

## Supplementary Materials

| Feature                    | Importance |
|----------------------------|------------|
| Pulse Rate                 | 19.55      |
| Resp Rate                  | 12.6       |
| BMI                        | 5.4        |
| BP systolic                | 5.26       |
| BP diastolic               | 5.17       |
| Home – Antibacterials      | 4.69       |
| O2 Sat (percentage)        | 4.38       |
| Antifungals                | 4.09       |
| Prior ED Discharge         | 2.74       |
| AGE                        | 2.5        |
| Height (cm)                | 2.49       |
| Home - Beta-Blockers       | 1.94       |
| Home – Hypoglycemics       | 1.91       |
| Home – Hormones            | 1.85       |
| Home – Diuretics           | 1.74       |
| Hypoglycemics              | 1.51       |
| Antibacterials             | 1.46       |
| Home – Vitamins            | 1.37       |
| Home – Antacids            | 1.09       |
| SEX                        | 1.06       |
| Antacids                   | 1.03       |
| Home – Anticonvulsants     | 1.00       |
| Home – Antivirals          | 0.95       |
| Beta-Blockers              | 0.87       |
| Home - Anti-Inflammatories | 0.82       |
| Home – Sedatives           | 0.77       |
| Sleeping Drugs             | 0.68       |
| Home – Antihistamines      | 0.68       |
| Diuretics                  | 0.65       |

|                                         |      |
|-----------------------------------------|------|
| Antipsychotics                          | 0.64 |
| Immunosuppressives                      | 0.55 |
| Home – Antipsychotics                   | 0.53 |
| Corticosteroids                         | 0.52 |
| Antihypertensives                       | 0.46 |
| Anti-Inflammatories                     | 0.46 |
| Home – Antiarrhythmics                  | 0.45 |
| Bronchodilators                         | 0.45 |
| Sedatives                               | 0.43 |
| Hormones                                | 0.42 |
| Had_Catheter                            | 0.42 |
| Home – Antihypertensives                | 0.32 |
| Home - Sleeping Drugs                   | 0.32 |
| Antianxiety Drugs                       | 0.31 |
| Antiemetics                             | 0.28 |
| Antipyretics                            | 0.27 |
| Home - Antianxiety Drugs                | 0.27 |
| Home – Laxatives                        | 0.27 |
| Antidiarrheals                          | 0.22 |
| Home – Bronchodilators                  | 0.19 |
| Home - Anticoagulants and Thrombolytics | 0.17 |
| Antiarrhythmics                         | 0.16 |
| Anticonvulsants                         | 0.15 |
| Antivirals                              | 0.15 |
| Home – Antifungals                      | 0.15 |
| Home – Antiemetics                      | 0.14 |
| Laxatives                               | 0.13 |
| Antidepressants                         | 0.12 |
| Home - Sex Hormones (Female)            | 0.11 |
| Sex Hormones (Female)                   | 0.09 |
| Analgesics                              | 0.09 |
| Muscle Relaxants                        | 0.08 |
| Home – Expectorant                      | 0.07 |

|                                  |      |
|----------------------------------|------|
| Antineoplastics                  | 0.07 |
| Anticoagulants and Thrombolytics | 0.07 |
| Vitamins                         | 0.06 |
| Home – Immunosuppressives        | 0.06 |
| Home – Antidiarrheals            | 0.04 |
| Cough Suppressants               | 0.02 |
| Home – Analgesics                | 0.02 |
| Decongestants                    | 0.01 |
| Home – Decongestants             | 0.01 |
| Home - Cough Suppressants        | 0.00 |
| Antihistamines                   | 0.00 |
| Home - Sex Hormones (Male)       | 0.00 |
| Home – Antineoplastics           | 0.00 |
| Sex Hormones (Male)              | 0.00 |
| Expectorant                      | 0.00 |
| Barbiturates                     | 0.00 |
| Home – Antidepressants           | 0.00 |
| Home - Muscle Relaxants          | 0.00 |
| Home – Corticosteroids           | 0.00 |

