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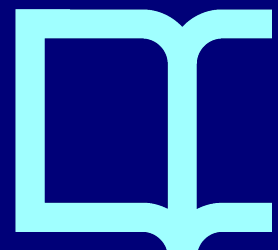
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Original Study

Geriatric Screening Tools to Select Older Adults Susceptible for Direct Transfer From the Emergency Department to Subacute Intermediate-Care Hospitalization

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A B S T R A C T

Keywords:

Comprehensive geriatric assessment
intermediate care
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potentially avoidable hospitalizations
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skilled nursing facilities

Objectives: Early transfer to intermediate-care hospitals, low-tech but with geriatric expertise, represents an alternative to conventional acute hospitalization for selected older adults visiting emergency departments (EDs). We evaluated if simple screening tools predict discharge destination in patients included in this pathway.

Design, Setting, and Participants: Cohort study, including patients transferred from ED to the intermediate-care hospital Parc Sanitari Pere Virgili, Barcelona, during 14 months (2012–2013) for exacerbated chronic diseases.

Measurements: At admission, we collected demographics, comprehensive geriatric assessment, and 3 screening tools (Identification of Seniors at Risk [ISAR], SilverCode, and Walter indicator).

Outcome: Discharge destination different from usual living situation (combined death and transfer to acute hospitals or long-term nursing care) versus return to previous situation (home or nursing home). **Results:** Of 265 patients (mean age \pm SD = 85.3 \pm 7.5, 69% women, 58% with acute respiratory infections, 38% with dementia), 80.8% returned to previous living situation after 14.1 \pm 6.5 days (mean \pm SD). In multivariable Cox proportional hazard models, ISAR >3 points (hazard ratio [HR] 2.06, 95% confidence interval [95% CI] 1.16–3.66) and >1 pressure ulcers (HR 2.09, 95% CI 1.11–3.93), but also continuous ISAR, and, in subanalyses, Walter indicator, increased the risk of negative outcomes. Using ROC curves, ISAR showed the best prediction among other variables, although predictive value was poor (AUC = 0.62 (0.53–0.71) for ISAR >3 and AUC = 0.65 (0.57–0.74) for continuous ISAR). ISAR and SilverCode showed fair prediction of acute hospital readmissions.

Conclusions: Among geriatric screening tools, ISAR was independently associated with discharge destination in older adults transferred from ED to intermediate care. Predictive validity was poor. Further research on selection of candidates for alternatives to conventional hospitalization is needed.

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Chronic diseases are prevalent in older adults, are associated with negative health outcomes and reduced quality of life, and represent a burden for health care systems, with high utilization of acute hospital beds.^{1,2} Moreover, hospitalization of elderly patients in non-specialized environments might increase the risk of unfavorable health outcomes, such as delirium and death.^{3,4}

Intermediate-care institutions, which in different health care systems might be identified, for instance, with community hospitals or skilled nursing facilities, have been proposed as alternatives to conventional acute hospitalizations for selected patients with flared-up chronic diseases.^{5,6} The 2011–2015 Health Plan of the autonomous region of Catalonia, Spain, prioritizes the implementation of alternatives to conventional hospitalization for patients with multimorbidity,⁷ mainly relying on an existing network of intermediate-care post-acute hospitals, which are traditionally dedicated to geriatric rehabilitation and palliative care. In these institutions, specific wards, named as “Subacute Care Units” (SCUs), have been reoriented to the care of older adults with reactivated chronic diseases or

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minor acute events in the context of clinical-social complexity. These units are provided with low technology but with geriatric specialization of the staff and an adapted environment. Direct admission from emergency departments (EDs) has been promoted, to reduce unnecessary acute hospital admissions.⁸ Because of the resources and characteristics of these units, direct admission requires an optimal selection of candidate patients.

The aim of our study was to evaluate if easy, quick, and inexpensive geriatric screening tools predict a discharge destination different from returning to the previous living situation for patients admitted to an SCU.

Methods

Design

This was a cohort study.

