

Critical Appraisal Worksheet – Diagnosis
Eastern Virginia Medical School EM Journal Club

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Citation: Newman-Toker DE,. HINTS Outperforms ABCD2 to Screen for Stroke in Acute Continuous Vertigo and Dizziness. Acad Emerg Med. 2013 Oct;20(10):986--996

Study Objectives:

To compare the accuracy of two previously published approaches purported to be useful in bedside screening for possible stroke in dizziness: a clinical decision rule (head impulse, nystagmus type, test of skew [HINTS]) and a risk stratification rule (age, blood pressure, clinical features, duration of symptoms, diabetes [ABCD2]).

Study Design:

The study design was a cross-sectional prospective study at a single academic center (OSD Saint Francis Medical Center) which serves as a stroke referral center for 25 community hospitals that has an annual volume of 86,000.

Inclusion Criteria:

1. >1 hour of acute, persistent, continuous vertigo or dizziness with spontaneous or gaze-evoked nystagmus, plus nausea and vomiting, head motion intolerance, and new gait unsteadiness presenting within 1 week of symptom onset
2. Required to have one or more stroke risk factors (smoking, hypertension, diabetes, hyperlipidemia, atrial fibrillation, eclampsia, hypercoagulable state, recent cervical trauma, prior stroke, myocardial infarction)

Exclusion Criteria:

1. Resolution of symptoms within 24 hours
2. History of multiple attacks of recurrent vertigo or dizziness compatible with Meniere's Disease, vestibular migraine, idiopathic recurrent vertigo, or successful treatment of BPPV by canalith repositioning
3. Lethargy sufficient to prevent participation in examination

THE ABCD 2 score

Component	Score
Age >60	+1
Systolic BP >140 or diastolic 90	+1
Clinical features <ul style="list-style-type: none"> • Unilateral weakness • Speech disturbance without weakness • Any other symptoms 	+2 +1 +0
Duration of Symptoms <10 minutes 10-59 minutes >60 minutes	+0 +1 +2
Diabetes	+1

Are the Results Valid?*	
Questions	Comments
A. Did clinicians face diagnostic uncertainty?	Yes. Uncertainty regarding distinguishing central vs. peripheral causes of vertigo. The HINTS exam was first introduced in 2009 by the same author of the current paper. The current study is an attempt to further validate the HINTS exam.
B. Was there a blind comparison with an independent gold standard applied similarly to the treatment group and the control group? (Confirmation bias)	Yes. All patients underwent a “gold standard” imaging study (97/4% underwent MRI and 4 underwent CT). Two neuroophthalmologists assessed patients independently and were blinded to imaging results. In this study HINTS and ABCD2 were applied to the same group of patients. The results were then compared to either MRI (if initial MRI negative, a repeat delayed MRI was done) or ancillary lab testing (paraneoplastic antibodies, serum thiamine levels, etc.) to determine diagnostic predictability of ABCD2 and HINTS for diagnosing a central etiology of symptoms.
C. Did the results of the test being evaluated influence the decision to perform the reference standard? (Ascertainment Bias)	No. All subjects underwent neuroimaging so HINTS or ABCD2 did not play a role in influencing who got the gold standard.
What are the Results?*	
Questions	Comments
A. What reported likelihood ratios were associated with the range of possible test results?	<p>ABCD2 for Stroke Sensitivity: 61.1%, Specificity 62.3% LR+ = 1.62, LR- = 0.62</p> <p>ABCD2 for Any Central Cause Sensitivity: 58.1%, Specificity 60.6%% LR+ = 1.47, LR- = 0.69</p>

