

Critical Review Form

Prognosis

Identification of Fall Risk Factors in Older Adult ED Patients, *Acad EM* 2009; 16: 211-219

Objective: “To determine independent risk factors of a 6-month fall risk among discharged community-dwelling older adults who used the ED for non-fall-related complaints”. (p. 212)

Methods: Prospective observational study at one academic ED in Pittsburgh PA between Jan 2002 and Aug 2002. Eligible patients were >65 years old, community-dwelling and in the ED for a non-fall related complaint. Exclusion criteria included non-English speaking, inability to complete the initial survey, pre-existing wheelchair- or bed-bound status, nursing home resident, and failure to consent or previous enrollment. Ambulatory was defined as self-reported ability to walk 10 steps with or without an assist device.

Data was collected during the index ED visit and included a 10- minute self-report survey of fall-risk factors previously described in ED and non-ED studies. Five trained research assistants collected the data by reading survey to participants and recording their responses. In addition to self-reported assessment of balance, dementia, depression, post falls, and overall health, research assistants objectively assessed vision and hearing. A mobility assessment consisting of getting up from an armless chair, sitting down in an armless chair, raising feet while walking, and turning 180° was obtained. The first 30 enrolled patients’ mobility assessments were video-taped and later reviewed independently by all 5 research assistants to assess reliability using the [Intraclass Correlation Coefficient](#) (ICC).

The dependent variable was the occurrence of a self-reported fall, defined as “when you suddenly find yourself on the ground, without intending to get there, after you were in either a lying, sitting or standing position.” ([Gibson 1987](#)) Independent variables were identified using [Cox proportional hazards model](#) and an automated backward stepwise selection with inclusion p-value 0.05 and exclusion p-value 0.10. Two-way interactions were entered into the backward stepwise algorithm.

Guide		Comments
I.	Are the results valid?	
A.	<p>Was the sample of patient’s representative? <i>In other words, how were subjects selected and did they pass through some sort of “filtering” system which could bias your results based on a non-representative sample. Also, were objective criteria used to diagnose the patients with the disorder?</i></p>	Yes. Subjects were urban community-dwelling geriatric ED patients in an academic hospital for any reason except a fall or fall-related injury’s all of whom were discharged home from the ED.
B.	<p>Were the patients sufficiently homogeneous with respect to prognostic risk? <i>In other words, did all patients share a similar risk from during the study period or was one group expected to begin with a higher morbidity or mortality risk?</i></p>	Yes. This was a prospective observational study so there was only 1 cohort. Patients were primarily white (80%) and female (63%). By inclusion criteria all were ambulatory, but 39% reported a fall sometime in the past year.
C.	<p>Was follow-up sufficiently complete? <i>In other words, were the investigators able to follow-up on subjects as planned or were a significant number lost to follow-up?</i></p>	No. “A total of 263 patients were enrolled, but 102 (39%) were lost to the full 6-months of follow-up.” (p 213).
D.	<p>Were objective and unbiased outcome criteria used? Investigators should clearly specify and define their target outcomes before the study and whenever possible they should base their criteria on objective measures.</p>	No. Falls used an explicit and referenced definition , but it was a different definition than was used in other ED falls studies (Tiedemann 2013 , Close 2003) and did not distinguish falls from syncope. In addition, the investigators relied upon self-reported dementia and depression rather than using more valid, objective tests. The consequence is that dementia (for example) was likely under-recognized since only 5% of patients in this study reported dementia, but multiple prior ED studies demonstrate the prevalence as 30-40% when actually assessed using a screening instrument.

II.

What are the results?

A. How likely are the outcomes over time?

Table 2
Univariate Cox HR for Variables Assessed

Variable	HR	p-Value*	95% CI for HR	
			Lower	Upper
Number of medications	1.077	0.119	0.987	1.176
Age	1.012	0.612	0.967	1.060
Gender	1.521	0.204	0.902	2.884
Marital status	1.041	0.813	0.748	1.447
Ambulation†	***	***	***	***
Cane-assisted ambulation	2.221	0.017	1.170	4.216
Does not climb stairs	0.846	0.645	0.420	1.706
Does not cut own toenails	2.740	0.002	1.429	5.253
Does not drive a car	1.195	0.583	0.632	2.260
Drives only in day	1.698	0.187	0.903	3.590
Does wear glasses	1.689	0.610	0.407	7.014
Does have glasses	1.155	0.693	0.560	2.378
Urinary incontinence	1.458	0.293	0.735	2.890
Health rating	1.712	0.099	0.904	3.243
Nonhealing foot sore	3.693	0.003	1.748	7.804
Leg injury	0.982	0.982	0.206	4.672
Known diabetes	1.861	0.088	0.539	3.691
Prior stroke	1.613	0.213	0.783	3.921
Irregular heartbeat	1.179	0.612	0.624	2.230
Reported dementia	1.161	0.837	0.279	4.824
Reported depression	2.254	0.034	1.116	4.553
Number of falls in previous year	1.230	0.004	1.100	1.376
Injurious falls	1.642	0.183	0.813	3.318
Reported near falls	2.083	0.024	1.098	3.952
Self-perceived imbalance	2.361	0.006	1.242	4.566
Previous ED use	2.173	0.018	1.148	4.112
Abnormal hearing OD	1.184	0.634	0.587	2.386
Abnormal hearing OS	1.281	0.494	0.622	2.637
Functional category abnormal	1.392	0.068	0.978	1.983
Functional category borderline	1.988	0.044	1.010	3.910
Race (nonwhite vs. white)	0.343	0.039	0.106	1.116
Stand in chair	1.025	0.960	0.400	2.624
Sit in chair	1.554	0.321	0.650	3.718
Raise feet	1.474	0.486	0.523	4.156
Turn 180°	1.475	0.485	0.523	4.157
Past fall	2.857	0.001	1.485	5.497
Visual acuity category	1.122	0.622	0.713	1.766

