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Risk for poor outcomes in older patients discharged from an emergency department: feasibility of four screening instruments

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Objectives To compare the prognostic value of four screening instruments used to detect the risk for poor outcomes [in terms of likelihood of recurrent emergency department (ED) visits, hospitalizations, or mortality] for older patients discharged home from an ED in the Netherlands.

Methods This is a prospective cohort study, which included all consecutive patients of at least 65 years discharged from the ED of a university teaching hospital in the Netherlands, between 1 December 2005, and 1 November 2006. Four screening instruments were tested: the identification of seniors at risk, the triage risk screening tool, and the Runciman and Rowland questionnaires. The cutoff of the Runciman questionnaire was adapted and the age cutoff was adapted for the other instruments. Recurrent ED visits, subsequent hospitalization, and mortality within 30 and 120 days after the index visit were collected from administrative data.

Results In total, 381 patients were included, with a mean age of 79.1 years. Within 120 days, 14.7% of the patients returned to ED, 17.2% were hospitalized, and 2.9% died.

The area under the curve was low for all instruments (between 0.43 and 0.60), indicating poor discriminatory power.

Conclusion Older ED patients discharged home are at higher risk of poor outcomes. None of the instruments were able to clearly discriminate between patients with and without poor outcomes. Differences in organization of the health care systems might influence the prognostic abilities of screening instruments. European Journal of Emergency Medicine 18:215–220 © 2011 Wolters Kluwer Health | Lippincott Williams & Wilkins.

INTRODUCTION

The percentage of people of more than or equal to 65 years will nearly double in the next 25 years. In the Netherlands, this percentage will increase from 13% in 2005 to 24% in 2030 [1]. The aging of the population will be accompanied by a rise in the absolute number of patients with multimorbidity (defined as the presence of two or more chronic conditions) and disabilities. Consequently, older patients will place a higher burden on health care systems.

Currently, older patients are already over-represented among emergency department (ED) admissions, and they use ED services more frequently than younger patients [2]. Owing to their multi-morbid conditions and concomitant disabilities, older patients are at higher risk for recurrent visits to the ED, subsequent (preventable) hospital admissions, (preventable) adverse drug events, functional decline, and institutionalization [3–7]. These negative outcomes may require a different approach toward older patients

admitted to the ED. Systematic screening to identify high-risk patients may help professionals to apply appropriate interventions and protect this vulnerable patient group from adverse outcomes [8].

For this purpose, four screening instruments that aimed at detecting high-risk patients in the ED have been developed and validated: the identification of seniors at risk (ISAR) [9], the triage risk screening tool (TRST) [10], the Runciman [11], and the Rowland questionnaires [5]. These instruments have been developed for the Canadian, North American, and the UK health care environments. The health care systems differ significantly between these countries, however, and the use of these instruments in other (Western) countries necessitates not only cross-cultural validation, but also proof of feasibility due to differences in the organization of the national systems of care and regulatory barriers. Moreover, these screening instruments have never been compared directly in a single sample using more than one adverse outcome [12] and have not been validated in the Dutch health care setting.

The aim of this study was to compare the four screening instruments in terms of their ability to predict poor outcomes in older ED patients, defined as recurrent ED visits, hospitalizations, or mortality 30 and 120 days after discharge from an ED in the Netherlands.

METHODS

Study design

This prospective cohort study was conducted during an 11-month period starting from 1 December 2005, to 1 November 2006, in a 1024-bed tertiary university teaching hospital in the Netherlands. All community-living older patients aged at least 65 years, visiting the ED and subsequently discharged home, were invited to participate.

Patients were excluded if we were unable to contact them shortly after discharge (defined as not able to contact them within 4 days), if they were unable to speak or understand Dutch, or if they did not provide informed consent. Owing to the logistic reasons, we could not cover a 24-h presence on the ED during the study period and, therefore, included patients within 2 days after discharge from the ED. The Institutional Review Board of our hospital approved the study.

