




# CLINICAL PREDICTORS OF SECONDARY HEADACHE IN THE EMERGENCY DEPARTMENT: AN EXPLORATORY MODEL OF A FOUR-VARIABLE BEDSIDE MODEL IN THE EMERGENCY DEPARTMENT

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**Background.** Rapid bedside identification of secondary versus primary headache is crucial for Emergency Department (ED) triage. The present study aimed to explore which routinely available variables independently contribute to discriminating secondary from primary headache.

**Methods.** We retrospectively included consecutive ED headache patients from AOUP Paolo Giaccone of Palermo, Italy (August 2024-September 2025). Demographic, clinical, instrumental, and biochemical data were collected. Headache diagnoses were reviewed and classified as primary or secondary by a headache specialist according to the International Classification of Headache Disorders, 3rd edition (ICHD-3) criteria. From exploratory bivariate analyses, four candidate variables were retained based on consistency with established red-flag literature and clinical interpretability [2]: patient age, systolic blood pressure (SBP), photophobia, and prior headache history. A multivariable logistic regression model was fitted, and internal performance was estimated using Harrell's optimism-corrected bootstrap (500 resamples) to mitigate bias introduced by data-driven variable selection. Adjusted odds ratios were estimated with 1,000 bootstrap percentile 95% confidence intervals (CIs).

**Results.** A total of 263 patients with complete diagnostic classification were available, of whom 102 had complete data on all four candidate variables (69 primary, 33 secondary). The clinical model showed an apparent AUC of 0.853 and an optimism-corrected AUC of 0.828 (95% bootstrap CI 0.75–0.90), indicating good discrimination with modest optimism (Δ = +0.025). At an optimal Youden threshold, sensitivity was 0.76 and specificity 0.81 for secondary headache. Three of the four candidates retained independent association with secondary headache: SBP per 10-mmHg increment (OR 1.46, 95% CI 1.12–2.15), absence of photophobia (OR for presence 0.17, 95% CI 0.02–0.66), and absence of prior headache history (OR for presence 0.12, 95% CI 0.02–0.35). Age per 10-year increment did not retain independent significance after adjustment (OR 0.83, 95% CI 0.48–1.29), suggesting an interaction with headache history.

**Conclusions.** in this exploratory analysis, three readily available bedside variables (SBP, photophobia, and prior headache history) together provide good discrimination between primary and secondary headache. Hypertension combined with absence of typical migraine features identifies patients who require further workup. Prospective external validation is warranted to prove the usefulness of this model in clinical practice.