Table S1: CatBoost Global Feature Importance

| Feature                    | Mean SHAP Impact | Direction             |
|----------------------------|------------------|-----------------------|
| Pulse Rate                 | 2.177            | Positive (risk)       |
| Resp Rate                  | 1.643            | Positive (risk)       |
| BMI                        | -0.386           | Negative (protective) |
| BP diastolic               | -0.246           | Negative (protective) |
| Home – Antibacterials      | 0.158            | Positive (risk)       |
| AGE                        | 0.101            | Positive (risk)       |
| O2 Sat (percentage)        | -0.087           | Negative (protective) |
| BP systolic                | 0.062            | Positive (risk)       |
| Home - Anti-Inflammatories | -0.054           | Negative (protective) |
| Antifungals                | -0.052           | Negative (protective) |
| Prior ED Discharge         | -0.046           | Negative (protective) |
| Antacids                   | 0.030            | Positive (risk)       |
| Home – Antacids            | 0.024            | Positive (risk)       |
| Home – Antivirals          | -0.023           | Negative (protective) |
| Home – Diuretics           | -0.021           | Negative (protective) |
| Sleeping Drugs             | 0.019            | Positive (risk)       |
| Home – Vitamins            | 0.019            | Positive (risk)       |
| Antibacterials             | 0.017            | Positive (risk)       |
| Had_Catheter               | -0.016           | Negative (protective) |
| Height (cm)                | 0.015            | Positive (risk)       |
| SEX                        | -0.014           | Negative (protective) |
| Home – Hormones            | -0.012           | Negative (protective) |
| Home - Sleeping Drugs      | 0.012            | Positive (risk)       |
| Home – Hypoglycemics       | -0.009           | Negative (protective) |
| Home – Antihistamines      | -0.008           | Negative (protective) |
| Diuretics                  | -0.008           | Negative (protective) |
| Home - Beta-Blockers       | -0.007           | Negative (protective) |
| Home – Sedatives           | -0.006           | Negative (protective) |
| Antihypertensives          | 0.006            | Positive (risk)       |
| Beta-Blockers              | -0.006           | Negative (protective) |

|                                         |        |                       |
|-----------------------------------------|--------|-----------------------|
| Hypoglycemics                           | -0.005 | Negative (protective) |
| Home – Antipsychotics                   | -0.004 | Negative (protective) |
| Home – Antihypertensives                | -0.004 | Negative (protective) |
| Antipyretics                            | 0.004  | Positive (risk)       |
| Hormones                                | -0.004 | Negative (protective) |
| Analgesics                              | -0.003 | Negative (protective) |
| Anti-Inflammatories                     | -0.003 | Negative (protective) |
| Immunosuppressives                      | -0.003 | Negative (protective) |
| Sedatives                               | -0.003 | Negative (protective) |
| Antiemetics                             | -0.002 | Negative (protective) |
| Home – Expectorant                      | -0.002 | Negative (protective) |
| Home - Anticoagulants and Thrombolytics | 0.002  | Positive (risk)       |
| Vitamins                                | 0.002  | Positive (risk)       |
| Antivirals                              | -0.002 | Negative (protective) |
| Home – Laxatives                        | 0.002  | Positive (risk)       |
| Antidiarrheals                          | 0.002  | Positive (risk)       |
| Home - Antianxiety Drugs                | -0.001 | Negative (protective) |
| Home – Anticonvulsants                  | -0.001 | Negative (protective) |
| Antipsychotics                          | 0.001  | Positive (risk)       |
| Home – Antiarrhythmics                  | -0.001 | Negative (protective) |
| Antidepressants                         | -0.001 | Negative (protective) |
| Home – Immunosuppressives               | -0.001 | Negative (protective) |
| Home - Sex Hormones (Female)            | 0.001  | Positive (risk)       |
| Laxatives                               | 0.001  | Positive (risk)       |
| Corticosteroids                         | -0.001 | Negative (protective) |
| Antineoplastics                         | -0.001 | Negative (protective) |
| Anticonvulsants                         | 0.00   | Positive (risk)       |
| Cough Suppressants                      | 0.00   | Negative (protective) |
| Antianxiety Drugs                       | 0.00   | Positive (risk)       |
| Bronchodilators                         | 0.00   | Positive (risk)       |
| Home – Analgesics                       | 0.00   | Positive (risk)       |
| Antiarrhythmics                         | 0.00   | Negative (protective) |
| Decongestants                           | 0.00   | Negative (protective) |