The emergency department in the Netherlands

An ED visit in the Netherlands does not exceed a stay of more than 24 h. Within this maximum timeframe, patients are hospitalized, discharged to their homes, or discharged to special care outside the hospital (e.g. nursing home or intermediate care). The ED is staffed by staff specialists, residents, and interns. Emergency medicine is a board specialty in the Netherlands. Nurses employed in the ED are registered nurses with additional training in emergency nursing. Neither the nursing nor the medical education provided special training in geriatric nursing or geriatric medicine. There is universal health coverage for patients by the Health Care Insurance Act and all patients have a general practitioner who is able to follow up patients after discharge from an ED [13].

Baseline assessment

All charts of patients who were discharged home after an ED visit were reviewed by the research team (a research nurse and geriatrician) within 2 days after discharge to identify patients eligible for inclusion. After inclusion, a trained research nurse in geriatrics carried out telephone interviews to assess functional status at the time of the ED visit. The risk of falling was assessed by asking patients if they had fallen one or more times in the past 6 months. Hearing impairment and/or visual impairment was present if a patient expressed that he/she had hearing or vision problems, irrespective of the use of a hearing aid or glasses. Physical functioning was assessed using the original Katz ADL index score [14,15]. The presence of depressive symptoms was measured with a shortened version of the geriatric depression scale [16]. This version measures two symptoms of depression: a lack of interest in activities that used to be pleasurable and persistent feelings of sadness or anxiety. If both symptoms were present, patients were scored as having depressive symptoms. Sociodemographic data, including educational level, marital status, and living arrangements were collected as well.

The number and the type of medications used by patients were collected from the medical ED chart.

Diagnosis at ED discharge was also registered from the medical ED chart and classified into eight International Classification of Diseases-9 based categories: infectious disease, cardiovascular disease, digestive system disease, renal/urological problem, neurological disease, trauma, orthopedic problem, and ‘other’ diagnoses.

Screening instruments

The four screening instruments were completed in the telephone interview by the research nurse, together with the baseline assessment. Table 1 gives a brief overview of the item content and scoring of the instruments.

In brief, the ISAR is a six-item questionnaire administered to patients of at least 65 years, and is aimed at assessing risk of functional decline and other adverse health outcomes [9]. The TRST is also a six-item questionnaire. The TRST has been validated in patients of at least 75 years, at the risk of functional decline [17], repeat ED visits, and rehospitalization [10]. The Runciman questionnaire consists of 11 items and was developed for patients of at least 75 years, and assesses the risk of functional decline [11]. The cut-off score of the Runciman questionnaire was adapted, as with the original cutoff score of at least 2, 98% of the patients were at increased risk for negative outcomes on this screening instrument. The Rowland questionnaire consists of seven items and focuses on the patients of at least 75 years who are at a higher risk of emergency room readmission [5].

Poor outcome at follow-up

Outcomes were registered at two points in time: at 30 days and 120 days. Within 120 days, problems associated with the reason for the ED visit will often become visible; after this time period the likelihood of significant, new medical events increases and can, therefore, bias results.

The ‘recurrent visit to the ED’ was the first visit to the ED after the index visit within 30–120 days. ‘Hospitalization’ was the first hospital admission after the initial discharge from the ED within 30–120 days. Patients who were hospitalized directly after the index visit were excluded from this study. We only registered unplanned readmissions to the hospital. If patients were hospitalized after a recurrent ED visit, they were both scored as recurrent visitors to the ED and also scored as ‘hospitalized’.

Mortality was registered up to 30–120 days after discharge from the ED; this information was abstracted from the municipal data registry system. A combined endpoint ‘poor outcome’ was also calculated which was defined as a recurrent visit to the ED and/or hospital admission and/or mortality within 30–120 days.

