PGY-3

Critical Review Form
Clinical Prediction or Decision Rule

Ohle R, Savage DW, Roy D, McIsaac S, Singh R, Lelli D, Tse D, Johns P, Yadav K, Perry JJ. Development of a Clinical Risk Score to Risk Stratify for a Serious Cause of Vertigo in Patients Presenting to the Emergency Department. Ann Emerg Med. 2025 Feb;85(2):122-131.

Objectives: **"to prospectively assess the clinical characteristics of patients presenting with vertigo to the ED and to derive a clinical risk score to identify high- and low-risk patients for a serious cause of their vertigo." (p. 123)**

Methods: **This prospective, multicenter, cohort study was conducted from July 2019 to August 2022 across three university-affiliated urban Canadian tertiary care teaching hospitals. Consecutive patients 18 years or older presenting with acute vertigo, dizziness, or imbalance and assessed by an emergency physician were enrolled. Exclusion criteria included symptom onset more than 14 days prior, recent head or neck trauma, GCS < 15, SBP < 90 mmHg, a syncopal episode within the previous 14 days, or active cancer.**

Emergency physicians or supervised residents completed standardized data forms in consecutive patients. Research staff collected and verified data, confirming eligibility and recording objective data from multiple sources, including ED records, consultant notes, and radiology reports. Patients underwent telephone follow-up at 7, 30, and 90 days to assess for subsequent serious diagnoses (stroke, TIA, vertebral artery dissection, or brain tumor). Data was collected for 43 candidate clinical variables known to be associated with one of more potential outcomes.

The primary outcome was a serious diagnosis (stroke, TIA, vertebral artery dissection, or brain tumor). Outcomes were confirmed through hospital records, autopsy reports, or patient follow-up. An Adjudication Committee consisting of a stroke neurologist and two experienced emergency physicians reviewed potential outcome events, requiring agreement from at least two of the three members.

A total of 2,078 out of 2,618 potentially eligible patients (79.4%) were enrolled. The mean age was 77.1 years, with 59% being women. CT head scans were performed on 643 patients (30.9%), and MRI on 56 patients (2.5%). Hospital admission occurred for 160 patients (7.7%), and specialist consultations for 234 patients (11.3%). There were 111 serious diagnoses (5.3%), including 99 strokes (81.1%), 11 TIAs (9.9%), 2 vertebral artery dissections (1.8%), and 1 brain tumor (0.9%). Follow-up completion was 80.4% at 30 days. Multivariate analysis found 6 variables independently positively associated and one variable negatively associated with a serious diagnosis (see Table 2).

Table 2. Sudbury Vertigo Risk Score.

Predictor	Points
Stroke-risk factors	
Male	1
Age >65 y	1
Diabetes	1
Hypertension	3
Neurologic deficits	
Motor/sensory	5
Cerebellar*	6
BPPV diagnosis	−5

BPPV, benign paroxysmal positional vertigo.
*Diplopia, dysarthria, dysphagia, dysmetria, ataxia.

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Guide	Comments
Is this a newly derived instrument (Level IV)?	
Was validation restricted to the retrospective use of statistical techniques on the original database? (If so, this is a Level IV rule & is not ready for clinical application).	Yes. "Internal validation of the model was carried out with bootstrapping, in which we used 1,000 bootstrap samples sampled randomly with replacement." (p. 124) Based on this study alone, this is a Level IV rule.
Were all important predictors included in the derivation process?	Uncertain. The authors report collecting data on 43 different clinical variables as candidates for the model. They later state that during logistic regression they started with only 14 candidate variables that "*a priori* we had defined as clinically important." Four of these were the combined as a single variable, cerebellar deficits. The authors provide no explanation for why the other 29 variables were not considered.
Were all important predictors present in significant proportion of the study population?	Yes. Table 1 in the study lists the proportion of patients with and without a serious diagnosis positive for each of the components of the risk score.
Does the rule make clinical sense?	Yes. The rule includes sensible criteria including age, gender, risk factors, neurologic findings, and previous diagnoses related to vertigo (i.e. BPPV). However, the score relies heavily on the presence of neurologic deficits, which would already lean towards a diagnosis of stroke, or a diagnosis of BPPV, which would equates with a diagnosis of peripheral disease. The rule does not appear to be clinically very useful.