|                                  |      |                       |
|----------------------------------|------|-----------------------|
| Home – Decongestants             | 0.00 | Negative (protective) |
| Muscle Relaxants                 | 0.00 | Negative (protective) |
| Home – Antiemetics               | 0.00 | Negative (protective) |
| Home – Antifungals               | 0.00 | Positive (risk)       |
| Home – Bronchodilators           | 0.00 | Positive (risk)       |
| Sex Hormones (Female)            | 0.00 | Positive (risk)       |
| Anticoagulants and Thrombolytics | 0.00 | Positive (risk)       |
| Home – Antidiarrheals            | 0.00 | Negative (protective) |
| Expectorant                      | 0.00 | Positive (risk)       |
| Home - Sex Hormones (Male)       | 0.00 | Positive (risk)       |
| Home – Antineoplastics           | 0.00 | Positive (risk)       |
| Home - Cough Suppressants        | 0.00 | Positive (risk)       |
| Antihistamines                   | 0.00 | Positive (risk)       |
| Barbiturates                     | 0.00 | Positive (risk)       |
| Home – Antidepressants           | 0.00 | Positive (risk)       |
| Home – Corticosteroids           | 0.00 | Positive (risk)       |
| Sex Hormones (Male)              | 0.00 | Positive (risk)       |
| Home - Muscle Relaxants          | 0.00 | Positive (risk)       |

Table S2: All Features by Directional Mean SHAP Impact – CatBoost Model

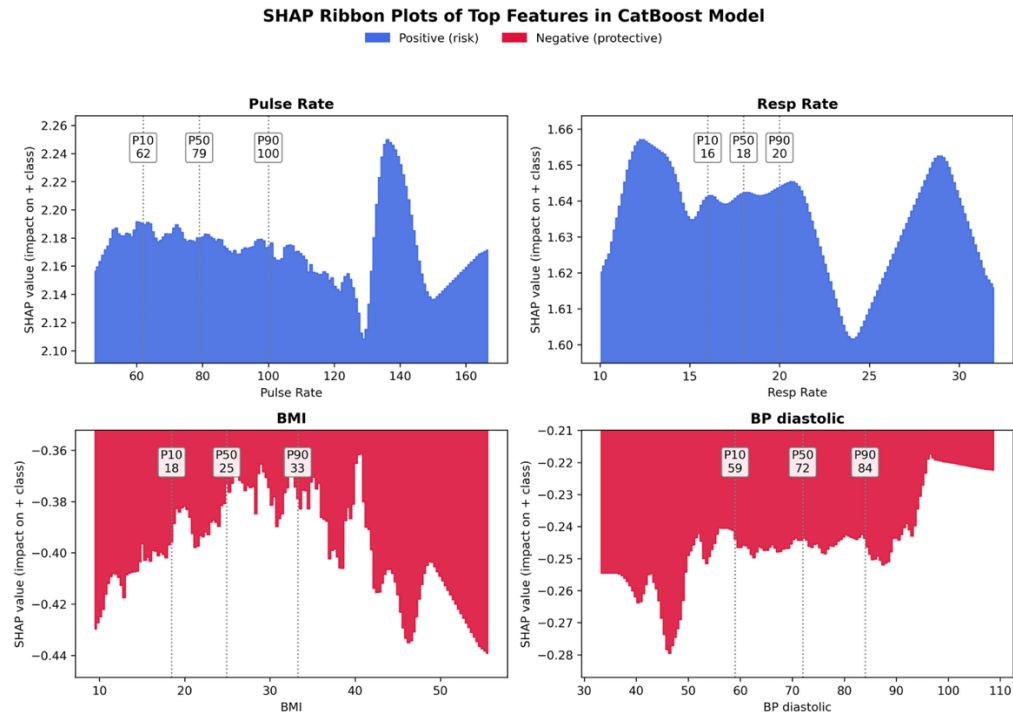


Figure S1: Binned SHAP ribbon plots for the top CatBoost features: Pulse Rate, Respiratory Rate, BMI, and diastolic blood pressure. The x-axis shows feature values and the y-axis shows SHAP values. Filled areas above zero (blue) indicate an average increase in predicted risk, and areas below zero (red) indicate a decrease. Curves are smoothed means of SHAP values within bins, with vertical dotted lines marking the 10th, 50th, and 90th percentiles of the evaluation data. Pulse rate and respiratory rate demonstrated consistently positive SHAP values, indicating that higher measurements were associated with increased predicted risk of deterioration. In contrast, BMI and diastolic blood pressure showed consistently negative SHAP values, indicating a protective association across their ranges. No feature demonstrated a reversal in direction of effect, supporting the stability and clinical plausibility of the model's learned relationships.

