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Background

- Among patients with advanced cancer admitted to the acute palliative care unit (APCU), delirium can affect 42–88% of individuals.
- However, few comprehensive studies have thoroughly examined its prevalence and potential risk factors.
- We aimed to present a new approach to predict to delirium admitted to the acute palliative care unit.

Methods

- **Methods:** multicenter, patient-based registry cohort collected from four hospitals in South Korea (between January 1, 2019, and December 31, 2020)
 - **Delirium:** identified by reviewing the medical records based on the criteria of the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition
 - **Machine learning models:** extreme gradient boosting, adaptive boosting, gradient boosting, light gradient boosting, logistic regression, support vector machine, and random forest
 - **Key inclusion criteria**
 - aged 20 years or older
 - diagnosed with advanced solid cancer
 - admitted to the APCU
- => 2328 patients who met the eligibility criteria

Results

- For k-fold cross-validation, the combination of extreme gradient boosting and random forest provided the best performance, achieving the following accuracy metrics: 68.83% sensitivity, 70.85% specificity, 69.84% balanced accuracy, and 74.55% area under the receiver operating characteristic curve.

| Model | Training data (n = 1851) | | | |
|---------------------|--------------------------|---------------------|---------------------------|---------------------|
| | Sensitivity, % (SD) | Specificity, % (SD) | Balanced accuracy, % (SD) | AUROC, % (SD) |
| GB | 66.58 (7.96) | 64.63 (2.89) | 65.60 (3.97) | 71.92 (5.87) |
| LGB | 68.03 (9.61) | 66.89 (3.54) | 67.47 (3.72) | 73.60 (5.44) |
| RF | 74.13 (6.48) | 64.68 (4.35) | 69.41 (1.48) | 74.06 (4.12) |
| SVM | 62.05 (11.81) | 66.02 (5.11) | 64.04 (5.83) | 70.42 (5.03) |
| AdaBoost | 58.12 (16.29) | 59.39 (13.34) | 58.75 (7.56) | 64.01 (7.41) |
| XGBoost | 67.21 (16.70) | 63.52 (20.43) | 65.37 (3.50) | 73.81 (5.48) |
| Logistic regression | 57.52 (8.28) | 68.18 (1.84) | 62.85 (3.71) | 69.70 (3.39) |
| LGB + RF | 64.22 (10.28) | 71.49 (4.32) | 67.85 (4.03) | 74.08 (5.13) |
| RF + XGB | 68.83 (8.36) | 70.85 (4.41) | 69.84 (4.46) | 74.55 (4.81) |
| LGB + XGB | 65.81 (8.22) | 70.85 (3.96) | 68.33 (4.71) | 73.81 (5.13) |
| LGB + RF + XGB | 69.60 (8.18) | 65.15 (3.95) | 67.38 (4.57) | 73.64 (5.14) |

Table 1. Five-fold cross validation result comparison according to machine learning models

- using feature importance analysis, sex was determined to be the top contributor in predicting delirium, followed by a history of delirium, chemotherapy, smoking status, alcohol consumption, and living with family.