Study Population and Setting

Patients consecutively transferred to the SCU of Parc Sanitari Pere Virgili from the ED of Vall d'Hebron University Hospital in Barcelona, where they had been selected by a consulting geriatric team, during 14 months (February 2012–April 2013). Inclusion criteria for direct transfer to intermediate care were (1) exacerbated chronic comorbidities (eg, heart failure or chronic obstructive pulmonary disease) or “minor” acute events (ie, urinary tract or respiratory infections) superimposed to chronic diseases, (2) hemodynamic stability, (3) not needing complex diagnostic testing, (4) social situation and support allowing the return to the usual living place. Parc Sanitari Pere Virgili is a 350-bed facility that includes geriatric rehabilitation, palliative care, and long-term nursing care units, with available 24-hour geriatricians, expert nurses, physiotherapists, and social workers, plus X-ray and urgent laboratory testing. The hospital provides teaching for residents in geriatrics and medical students. Goals of the SCU include completing medical treatments and providing comprehensive geriatric assessment and individualized interdisciplinary geriatric care so as to prevent or manage complications of hospitalization in older adults (eg, immobilization, delirium, falls).

Baseline Evaluation

We used data from the hospital's routine comprehensive geriatric assessment, which includes demographics (age, sex), marital status, clinical characteristics (main admission diagnosis, Charlson comorbidity index [best–worst score], prevalent pressure ulcers, Emina scale for risk of pressure ulcers [0–15, best–worst]), cognitive impairment (history of dementia, Pfeiffer Short Portable Mental Questionnaire [0–10, best–worst]), and disability in the basic activities of daily living (Barthel Index [0–100, dependency–autonomy]). At admission to our SCU, we administered 3 geriatric prognostic tools: (1) the Identification of Seniors at Risk (ISAR) scale, a simple 6-question test (score 0–6, best–worst) validated in the ED to predict adverse health outcomes after home discharge,⁹ which takes into account function (premorbid and post-acute change), polypharmacy, cognitive and visual impairment, and recent hospitalizations; (2) the Silver Code (score 0–30, best–worst), validated in the ED to predict 1-year mortality,¹⁰ which combines demographics, polypharmacy, comorbidities, and previous hospitalizations; and (3) the Walter indicator (score 0–20, best–worst) predicts 1-year mortality at hospital discharge¹¹ and combines demographics, clinical aspects (heart failure, cancer with or without metastases), and laboratory testing (albumin, creatinine). To improve the clinical meaningfulness and eventual practical use of the results, we used continuous score as well

as cutoffs to identify patients at risk, based on previous works for SilverCode (>11 points)¹² and Walter indicator (>6 points).¹¹ Top versus other 2 tertiles (>3 points), a cutoff already used in the literature,¹³ was used for the ISAR. Data were collected by expert physicians or nurses working in the unit, which were selected, trained, and stable during the study period. Because these data were extracted from our usual health electronic records software, patients did not sign a specific ad hoc informed consent other than a general consent, which allows using their anonymous data for different clinical and study purposes. The study protocol was approved by the Committee for Ethics in Animal and Human Experimentation of the Universitat Autònoma de Barcelona.

Outcome

According to the goals of these units, which promote a prompt management of the acute condition and a rapid discharge to previous living place, we selected the following variable as an outcome: discharge to the usual living situation (home or usual nursing home) versus a different discharge destination (death, return to the acute hospital, or transfer to long-term nursing care). In our system, long-term nursing care units represent an intensive nursing resource, belonging to the health care department, dedicated to managing health care conditions (skin wounds or other complex situations in chronic and disabled older adults) within a limited timeframe (<3 months). This resource is different from a nursing home, which belongs to the welfare and social system. In this sense, the outcome combined 3 health-related reasons of not returning home. Quality requirements of the Catalan health care administration set >70% of discharges to previous living situation.