| <b>Feature</b>         | <b>Unit of change</b> | <b>OR (95% CI)</b>       | <b>P-value</b> |
|------------------------|-----------------------|--------------------------|----------------|
| Pulse Rate             | per 1 SD              | 1.82 (95% CI 1.66–1.99)  | p < 0.0001     |
| Antifungals            | 1 vs 0                | 3.09 (95% CI 2.57–3.72)  | p < 0.0001     |
| Home – Antibacterials  | 1 vs 0                | 3.18 (95% CI 2.61–3.86)  | p < 0.0001     |
| Antibacterials         | 1 vs 0                | 3.03 (95% CI 2.49–3.68)  | p < 0.0001     |
| Prior ED Discharge     | 1 vs 0                | 3.53 (95% CI 2.81–4.44)  | p < 0.0001     |
| Resp Rate              | per 1 SD              | 1.87 (95% CI 1.67–2.09)  | p < 0.0001     |
| Home – Diuretics       | 1 vs 0                | 2.66 (95% CI 2.21–3.19)  | p < 0.0001     |
| Home - Beta-Blockers   | 1 vs 0                | 2.31 (95% CI 1.93–2.78)  | p < 0.0001     |
| Home – Hypoglycemics   | 1 vs 0                | 2.31 (95% CI 1.92–2.78)  | p < 0.0001     |
| Hypoglycemics          | 1 vs 0                | 2.26 (95% CI 1.87–2.72)  | p < 0.0001     |
| Beta-Blockers          | 1 vs 0                | 2.20 (95% CI 1.83–2.65)  | p < 0.0001     |
| Home – Antifungals     | 1 vs 0                | 2.31 (95% CI 1.89–2.82)  | p < 0.0001     |
| O2 Sat (percentage)    | per 1 SD              | 0.70 (95% CI 0.64–0.76)  | p < 0.0001     |
| Diuretics              | 1 vs 0                | 1.96 (95% CI 1.75–2.54)  | p < 0.0001     |
| Home – Antivirals      | 1 vs 0                | 2.28 (95% CI 1.85–2.80)  | p < 0.0001     |
| Home – Hormones        | 1 vs 0                | 2.09 (95% CI 1.67–2.41)  | p < 0.0001     |
| Immunosuppressives     | 1 vs 0                | 2.12 (95% CI 1.74–2.58)  | p < 0.0001     |
| Antacids               | 1 vs 0                | 2.73 (95% CI 2.07–3.61)  | p < 0.0001     |
| Home – Antacids        | 1 vs 0                | 2.39 (95% CI 1.84–3.09)  | p < 0.0001     |
| Hormones               | 1 vs 0                | 1.92 (95% CI 1.60–2.30)  | p < 0.0001     |
| BP diastolic           | per 1 SD              | 0.82 (95% CI 0.75–0.90)  | p < 0.0001     |
| Bronchodilators        | 1 vs 0                | 1.86 (95% CI 1.53–2.26)  | p < 0.0001     |
| Home – Bronchodilators | 1 vs 0                | 1.80 (95% CI 1.47–2.24)  | p < 0.0001     |
| Had_Catheter           | 1 vs 0                | 1.77 (95% CI 1.42–2.19)  | p < 0.0001     |
| Home – Antihistamines  | 1 vs 0                | 1.73 (95% CI 1.42–2.09)  | p < 0.0001     |
| Home – Sedatives       | 1 vs 0                | 7.04 (95% CI 3.15–15.74) | p < 0.0001     |
| Sedatives              | 1 vs 0                | 7.04 (95% CI 3.15–15.74) | p < 0.0001     |
| Vitamins               | 1 vs 0                | 3.52 (95% CI 2.09–5.91)  | p < 0.0001     |
| Home – Anticonvulsants | 1 vs 0                | 1.55 (95% CI 1.29–1.86)  | p < 0.0001     |
| Anticonvulsants        | 1 vs 0                | 1.50 (95% CI 1.25–1.80)  | p < 0.0001     |
| Corticosteroids        | 1 vs 0                | 1.49 (95% CI 1.24–1.79)  | p < 0.0001     |