[TABLE 1]

Statistical analyses

Baseline characteristics, screening test results, and the prevalence of poor outcome indicators were summarized using descriptive statistics. Analyses of the prognostic value of the four screening instruments were carried out with the aid of 2 x 2 tables, with poor outcome indicators and positive screening test results included as either present or absent. Prognostic abilities were expressed in terms of sensitivity, specificity, and the area under the ROC curve (AUC) with 95% confidence intervals. We also calculated the positive and a negative predictive value, indicating the chance of a poor outcome given a positive and negative test result, respectively. All analyses were carried out in SPSS, version 18 (IBM corporation, Sommers, New York, USA).

RESULTS

In total, during the study period 2368 patients of at least 65 years visited the ED of which 505 patients were eligible (Fig. 1). Of these patients, 124 (25%) were excluded because we were unable to contact them after ED discharge (n=76), because they declined to participate (n=36), or because they had insufficient Dutch language capabilities (n=12). A total of 381 patients were included in the study. Of all older patients (n= 2368) who had visited the ED, 79% were hospitalized, whereas 21% were discharged home. The latter group was the eligible patients for inclusion. After inclusion, there was no attrition of patients in the follow-up period.

There were no significant differences between included and excluded patients with regard to age, sex, social status, and living arrangement.

Table 2 presents the baseline characteristics of the study population. The mean age was 79 years (standard deviation; 6 years), 39% were male and 73% had no functional limitations at the time of their ED visit.

After 30 days, the return rate to the ED was 6.3%; a total of 7.6% of the patients were hospitalized and 0.8% of the patients died. Within 120 days, 14.7% of the discharged patients returned to the ED, 17.2% were hospitalized and 2.9% died. Overall, 9.2% of the patients had a poor outcome within 30 days and 19.7% within 120 days (Table 2).

[FIGURE 1]

[TABLE 2]

[TABLE 3]

Table 3 indicates the prognostic abilities of the ISAR, the TRST, the Runciman, and the Rowland questionnaires in relation to recurrent visits to the ED, hospitalization, mortality, and overall poor outcomes 120 days after ED discharge. Positive test results for the ISAR, TRST, Runciman, and Rowland questionnaires were: 49.1, 68.2, 76.1, and 18.6%, respectively. Sensitivity and specificity rates across the different poor outcome indicators varied between the screening instruments. The Runciman questionnaire showed high sensitivity but low specificity, whereas the Rowland questionnaire suggested a contrasting picture. Changing cutoff points for both instruments did not improve prognostic abilities. With the exception of the mortality endpoint, the TSRTwas more sensitive and less specific than the ISAR. However, the AUC values of all screening instruments indicated poor overall discriminatory power. None of the instruments were able to clearly discriminate between patients with and without poor outcomes. This could also be observed by the predictive values: post-test probabilities of poor outcome indicators were only slightly changed by the results on the screening tests. Analyses on the 30-day outcomes had the same results (data available on request).

DISCUSSION

This study of discharged older ED patients showed that poor outcomes after an ED visit are a common problem.

Fifteen percent of nonhospitalized older patients returned to the ED within 120 days, and almost all of the returning patients were subsequently hospitalized. When combining the different outcome indicators, approximately one-fifth of the patients suffered from a poor outcome. None of the screening instruments studied were sufficiently able to predict and discriminate between patients with and without poor outcomes.

The prognostic properties of these screening instruments were mostly in disagreement with other studies. The ISAR was developed and validated to detect a broad range of adverse health outcomes. Focusing on the health care utilization, the AUCs were higher in earlier studies, ranging from 0.61 to 0.71 [18,19]. Studies on the TRST showed conflicting results. Two studies indicated that the TRST had moderate-to-acceptable AUCs, ranging from 0.64 (functional decline and composite endpoint health care utilization) to 0.72 (hospitalization) [10,17], whereas another study concluded that the TRST should not be used as a screening tool because it lacks clinically meaningful diagnostic abilities [20]. The Runciman and Rowland questionnaires were developed to detect patients at higher risk of functional decline and readmission to the ED. One small study compared both instruments on their predictive power in detecting patients at risk for readmission to the ED and found much higher AUCs (0.63– 0.74) than those in this study [21].