Statistical Analysis

To assess the association between baseline variables and the outcomes, we used χ^2 test (dichotomous variables) and *t* test (continuous variable). Variables showing a bivariate association with the outcome ($P < .05$), and with clinical meaningfulness, were entered in a stepwise Cox proportional hazards model. We built different models including ISAR, Silver Code, and Walter as either continuous or dichotomous variables. Because the Walter indicator was calculated on only 84% ($n = 223$) of the sample, because of limited availability of laboratory testing results, whereas the other scales on virtually 100% of the sample, we first excluded the Walter indicator from the multivariable analyses, including it in further analyses. To further explore the impact of social status on the outcome (particularly on discharge to long-term nursing care) we conducted analyses comparing baseline variables and the outcomes between married and not married participants. Finally, we ran receiving operator characteristic (ROC) curves to determine the prediction of the outcomes using the selected scales plus a number of other geriatric variables (disability in basic activities of daily living, dementia, and pressure ulcers) that might have a practical impact on discharge destination and were associated with the outcomes, at least in bivariate analyses. We first assessed the area under the curve (AUC) for continuous measures and then, in light of a potential clinical translation, for the specified dichotomous variables. Statistical analysis was performed using SPSS 19.0 (IBM SPSS Statistics, IBM Corporation, Chicago, IL).

Results

We enrolled 265 patients (mean age \pm SD = 85.31 \pm 7.54 years, 69% women) with previous clinical and social complexity (37.8% had dementia, mean Charlson Index \pm SD was 2.36 \pm 1.58, 72% were not

Table 1
Association Between Baseline Characteristics and Discharge Destination (Combined Death, ED, or Long-Term Care Versus Return to Previous Living Situation: Home or Nursing Home)

	Total, n = 265	Discharge Destination		P
		Previous Living Situation (Home, Nursing Home), n = 214	Others (Death, ED, Long-Term Care), n = 51	
Age	85.3 ± 7.5	85.3 ± 7.3	85.4 ± 8.3	.934
Female	183 (69.1)	150 (70.1)	33 (64.7)	.454
Married	72 (27.8)	58 (27.8)	14 (28.0)	.972
Diabetes mellitus	82 (31.3)	68 (31.9)	14 (28.6)	.648
Dementia	99 (37.8)	74 (34.7)	25 (51.0)	.034
Cognition, Pfeiffer Short Portable Mental Questionnaire*	3.5 ± 3.5	3.5 ± 3.4	3.7 ± 4.0	.665
Comorbidity, Charlson Index*	2.4 ± 1.6	2.41 ± 1.6	2.15 ± 1.3	.316
Previous function, Barthel Index*	52.3 ± 35.2	55.3 ± 34.2	41.0 ± 37.0	.011
Disabled, Barthel Index <60	118 (44.5)	85 (39.7)	33 (64.7)	.001
No. pressure ulcers	0.2 ± 0.4	0.1 ± 0.3	0.3 ± 0.5	.006
At least one ulcer	44 (16.6)	29 (13.6)	15 (29.4)	.006
Risk of new ulcers, Emina*	6.4 ± 3.9	6.5 ± 3.8	6.2 ± 4.5	.738
Main admission diagnostic				
Respiratory infections	154 (58.3)	123 (57.7)	31 (60.8)	.936
Heart failure	56 (21.2)	47 (22.1)	9 (17.6)	.488
Urinary infections	29 (11.0)	24 (11.3)	5 (9.8)	.764
Other diagnoses	25 (9.5)	19 (8.9)	6 (11.8)	.533
Prognostic scales				
ISAR, total score*	3.1 ± 1.3	2.9 ± 1.3	3.7 ± 1.1	<.001
ISAR >3 points	111 (42.0)	80 (37.4)	31 (62.0)	.001
SilverCode, total score*	9.9 ± 4.8	9.9 ± 4.7	10.3 ± 5.1	.542
SilverCode >11 points	122 (46.2)	44 (20.6)	13 (26)	.400
Walter indicator, total*	4.8 ± 2.6	4.6 ± 2.6	5.7 ± 2.3	.011
Walter indicator >6 points	48 (21.5)	36 (19.8)	12 (29.3)	.182
Discharge destination				
Previous living situation	214 (80.8)			
Other intermediate-care resources (long-term care)	31 (11.7)			
Transfer to acute hospital	9 (3.4)			
Death	11 (4.2)			

Values are expressed as mean ± SD or n (%).