|                              |          |                           |            |
|------------------------------|----------|---------------------------|------------|
| Home – Corticosteroids       | 1 vs 0   | 1.49 (95% CI 1.24–1.79)   | p < 0.0001 |
| BP systolic                  | per 1 SD | 0.82 (95% CI 0.75–0.90)   | p < 0.0001 |
| Antivirals                   | 1 vs 0   | 1.84 (95% CI 1.39–2.44)   | p < 0.0001 |
| Expectorant                  | 1 vs 0   | 2.46 (95% CI 1.61–3.76)   | p < 0.0001 |
| Home – Expectorant           | 1 vs 0   | 2.46 (95% CI 1.61–3.76)   | p < 0.0001 |
| BMI                          | per 1 SD | 0.82 (95% CI 0.74–0.91)   | p < 0.0001 |
| Home – Antihypertensives     | 1 vs 0   | 1.59 (95% CI 1.26–2.01)   | p < 0.001  |
| Home – Antipsychotics        | 1 vs 0   | 1.51 (95% CI 1.22–1.88)   | p < 0.001  |
| Antihypertensives            | 1 vs 0   | 1.57 (95% CI 1.24–1.99)   | p < 0.001  |
| Antipsychotics               | 1 vs 0   | 1.50 (95% CI 1.21–1.87)   | p < 0.001  |
| Antiarrhythmics              | 1 vs 0   | 1.86 (95% CI 1.31–2.62)   | p < 0.001  |
| Antihistamines               | 1 vs 0   | 1.56 (95% CI 1.20–2.03)   | p < 0.01   |
| Home – Antiemetics           | 1 vs 0   | 1.35 (95% CI 1.13–1.62)   | p < 0.01   |
| Home – Antiarrhythmics       | 1 vs 0   | 1.75 (95% CI 1.22–2.53)   | p < 0.01   |
| SEX                          | 1 vs 0   | 1.31 (95% CI 1.10–1.58)   | p < 0.01   |
| Antidiarrheals               | 1 vs 0   | 1.72 (95% CI 1.20–2.46)   | p < 0.01   |
| Home – Antidiarrheals        | 1 vs 0   | 1.85 (95% CI 1.38–2.49)   | p < 0.01   |
| Cough Suppressants           | 1 vs 0   | 1.89 (95% CI 1.18–2.90)   | p < 0.01   |
| Home - Cough Suppressants    | 1 vs 0   | 1.89 (95% CI 1.18–2.90)   | p < 0.01   |
| Antipyretics                 | 1 vs 0   | 1.38 (95% CI 1.08–1.78)   | p < 0.01   |
| Sleeping Drugs               | 1 vs 0   | 1.53 (95% CI 1.05–1.52)   | p = 0.02   |
| Home - Sleeping Drugs        | 1 vs 0   | 1.53 (95% CI 1.05–1.52)   | p = 0.02   |
| Home - Muscle Relaxants      | 1 vs 0   | 1.30 (95% CI 1.05–1.62)   | p = 0.02   |
| Home – Immunosuppressives    | 1 vs 0   | 1.43 (95% CI 0.95–2.15)   | p = 0.09   |
| Muscle Relaxants             | 1 vs 0   | 1.20 (95% CI 0.96–1.50)   | p = 0.11   |
| Home - Sex Hormones (Female) | 1 vs 0   | 0.53 (95% CI 0.24–1.18)   | p = 0.12   |
| Home - Anti-Inflammatories   | 1 vs 0   | 1.14 (95% CI 0.95–1.37)   | p = 0.15   |
| Home – Analgesics            | 1 vs 0   | 7.63 (95% CI 0.45–128.75) | p = 0.16   |
| Sex Hormones (Female)        | 1 vs 0   | 0.60 (95% CI 0.28–1.29)   | p = 0.19   |
| Anti-Inflammatories          | 1 vs 0   | 1.14 (95% CI 0.94–1.39)   | p = 0.19   |
| Laxatives                    | 1 vs 0   | 1.95 (95% CI 0.58–6.59)   | p = 0.28   |
| Home – Laxatives             | 1 vs 0   | 1.85 (95% CI 0.55–6.29)   | p = 0.32   |
| Height (cm)                  | per 1 SD | 1.04 (95% CI 0.95–1.15)   | p = 0.37   |