There could be some explanations for the differences found between the diagnostic abilities of the four instruments used in this study compared with earlier studies. The ISAR has been developed and validated in Canada. In Canada, patients can stay for up to 3 days in the ED, whereas in the ED, in most European countries, this stay is limited to a maximum of 24 h (usually 2–6 h). This might influence the case mix of patients on the ED.

The TRST was developed in the USA, where the insurance policies are different and the system of general practitioners (GP) does not provide universal coverage for all US inhabitants. In the Netherlands, as in most other European countries, all inhabitants are obligated to have health care insurance and, moreover, all civilians have a GP.

Patients are supposed to contact their GP in the case of subacute health problems, and the GP decides whether a patient should be referred to ED.Only at weekends, in the evenings, during the night and in an emergency, can patients go directly to the ED. Of all older patients visiting the ED in this study, 79% were hospitalized, whereas 21% were discharged to their homes. This percentage of hospitalizations is higher than in the USA, where hospitalization rates after an index ED visit varied between 33 and 50% [2,4]. The 100% availability of a GP might influence the hospitalization rate after the index ED visits, as only seriously ill patients will be sent in. This could also explain why the studied screening instruments did not perform well. The patients admitted to an ED in the Netherlands might be more ill due to selection by their GP. In addition, a GP can provide the patient with a follow-up after the ED visit, which might prevent ED

readmission. Rates of return visits to the ED and subsequent hospital admissions were higher in the USA and Canada [2,4]; this might be attributed to a lack of a GP who can treat the patient.

Differences in the organization of health care cannot, however, be the only explanation, as the Runciman and Rowland questionnaires were developed in Europe and were also unable to identify patients at risk. We also found significant differences in the prognostic abilities of the screening instruments compared with a Belgian study [21]. Although this study focused solely on readmissions, much higher AUCs were found for the screening instruments. The organization of the health care in Belgium is quite similar to the Netherlands. The Belgian study represents a small sample, with a lower median age compared with this study (74 vs. 78 years) and found much higher readmission rates at 120 days (33 vs. 15%).

This could be an explanation for the differences in prognostic abilities.

Several shortcomings of this study should be recognized.

Owing to the logistic reasons, we were not capable of covering a 24-h presence on the ED to screen patients.

We, therefore, had to choose either to see patients on weekdays in daytime or to contact all discharged patients by telephone after discharge. As the primary health care is well organized, we expected to see a selection of patients if we would only include patients on weekdays. In evening and night shifts more self-referral patients attend to the ED and this could have given bias. Therefore, we decided to phone all discharged patients. Our approach, however, could have introduced selection bias, as patients with, for example, cognitive impairment or many disabilities were not able to answer the telephone call.

Our study was a single centre study, in a tertiary university teaching hospital, which could have influenced the case mix of patients seen in the ED. Furthermore; we registered only return visits to the ED and hospitalizations in our own hospital. This could lead to an underestimation of the actual number of visits to the ED and hospitalizations.

The TRSTand Runciman and Rowland questionnaires were validated for patients of at least 75 years at risk of functional decline or readmissions, whereas we included patients of at least 65 years. This could have influenced the prognostic value of these instruments. In this study, only discharged patients after an ED visit were included, whereas the ISAR was validated to screen all ED patients either hospitalized or discharged after an ED visit. This might influence the a priori likelihood of a poor outcome. All other screening instruments were developed and validated to detect older patients at risk for poor outcomes after discharge from an ED.

Screening at the ED can be a helpful first step in preventing adverse outcomes in older, nonhospitalized patients. A systematic review of McCusker and Verdon [8] on geriatric interventions to reduce ED visits showed that interventions were most effective when they were based in primary care and targeted on patients at higher risk of adverse outcomes. The organization of primary care in the Netherlands, including comprehensive coverage and strong organization, provides a solid infrastructure for these types of interventions.