Has the instrument been validated? (Level II or III). If so, consider the following:	
Did validation include prospective studies on several different populations from that used to derive it (II) or was it restricted to a single population (III)?	N/A. This was a derivation study with validation only performed using bootstrapping on the same patient population.
How well did the derivation/validation study meet the following criteria?	
Did the patients represent a wide spectrum of severity of disease?	Uncertain. This study does not mention the severity of symptoms among patients included in the derivation cohort. That can be difficult to quantify as there is no scoring system for vertigo severity.
Was there a blinded assessment of the gold standard?	No. Diagnosis was made by an adjudication committee based on hospital records, autopsy reports, and follow-up. Patients did not all receive the same testing or consultation in the hospital. "CT head scan was performed in 643 (30.9%) patients, and a magnetic resonance imaging (MRI) scan was performed in 56 (2.5%) patients. There were 160 (7.7%) admitted to the hospital, and specialist consultation was requested (in emergency or as outpatient) for 234 (11.3%) patients." (p. 126) Additionally, follow-up was only completed in around 80% of patients. This all puts the findings at risk of partial and differential verification bias.
Was there an explicit and accurate interpretation of the predictor variables & the actual rule without knowledge of the outcome?	Presumably yes. This was a prospective study in which clinical predictor variables were recorded by physicians at the time of care. While the exact timing of data collection is unclear, it seems likely that this occurred before results of imaging and ultimate diagnoses were known.
Did the results of the assessment of the variables or of the rule influence the decision to perform the gold standard?	Likely yes. While there is no clear "gold standard" test in this study, it seems likely that the presence of absence of predictor variables would have influenced the decision to perform additional imaging such as CT or MRI as well as the decision to obtain neurologic consultation and admit the patient.
How powerful is the rule (in terms of sensitivity & specificity; likelihood ratios; proportions with alternative outcomes; or relative risks or absolute outcome rates)?	• The model had excellent discrimination (C-statistic of 0.972) which remained unchanged when we adjusted for optimism (C-statistic of 0.969). • The probability of a serious cause ranged from 0% for a score of <5, 2.1% for a score of 5 to 8, and 41% for a score >8 • For our primary outcome, a serious diagnosis, the sensitivity was 100% (95% CI 97-100%) and the specificity was 72.1% (95% CI 70.1% to 74%) for a score >4. o This corresponds to a LR- of 0 and LR+ of 3.58. • Using a score of >4 to define a high-risk group that warrants further investigation would reduce CT use by 10%.
Has an impact analysis demonstrated change in clinical behavior or patient outcomes as a result of using the instrument (Level I)? If so, consider the following:	
How well did the study guard against bias in terms of differences at the start (concealed randomization, adjustment in analysis) or as the study proceeded (blinding, co-intervention, loss to follow-up)?	The authors provide no specifics regarding blinding of investigators and data collectors to imaging results or ultimate diagnoses, but the prospective nature of this study makes it unlikely that they were aware of these results. There was no single gold standard applied to all patients with a high risk of verification bias as a result. Nearly 20% of patients were lost to follow-up (attrition bias).
What was the impact on clinician behavior and patient-important outcomes?	This was a derivation study and not designed to prospectively assess the impact of the clinical decision rule. The authors estimate based on their findings that use of a score cutoff >4 would reduce CT usage by 10%. No further estimates of the impact of these findings were provided.

Limitations:

1. **The authors report that information on 43 candidate clinical variables was collected prospectively. They only used 14 of these (4 of which were combined) in their statistical modelling, with no explanation for the exclusion of the 29 others.**

2. **Diagnosis of the outcome of interest was made by an adjudication committee based on multiple sources. CT head scans were performed on 643 patients (30.9%) and MRI on 56 patients (2.5%) (differential and partial verification bias).**

3. **Follow-up completion at 30 days only occurred in 80.4% of patients (attrition bias).**

4. **This was a derivation study only, with validation performed on the same sample using the bootstrapping technique. Further validation in additional and variate population is necessary before widespread use of this CDR (Level IV rule).**

Bottom Line:

This initial prospective derivation of a clinical decision rule for serious causes of vertigo performed in 3 urban Canadian tertiary care teaching hospitals resulted in a rule with 7 variables with a sensitivity of 100% at a score > 4. Further validation studies will be necessary to verify these findings and determine the best manner in which to use this rule.