### Article Citation

### Country(ies)
United States of America - St. Luke’s University Hospital, Bethlehem, PA

### Funding Source(s)
Department of Emergency Medicine St. Luke’s University Health Network - A non-profit, regional health network affiliate of Lewis Katz School of Medicine Temple University, Philadelphia PA.

### Purpose

**Research Question(s):** The objective of this study was to validate modified NEXUS criteria in a low-risk elderly fall population. Two modifications to Nexus were: a modified definition for distracting injury and the definition of normal mentation.

**Hypotheses:** Amongst geriatric emergency department patients presenting with a chief complaint of injury from a fall but not triaged to a trauma bay IF the following two modification to the NEXUS criteria are implemented: 1) substituting “normal alertness” with “patient’s baseline mental status” and 2) limiting physical exam findings of distracting injuries to trauma just of the head or face, THEN the specificity of the popular NEXUS decision making tool will be improved to more than 12.9% while maintaining the rules 100% sensitivity to identify patients who will have radiographic evidence of a cervical spinal cord injury.

**Study Purpose:** If in a prospective observational cohort study above modified NEXUS criteria are applied to geriatric low risk fall patients and this modified rule has a specificity of greater than 12.9% and a sensitivity of 100% then this would justify a prospective, randomized control, multi-center clinical trial to expand age range low risk adult injury from a fall patients could either be evaluated prehospital without an ED evaluation or be sent home from the emergency department without radiographic imaging of the cervical c-spine.

### Methods

**Study Design:** Prospective observational cohort study

**Outcome(s) [or Dependent Variable]:** No acute neck injury/acute neck injury. Patient was determined to have no significant acute neck injury if the following criteria were met: 1) He/she had a negative neck computed tomography (CT) or magnetic resonance imaging (MRI) performed; 2) the patient was admitted to the hospital and had no sequelae at discharge; 3) review of his/her medical record revealed repeat hospital visits unrelated to falls with no sequelae or complaints related to the index visit; or 4) the patient had no ED visits or complaints at 30 days post-injury in telephone follow up.
**Intervention [or Independent Variable]:** Not applicable. An observation only study. All participants were allocated to the group who had modified NEXUS criteria applied to them and were followed up as described above in Outcome(s) [or Dependent Variable].

**Ethics Review:** [ ] IRB Review  [ ] IACUC Review  [ ] Other: [ ] None Stated

**Research Setting:** Study site was a single Level I community trauma center that hosts an emergency medicine residency with 40 total residents. Site is located in Mid-Atlantic region of the USA. The annual ED census is about 75,000. There are about 2,100 trauma alerts annually, and 130-150 of these are for geriatric fall patients.

**Study Subjects:** Elderly fall patients. Enrolled as a convenience sample of patients over a 16-month period in 2011-2012. Interventions were: subsequently reviewed their charts and a phone interview at 4-6 weeks status post initial ED injury from a fall visit.

**Inclusion Criteria:** Patients were eligible if they were 65 years of age or older and presented to the ED with a complaint related to a fall. Additionally, patients were required to be at baseline neurologic status as per their family member or chronic care facility staff. Patients were not excluded due to dementia, aphasia, or any cognitive or neurologic deficit that was determined by the physician caring for them to be their baseline mental status.

**Exclusion Criteria:** Patients were excluded if they met major trauma criteria and were triaged to the trauma bay or if they were determined to have an acute clinical change in baseline neurologic functioning including clinical intoxication.

**Study Interventions:** No interventions. Observational study.

**Study Groups:** Only one observation group

**Instruments/Measures Used:** In ED: Physician caring for the patient completed a data collection form including: presence or absence of NEXUS criteria, signs and location of head trauma. Research associates collected: patient disposition status, admission service if admitted, diagnostic tests done, results of radiographic studies, neurosurgical procedures done during an admission, trauma injuries documented (particularly: visceral injuries or bony injuries but not soft tissue injuries like abrasions, lacerations, skin tears, or contusions). In follow-up: Research associate called patients or their decision maker 4-6 weeks after ED visit. Participants who were called were queried as to how they were feeling globally as well as specifically queried about: neck pain, numbness, tingling, weakness, and the presence of other neurologic symptoms. Patients were queried about any interval ED visits and their outcome(s).

**Data Collection:** Data entry done by research assistants and investigators. Tabulated in Microsoft Excel. Analyzed using MedCalc and VassarStats.

**Data Analysis:**

- **A priori sample size calculation?** [ ] Yes  [ ] No  [ ] Not Described  [ ] N/A
- **Statistical analyses used:** Descriptive statistics and chi square.
- **Adjustment for potential confounders?** [ ] Yes  [ ] No  [ ] Not Described  [ ] N/A
  - If yes, list:

**Results**

**Study participants:**
Brief answers to research questions [key findings]: Using the patient’s personal baseline mental status rather than GCS and using signs of trauma to the head and neck as the only distracting injury, these modified NEXUS criteria performed well in this population. They had a sensitivity of 100% (67.9-100%), a negative predictive value of 100% (98.7-100%), and a specificity of 47.7 (44.2-51.3).

Additional findings: Like the NEXUS cohort, this studies population had a low rate of cervical spine injury (CSI) with only 1.4% of the subjects with abnormalities seen on imaging. If only geriatric patients in the NEXUS cohort are sampled, the reported incidence of CSI is 4.6%. This report’s incidence is likely lower because they specifically looked at a low-risk population that was not triaged to the trauma bay.

Limitations: The elderly population enrolled in this study included only injury due to falls. Therefore, the data may not be extrapolated to all-cause trauma. This decision rule is only for low-risk patient cohort or those not resulting in a trauma alert based on the facility’s trauma alert criteria (See Appendix 1). As well, this study was done at a single tertiary care trauma center and the geriatric population may not reflect the experience of other facilities.

Clinical Implications

Applicable: Yes
Feasible: Yes
Clinically relevant: Yes

Comments: Above modified NEXUS criteria when applied to geriatric low risk fall patients have a specificity of 47%, much greater than 12.9% of standard NEXUS criteria and maintain a sensitivity of 100% thus this study strongly justifies a prospective, randomized control, multi-center clinical trial of above modified
NEXUS criteria to expand age range low risk adult fall patients this decision rule could be used on. This could have wide spread practice changing impact as this would greatly increase fall patients that could either be evaluated prehospital, without an ED evaluation, or be sent home from the ED without radiographic imaging of the cervical c-spine.

<table>
<thead>
<tr>
<th>Level of evidence generated from this study</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ ] Ia: evidence obtained from meta-analysis of randomized controlled trials</td>
</tr>
<tr>
<td>[ ] Ib: evidence obtained from at least one randomized controlled trial</td>
</tr>
<tr>
<td>[x] IIa: evidence obtained from at least one well-designed, controlled study without randomization</td>
</tr>
<tr>
<td>[ ] IIb: evidence obtained from at least one other type of well-designed quasi-experimental study</td>
</tr>
<tr>
<td>[ ] III: evidence obtained from a well-designed, non-experimental study</td>
</tr>
<tr>
<td>[ ] IV: expert committee reports; expert opinion; case study; case report</td>
</tr>
</tbody>
</table>

Additional Comments/Discussion/Notes