|                                         |          |                          |          |
|-----------------------------------------|----------|--------------------------|----------|
| Home – Antineoplastics                  | 1 vs 0   | 1.18 (95% CI 0.79–1.75)  | p = 0.43 |
| Antianxiety Drugs                       | 1 vs 0   | 1.09 (95% CI 0.88–1.35)  | p = 0.43 |
| Antineoplastics                         | 1 vs 0   | 1.11 (95% CI 0.73–1.70)  | p = 0.62 |
| AGE                                     | per 1 SD | 1.02 (95% CI 0.93–1.12)  | p = 0.64 |
| Home - Antianxiety Drugs                | 1 vs 0   | 1.05 (95% CI 0.84–1.31)  | p = 0.66 |
| Home - Sex Hormones (Male)              | 1 vs 0   | 1.08 (95% CI 0.75–1.55)  | p = 0.67 |
| Sex Hormones (Male)                     | 1 vs 0   | 1.08 (95% CI 0.75–1.55)  | p = 0.67 |
| Antidepressants                         | 1 vs 0   | 1.03 (95% CI 0.86–1.24)  | p = 0.75 |
| Barbiturates                            | 1 vs 0   | 1.71 (95% CI 0.06–51.15) | p = 0.76 |
| Analgesics                              | 1 vs 0   | 1.03 (95% CI 0.85–1.25)  | p = 0.78 |
| Decongestants                           | 1 vs 0   | 1.14 (95% CI 0.37–3.56)  | p = 0.82 |
| Home – Decongestants                    | 1 vs 0   | 1.14 (95% CI 0.37–3.56)  | p = 0.82 |
| Home – Antidepressants                  | 1 vs 0   | 1.00 (95% CI 0.83–1.21)  | p = 0.96 |
| Anticoagulants and Thrombolytics        | 1 vs 0   | 0.99 (95% CI 0.71–1.40)  | p = 0.98 |
| Home - Anticoagulants and Thrombolytics | 1 vs 0   | 0.99 (95% CI 0.71–1.40)  | p = 0.98 |

Table S3: Univariate Odds Ratio (All Features)

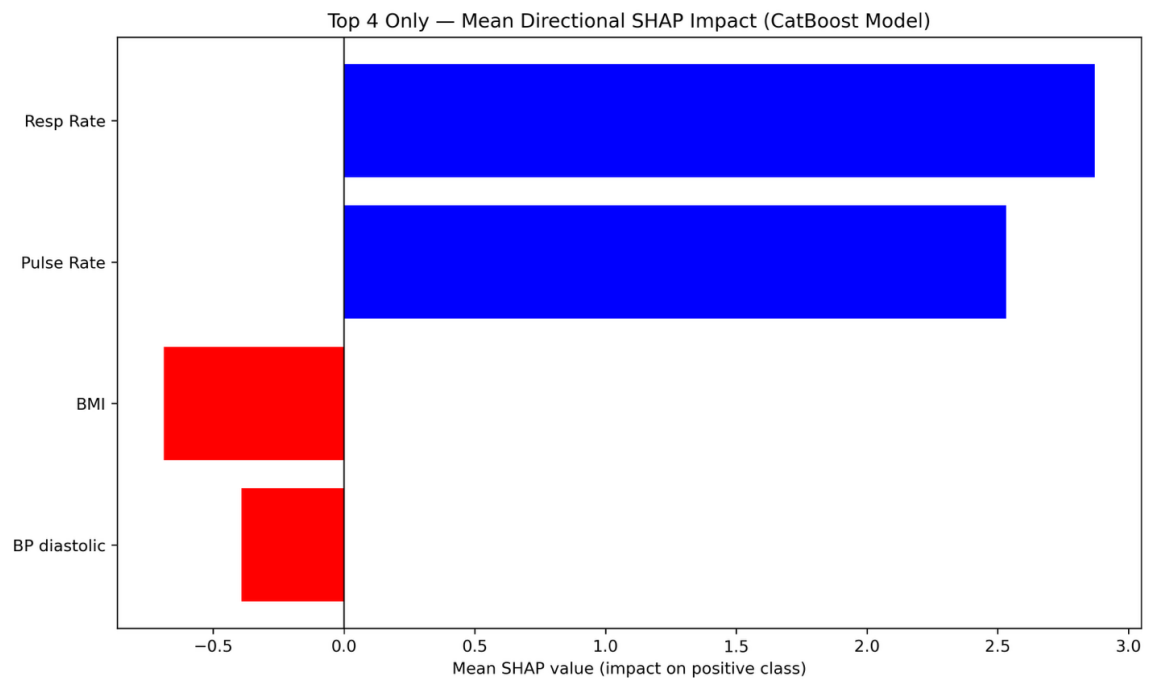


Figure S2: Mean Directional SHAP Impact (CatBoost Model) with only the top 4 contributing features

| Feature      | Mean SHAP | Direction             |
|--------------|-----------|-----------------------|
| Resp Rate    | 2.8717    | Positive (risk)       |
| Pulse Rate   | 2.5319    | Positive (risk)       |
| BMI          | -0.6895   | Negative (protective) |
| BP diastolic | -0.3925   | Negative (protective) |

Table S4: Features by Directional Mean SHAP Impact – CatBoost Model including top 4 contributing features only