CI = confidence interval; HR = hazard ratio; OD = right eye; OS = left eye.
*p-value based on likelihood ratio statistics. CIs are based on Wald statistic.
†All patients were ambulatory.

Table 4
Mean Probability of Reporting Fall during the 6-Month Follow-up
Period with Anywhere from Zero to Four Risk Factors Present

Number of Risk Factors	Number of Subjects	Mean Probability of Falling in 6 Months
0	59	0.0396
1	74	0.0872
2	70	0.1403
3	41	0.2364
4	15	0.4166

The number of patients from our cohort represented by each of these categories is displayed.

- 263 enrolled with 80% white, 63% female and mean age 76 years, but only 161 (61%) completed 6-months of follow-up.
- 39% (95% CI 33-45%) reported at least one fall in the previous 12-months and 22% of falls were injurious (mostly fractures and contusions).
- 14% (95% CI 10-19%) reported at least one fall during the 6-months follow-up.
- The **ICC** for single measures was 0.77 (95% CI 0.67-0.87) and 0.95 (95% CI 0.91-0.97) for classification of mobility assessments as normal, borderline, or abnormal.
- Univariate analysis identified 10 risk factors associated with 6-month falls (Table 2 page 215 – see in left column) which were entered into [Cox proportional hazards model](#) leaving **4 independent risk factors: non-healing foot sore (HR 3.71, 95% CI 1.73-7.95), reported past falls (HR 2.62, 95% CI 1.33-5.19), inability to cut own toenails (HR 2.04, 95% CI 1.04-4.01), and self-reported depression (HR 1.72, 95% CI 0.83-3.55).**
- Pre-planned subset analysis of past fallers and non-past fallers using these same 10 independent predictors was performed. In past fallers, only toenail clipping and non-healing foot sores remained in the model. In non-past fallers, only depression past falls and previous ED use remained in the model.
- The mean probability of falling increased as the number of these 4 risk factors increased (see Table 4)

		<ul style="list-style-type: none"> • None of the mobility assessments were independently associated with fall risk.
B.	<p>How precise are the estimates of likelihood? <i>In other words, what are the confidence intervals for the given outcome likelihoods?</i></p>	See 95% CI above.
III.	<p>How can I apply the results to patient care?</p>	
A.	<p>Were the study patients and their management similar to those in my practice?</p>	Probably. There is a different ethnic background in this Pittsburgh hospital (80% white) than in Barnes Jewish Hospital in St. Louis (60% black), but otherwise similar socio-demographic strata and diversity of age-related comorbid illness burden and access to timely primary care.
B.	<p>Was the follow-up sufficiently long?</p>	Six month follow-up is appropriate for ED settings, but 39% lost to follow-up is problematic, particularly since “past fallers and those with worse health assessment were more likely to be lost to follow-up.” (p. 216)
C.	<p>Can I use the results in the management of patients in my practice?</p>	<p>No. This is at best a Level III CDR not ready for widespread use. As recommended by CDR methodology, it awaits validation on different patients and in other ED settings. The medical literature is replete with CDRs that appear promising in one setting but cannot be validated ($LR^+ > 10$ or $LR^- < 0.1$) in other settings.</p> <p>The key issues in further studies will be:</p> <ol style="list-style-type: none"> Can this instrument accurately and reliably predict future falls on more heterogeneous ED geriatric populations? Can this instrument be incorporated into ED management so as not to disrupt EM nurse and physician patient flow (kiosks, iPad, screening Geriatric Technicians)? Can we efficiently link higher risk fall patients with effective interventions from the ED?

		d) Will EP's embrace this preventive health issue if challenges A thru C can be attained? e) Who will pay for this research?
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Limitations

- 1) Failure to use [STARD criteria](#), including not reporting sensitivity, specificity, [likelihood ratios](#), or [ROC AUC](#).
- 2) Failure to use objective measures for [dementia](#), [delirium](#), or [depression](#).
- 3) Failure to compare this CDR with existing, non-ED fall risk tools.
- 4) 39% lost to 6-month follow-up with higher risk of spectrum bias (skewed towards less ill patients = falsely increased specificity, see [Kohn 2013](#)).
- 5) Non-objective (self-reported) primary outcome of falls.
- 6) No *a priori* [sample size](#) calculation.

Bottom Line

Four risk factors (non-healing foot sores, past falls, inability to cut own toenails, self-reported depression) are independently associated with 6-month fall risk in community-dwelling geriatric ED patients who are discharged home, but this model/risk prediction instrument requires validation followed by feasibility and effectiveness testing before widespread use. Objective tests of gait and balance do not predict 6-month falls in ED populations, but these performance tests are reliable.