	<p>HIT (Head Impulse Test Only) for Stroke Sensitivity: 90.3%, Specificity 87.0% LR+ = 6.95, LR- = 0.11</p> <p>HIT (Head Impulse Test Only) for Any Central Cause Sensitivity: 91.1%, Specificity 100.0% LR+ = >91.1 (Infinite), LR- = 0.09</p> <p>HINTS for Stroke Sensitivity: 96.5%, Specificity 62.3% LR+ = 6.19, LR- = 0.04</p> <p>HINTS for Any Central Cause Sensitivity: 96.8%, Specificity 63.9% LR+ = 63.9, LR- = 0.03</p> <p>HINTS Plus for Stroke Sensitivity: 99.1%, Specificity 83.1% LR+ = 5.87, LR- = 0.01</p> <p>HINTS Plus for Any Central Cause Sensitivity: 99.2%, Specificity 97.0% LR+ = 32.7, LR- = 0.01</p> <p>The ROC curve for ABCD2 was 0.613 (95%CI 0.531 to 0.695) while the ROC for HINTS was 0.995 (95%CI 0.985-1.000).</p>
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How Can the Results Apply to Patient Care?*

<i>Questions</i>	<i>Comments</i>
A. Will the reproducibility of the test result and its interpretation be satisfactory in my clinical setting?	Not quite. Although the test results show HINTS can identify a central etiology of vertigo in a select group of high-risk patients there are many issues reproducing the level of sensitivity and specificity as reported in the paper. First the number of patients presenting to the ED who are high risk and similar to the patient population in the paper is low. For example, over a period of 13 years at the clinical study site, only 190 adults were enrolled. This is at a center with 86,000 ED visits a year and a designated “stroke center”. If HINTS were to be applied more broadly certainly the sensitivity and specificity could be affected. Secondly, HINTS was performed in this study by one of two trained neuro-ophthmology study examiners. There has been no investigation into the sensitivity and specificity of this test when performed by ED physicians. Also concerning is that there is no report of inter-operator reliability. Although there were two examiners in this study, it appears that only one examiner did the exam on each patient.
B. Are the results applicable to patients in my clinical setting?	Possibly. Having a clinical tool that could assist in identifying those likely to have a central cause could help with diagnostic accuracy as well as decrease unnecessary testing in some. . That stated, the patient

	population in the study is highly selected towards higher risk patients. Additionally as mentioned previously the sensitivity and specificity of the HINTS exam in novice hands is unknown.
C. Will the results change my management strategy?	Unlikely. Ideally, HINTS can be applied to high-risk patients with suspected central etiology allowing for more rapid assessment and in theory this could reduce MRI utilization for patients where a central vertigo etiology is not felt to be likely. However, at least for now, HINTS will only be an adjunct. In the high risk patient even with a HINTS exam supporting a non-central etiology of the patient's vertigo it would be difficult to discharge that patient ascribing their symptoms to a peripheral etiology just based on the HINTS exam alone. Consider even if the sensitivity of the HINTS exam is 96% in ED physician hands (this is the expert performed exam sensitivity as reported in the paper) would sending home the 4% of posterior strokes that are missed by the HINTS exam be acceptable in the United States? Probably not.
D. Will patients be better off as a result of the test?	HINTS may in the future be validated for general ED usage and help reduce MRI utilization, decrease hospital stays, and increase diagnostic accuracy for vertigo of a non-central origin. For now, I do not think HINTS will affect patient outcomes, as it cannot be applied in the general ED setting with certainty.

Limitations:

1. Patients enrolled in study were in a very high-risk group and were not the everyday vertigo patient. This makes generalizability to the everyday ED setting difficult.
2. There has been no examination of inter-rater reliability of the HINTS exam.
3. Testing with aforementioned sensitivity and specificities was done by highly trained neuro-ophthalmologist (2 of the study examiners). It has not been validated in the general ED physician.
4. ABCD2 was never designed to be a tool to evaluate for posterior stroke, and such comparing the HINTS method against it offers little.

Your Clinical Bottom Line:

The HINTS exam may prove to be useful in the future, however until further research is done to address its multiple limitations its use for making clinical decisions in the ED is fairly limited. At this time HINTS may be better served as part of the physical exam rather than a definitive decision making tool.