Further research should focus on improving and validating screening instruments for the European situation. Demographic changes in the population will increase the burden on the health care system in general, and the ED system specifically, in a few years time. As timeliness is critical for EDs, an effective and efficient choice has to be made between those older patients that are vulnerable and require extra care and those patients needing merely standard care.

In conclusion, older patients discharged after visiting the ED include a large group of vulnerable patients at higher risk of poor outcomes. None of the studied screening instruments was capable of detecting older patients at risk for recurrent ED visits, subsequent hospitalizations, or mortality. Demographic changes have increased the need to identify, at an early stage, which patients are at higher risk of poor outcomes, highlighting the need to develop a screening instrument with higher discriminative power.

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TABLES AND FIGURE

Table 1

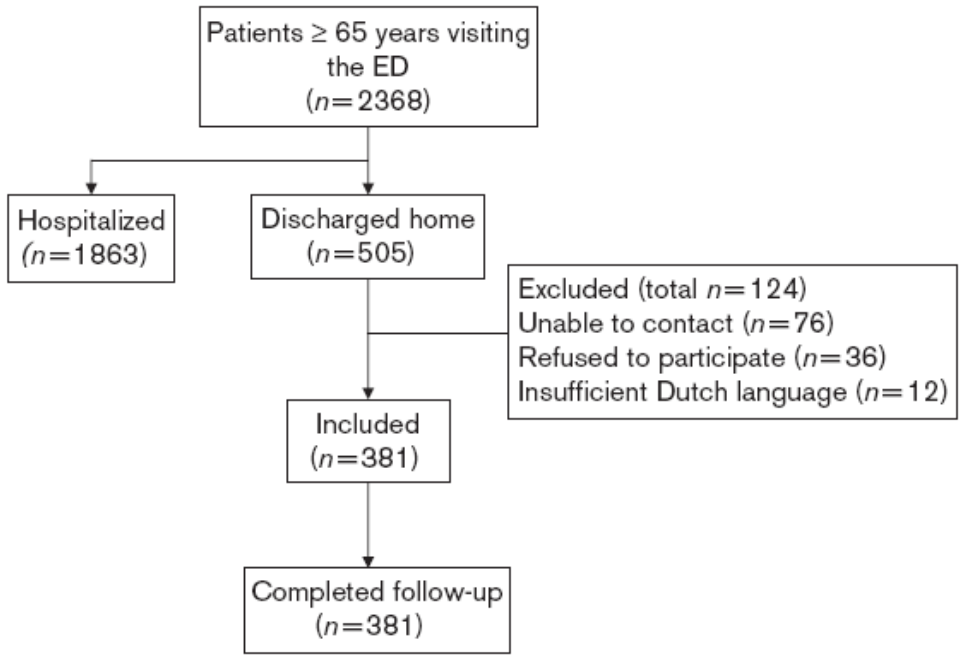
Table 1 Item content and scoring of the four screening instruments

Instrument	Cutoff score	Year	Country of development	Number of items	Age (years)	Items	Developed or validated to detect patients at risk for
ISAR [9]	≥ 2	1999	Canada	6	≥ 65	1. Activities of daily living 2. Instrumental activities of daily living 3. Recent hospitalization 4. Visual impairment 5. Cognitive problems 6. Use of three or more different medications	functional decline readmission hospitalization depression mortality institutionalization
TRST [10]	≥ 2	2003	USA	6	≥ 75	1. Cognitive impairment 2. Difficulty in walking 3. Recent fall or transfer problems 4. Living alone 5. Five or more different medications 6. Recent hospitalization or recent ED visit 7. Nurse concerns	functional decline recurrent ED visits hospitalization
Runciman [11][a]	≥ 3	1996	UK	11	≥ 75	1. Presence of soft tissue injury 2/3 Traveling alone before and after ED visit 4/5 Needing help with shopping before and after ED visit 6/7 Needing help with dressing before and after ED visit 8. Use of diuretics 9. Problems with 'water works' 10. Use of a walking aid 11. Remember an address earlier given	functional decline readmissions
Rowland [5]	≥ 2	1990	UK	7	≥ 75	1. Use of walking aid 2. Needing help with dressing 3. Needing help with finance 4. Needing help with grocery shopping 5. Use of day care 6. Use of meal device 7. Needing professional home care	readmissions

