI: 0.14–0.91) of non-compliance, and those who took other actions had 0.22 times the odds (AOR: 0.22, 95% CI: 0.12–0.84) compared to those who did nothing.

**Table 4: Model Performance Metrics Including Hosmer-Lemeshow Test, AUC, and Classification Accuracy**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Hosmer and Lemeshow Test | | | Area Under the Curve | | Classification Accuracy |
| Chi-square | df | P-value | Area | 95% CI |
| 5.97 | 8 | 0.651 | 85.20% | 83.96%-87.51% | 87.50% |

The model demonstrated good fit as indicated by the **Hosmer and Lemeshow test** (χ² = 5.97, df = 8, *p* = 0.651), suggesting no significant difference between observed and predicted values. The **area under the curve (AUC)** was 85.2% (95% CI: 83.96%–87.51%), reflecting excellent discriminative ability. The model’s **classification accuracy** was 87.5%, indicating a high level of correctness in predicting vaccine compliance.

**Figure 3: ROC Curve of final multivariable logistic regression model**