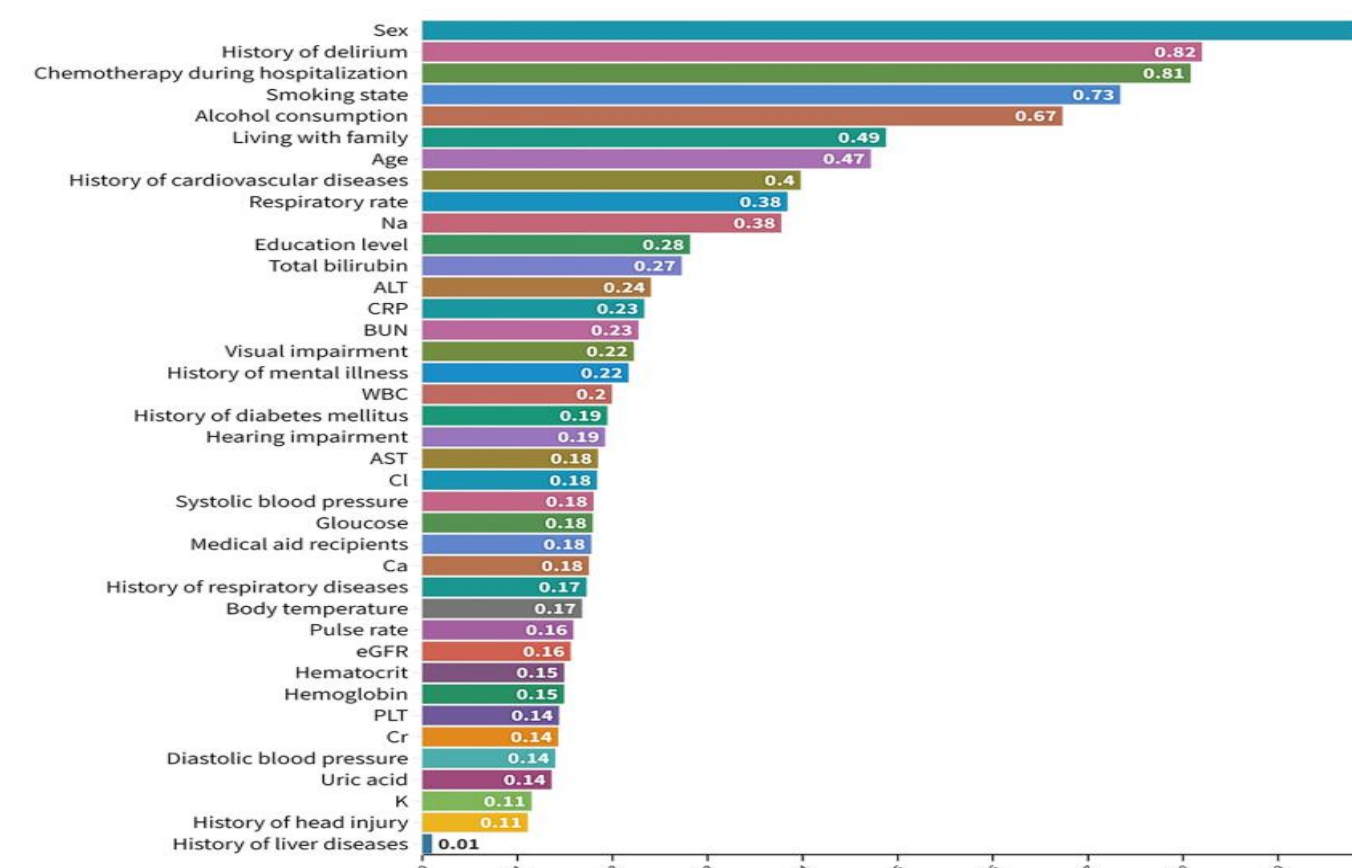


Figure 1. Ranked feature importance values for all 39 features

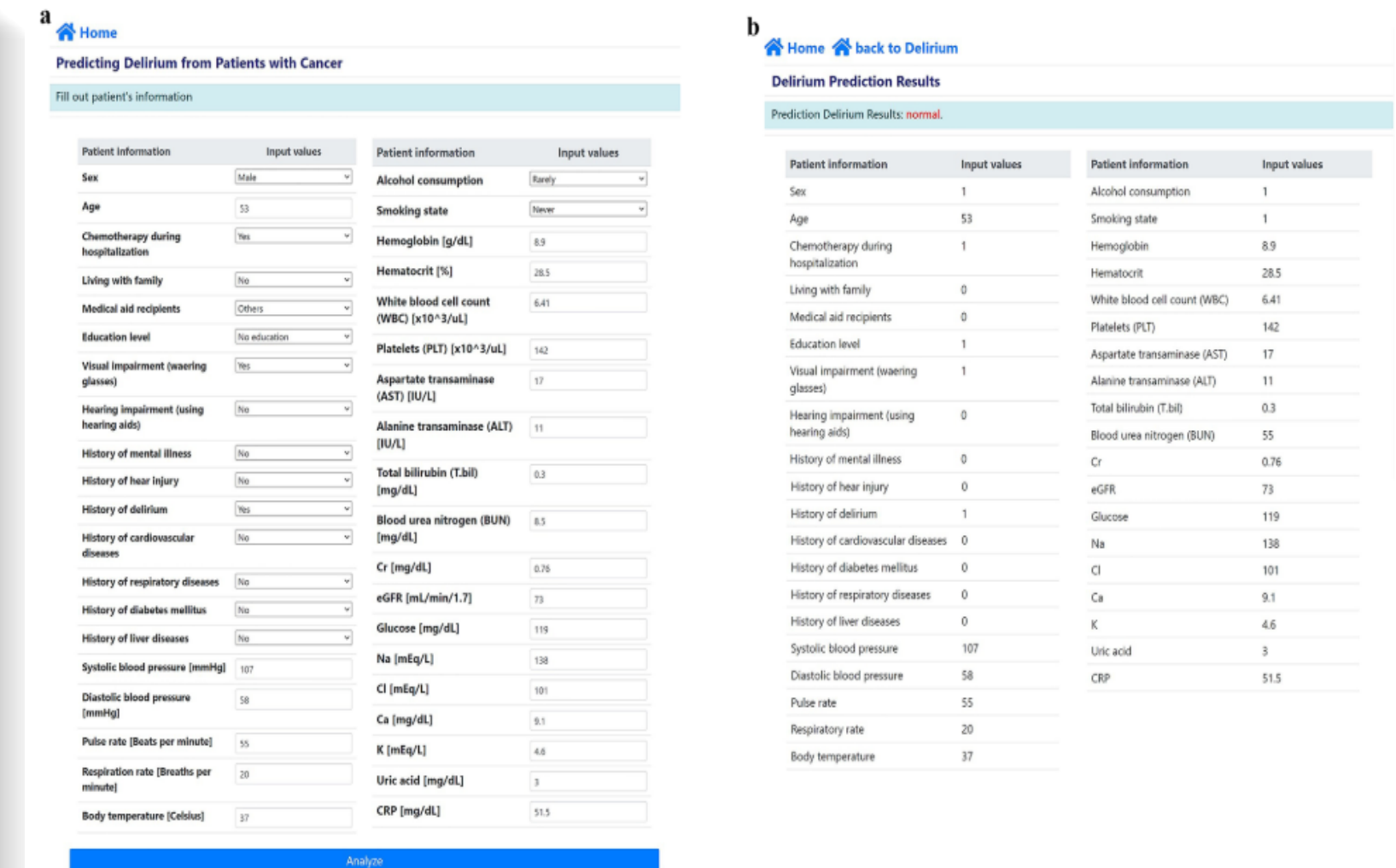


Figure 2. Deployed web application predicting delirium: (a) user input, (b) prediction results with delirium probability in patients with advanced cancer ([http:// ai-wm.khu.ac.kr/Delirium/](http://ai-wm.khu.ac.kr/Delirium/))

Conclusions

- Based on a large-scale, multicenter, patient-based registry cohort, a machine learning prediction model for delirium in patients with advanced cancer was developed in South Korea. We believe that this model will assist healthcare providers in treating patients with delirium and advanced cancer.

Keywords: Delirium; cancer; Feature importance; Machine learning; Palliative care

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