ED, emergency department; ISAR, identification of seniors at risk; TRST, triage risk screening tool.
[a]Cutoff score was adapted; original cutoff was ≥ 2.

Figure 1

Fig. 1



Flow chart of patient selection. ED, emergency department.

Table 2

Table 2 Baseline characteristics of older patients discharged from the emergency department ($n = 381$)

Variable	Patients
Demographic	
Age[a]	79.1 (6.3)
Male (%)	38.8
Years of education	8.4 (2.8)
Caucasian (%)	93.4
Marital status	
Alone (%)	52.2
Living arrangement	
Living independently (%)	79.0
Senior residence (%)	14.2
Other (%)	6.8
Functional status at admission	
One or more fall(s) in the past 6 months (%)	7.3
Hearing impairment (%)	10.8
Visual impairment (%)	8.4
Depression symptoms (%)	19.1
Limitations on Katz Activity of Daily Living index	
Zero limitations (%)	73.2
1–3 limitations (%)	21.5
4–6 limitations (%)	5.3
Status at ED visit	
Number of medications[a]	3.8 (2.9)
Diagnosis at ED discharge	
Infectious disease (%)	10.8
Cardiovascular disease (%)	8.1
Disease of the digestive system (%)	8.4
Renal/urological disease (%)	4.2
Neurological disease (%)	5.8
Trauma and orthopedic problems (%)	48.2
Other (%)	14.4

ED, emergency department.
[a]Mean and standard deviation are given for continuous variables.

Table 3

Table 3 Prognostic value of four screening instruments, 120 days after discharge from the emergency department ($n=381$)

Instrument	Prevalence poor outcomes (%)	Sensitivity	Specificity	Positive predictive value (%)	1-Negative predictive value (%)	AUC (95% CI)
Recurrent visit to the ED						
ISAR		0.56	0.54	19	10	0.59 (0.51–0.67)
TRST	14.7	0.79	0.33	17	10	0.56 (0.48–0.64)
Runciman		0.85	0.12	14	17	0.49 (0.40–0.58)
Rowland		0.23	0.82	18	14	0.53 (0.44–0.61)
Hospitalization						
ISAR		0.65	0.54	22	12	0.59 (0.52–0.67)
TRST	17.2	0.77	0.33	19	13	0.55 (0.49–0.63)
Runciman		0.85	0.12	17	18	0.48 (0.40–0.57)
Rowland		0.23	0.83	23	16	0.54 (0.46–0.62)
Mortality						
ISAR		0.64	0.51	4	2	0.58 (0.41–0.74)
TRST	2.9	0.55	0.31	2	4	0.43 (0.25–0.61)
Runciman		0.78	0.12	2	5	0.44 (0.25–0.65)
Rowland		0.27	0.82	4	3	0.54 (0.36–0.73)
Poor outcomes (combined)						
ISAR		0.65	0.54	26	13	0.60 (0.53–0.67)
TRST	19.7	0.75	0.33	22	16	0.54 (0.47–0.61)
Runciman		0.86	0.12	19	23	0.49 (0.41–0.57)
Rowland		0.25	0.83	27	18	0.54 (0.47–0.62)

AUC, area under the curve; CI, confidence interval; ED, emergency department; ISAR, identification of seniors at risk; TRST, triage risk screening tool.