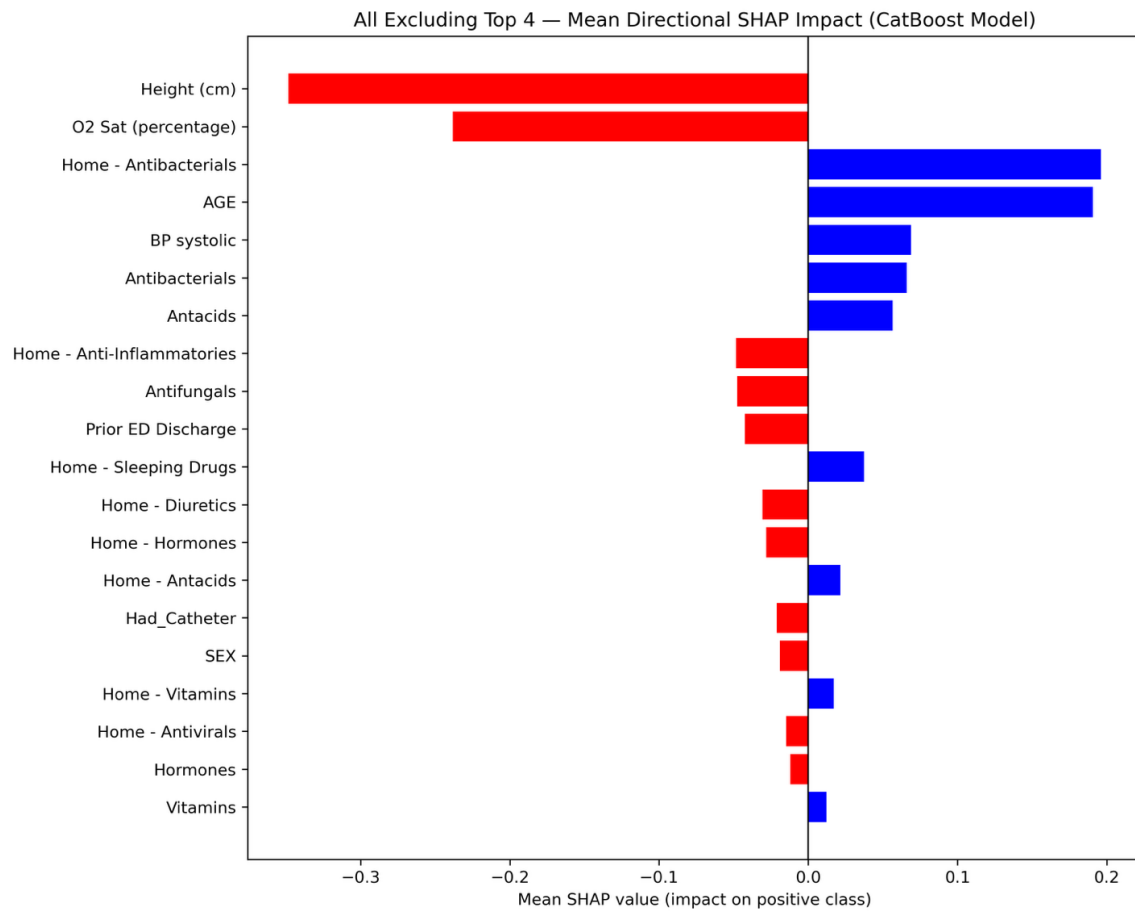


Figure S3: Mean Directional SHAP Impact (CatBoost Model) with all features other than the top 4 contributors.

| Feature                    | Mean SHAP | Direction             |
|----------------------------|-----------|-----------------------|
| Height (cm)                | -0.3484   | Negative (protective) |
| O2 Sat (percentage)        | -0.2381   | Negative (protective) |
| Home – Antibacterials      | 0.1961    | Positive (risk)       |
| AGE                        | 0.1906    | Positive (risk)       |
| BP systolic                | 0.0689    | Positive (risk)       |
| Antibacterials             | 0.0658    | Positive (risk)       |
| Antacids                   | 0.0567    | Positive (risk)       |
| Home - Anti-Inflammatories | -0.0484   | Negative (protective) |
| Antifungals                | -0.0477   | Negative (protective) |
| Prior ED Discharge         | 0.0423    | Negative (protective) |
| Home - Sleeping Drugs      | 0.0374    | Positive (risk)       |
| Home – Diuretics           | -0.0308   | Negative (protective) |
| Home – Hormones            | -0.0289   | Negative (protective) |
| Home – Antacids            | 0.0716    | Positive (risk)       |
| Had_Catheter               | -0.0212   | Negative (protective) |
| SEX                        | -0.0191   | Negative (protective) |
| Home – Vitamins            | 0.0171    | Positive (risk)       |
| Home – Antivirals          | -0.0148   | Negative (protective) |
| Hormones                   | -0.0121   | Negative (protective) |
| Vitamins                   | 0.0121    | Positive (risk)       |
| Sleeping Drugs             | -0.0117   | Negative (protective) |
| Home – Hypoglycemics       | -0.0113   | Negative (protective) |
| Home - Beta Blockers       | -0.0112   | Negative (protective) |
| Immunosuppressives         | -0.01     | Negative (protective) |
| Antihistamines             | -0.0098   | Negative (protective) |
| Anti-Inflammatories        | -0.0088   | Negative (protective) |
| Beta Blockers              | -0.0086   | Negative (protective) |
| Home – Antihypertensives   | 0.0083    | Positive (risk)       |
| Diuretics                  | 0.008     | Positive (risk)       |
| Home – Antidepressants     | -0.0077   | Negative (protective) |
| Home – Sedatives           | -0.0073   | Negative (protective) |

|                                  |         |                       |
|----------------------------------|---------|-----------------------|
| Anticonvulsants                  | -0.0068 | Negative (protective) |
| Hypoglycemics                    | -0.0064 | Negative (protective) |
| Antiarrhythmics                  | -0.0054 | Negative (protective) |
| Analgesics                       | -0.0047 | Negative (protective) |
| Sedatives                        | -0.0043 | Negative (protective) |
| Muscle Relaxants                 | -0.0041 | Negative (protective) |
| Antipyretics                     | 0.0041  | Positive (risk)       |
| Antianxiety Drugs                | -0.0039 | Negative (protective) |
| Home - Antianxiety Drugs         | -0.0036 | Negative (protective) |
| Home – Antiemetics               | -0.0034 | Negative (protective) |
| Sex Hormones (Male)              | 0.0033  | Positive (risk)       |
| Antiemetics                      | -0.0032 | Negative (protective) |
| Cough Suppressants               | 0.0032  | Positive (risk)       |
| Home – Anticonvulsants           | 0.0032  | Positive (risk)       |
| Home – Antidiarrheals            | -0.003  | Negative (protective) |
| Antineoplastics                  | -0.003  | Negative (protective) |
| Laxatives                        | 0.0024  | Positive (risk)       |
| Home – Antihistamines            | -0.0022 | Negative (protective) |
| Antihypertensives                | 0.002   | Positive (risk)       |
| Antidepressants                  | 0.0018  | Positive (risk)       |
| Anticoagulants and Thrombolytics | -0.0017 | Negative (protective) |
| Home – Expectorant               | -0.0017 | Negative (protective) |
| Home – Laxatives                 | 0.0015  | Positive (risk)       |
| Home - Cough Suppressants        | -0.0014 | Negative (protective) |
| Home – Antineoplastics           | -0.0013 | Negative (protective) |
| Corticosteroids                  | 0.0012  | Positive (risk)       |
| Home – Immunosuppressives        | -0.0011 | Negative (protective) |
| Bronchodilators                  | -0.0011 | Negative (protective) |
| Antivirals                       | -0.001  | Negative (protective) |
| Antidiarrheals                   | -0.001  | Negative (protective) |
| Home – Corticosteroids           | -0.0009 | Negative (protective) |
| Home – Bronchodilators           | -0.0008 | Negative (protective) |
| Home – Antiarrhythmics           | 0.0007  | Positive (risk)       |

|                                         |         |                       |
|-----------------------------------------|---------|-----------------------|
| Home - Muscle Relaxants                 | -0.0006 | Negative (protective) |
| Home – Antifungals                      | -0.0006 | Negative (protective) |
| Home - Sex Hormones (Female)            | 0.0003  | Positive (risk)       |
| Home - Anticoagulants and Thrombolytics | 0.0003  | Positive (risk)       |
| Home – Antipsychotics                   | 0.0003  | Positive (risk)       |
| Home – Decongestants                    | 0.0003  | Positive (risk)       |
| Home – Analgesics                       | 0.0003  | Positive (risk)       |
| Sex Hormones (Female)                   | -0.0003 | Negative (protective) |
| Antipsychotics                          | -0.0002 | Negative (protective) |
| Expectorant                             | 0.0002  | Positive (risk)       |
| Decongestants                           | -0.0001 | Negative (protective) |
| Home - Sex Hormones (Male)              | 0       | Negative (protective) |
| Barbiturates                            | 0       | Negative (protective) |

Table S5: All Features by Directional Mean SHAP Impact – CatBoost Model excluding top 4 contributing features