*For all the showed assessment tools with continuous scores, higher scores indicate worse results but for Barthel Index (score ranges from 0 to 100, where 0 indicates total disability and 100 best possible function).

living with a spouse) and moderate-severe disability (mean previous Barthel Index ± SD = 52.3 ± 35.2), admitted for respiratory infections (58.3%), heart failure (21.2%), or urinary infections (11%) (Table 1). After a mean length of stay ± SD of 14.1 ± 6.5, 80.8% were discharged to the previous living situation, whereas 11.7% were transferred to long-term care, 3.4% returned to the ED, and 4.2% died. Not married participants (n = 187) were older (86.2 ± 7.5 versus 83.3 ± 6.8, P = .005), more disabled, and had a higher prevalence of women and of health care conditions (including dementia and pressure ulcers), compared with married participants. However, not married and married participants had comparable discharge destination (including discharge to long-term care, slightly but not significantly higher in married participants: 13.9% versus 11.2%, P = .505), although not married stayed longer in the SCU (2.2 days of mean difference, P = .016).

In Cox proportional hazard models (Table 2), each point increase of the ISAR questionnaire was associated with a more than 30% increased risk and each prevalent pressure ulcer with an almost doubled risk of a worse outcome. Also, ISAR >3 points (hazard ratio [HR] 2.06, 95% confidence interval [95% CI] 1.16–3.66) and having at least 1 pressure ulcer (HR 2.09, 95% CI 1.11–3.93) were associated with a twofold increased risk of discharge different from previous living situation.

When the Walter indicator was introduced in the different models, ISAR >3 points (HR 2.52, 95% CI 1.36–4.66) and the number of prevalent pressure ulcers (HR 3.00, 95% CI 1.51–5.94) remained independently associated with a higher risk of discharge destination different from usual situation, as well as the ISAR continuous scale (HR 1.35, 95% CI 1.03–1.76). In these models, only the Walter indicator as a continuous scale was independently associated with a worse outcome (HR 1.16, 95% CI 1.02–1.32), but not a dichotomous Walter indicator >6 points.

Using ROC curves (Table 3), only a few variables (ISAR, both as a continuous and a dichotomous variable, Barthel Index <60 and Walter indicator) predicted the outcome, although prediction was poor. ISAR continuous score showed the largest AUC (0.65 [0.57–0.74]). Looking at disaggregate outcomes, ISAR (0.72) and SilverCode (0.73) showed a fair prediction of discharge back to the acute hospital. Conversely, SilverCode better, but poorly, predicted mortality, whereas ISAR, pressure ulcers, and functional status (Barthel Index) predicted transfer to long-term care.

Discussion

We assessed predictive validity of simple geriatric screening tools to identify candidates to be transferred from ED to SCU, intermediate-

Table 2
Cox Proportional Hazard Models for the Association Between Baseline Variable and the Risk of a Discharge Destination (Death, Emergency Room, or Long-Term Care) Different From Return to Previous Living Situation (Home or Nursing Home)

	P	HR (95% CI)	95% CI Lower–Top
Model including continuous scales			
ISAR	.011	1.38	1.08–1.77
Pre-acute Barthel Index	.912	1.00	0.99–1.01
No. prevalent pressures ulcers	.057	1.85	0.98–3.49
Dementia	.243	1.42	0.79–2.57
Model including dichotomous variables			
ISAR >3 points	.014	2.06	1.16–3.66
Barthel Index <60	.506	1.26	0.64–2.49
At least 1 pressure ulcer	.022	2.09	1.11–3.93
Dementia	.133	1.58	0.87–2.86

Table 3
ROC Curves

	Combined		Transfer to Acute Hospital		Death		Intermediate Long-Term Care	
	AUC	95% CI	AUC	95% CI	AUC	95% CI	AUC	95% CI
		Lower–Top		Lower–Top		Lower–Top		Lower–Top
Continuous variables								
ISAR	0.65	0.57–0.74	0.72	0.59–0.85	0.53	0.34–0.71	0.65	0.54–0.75
Pre-acute Barthel Index	0.37	0.28–0.47	0.41	0.25–0.57	0.38	0.18–0.57	0.38	0.26–0.51
N prevalent pressures ulcers	0.58	0.49–0.67	0.41	0.25–0.57	0.46	0.29–0.63	0.66	0.55–0.78
SilverCode	0.56	0.46–0.65	0.73	0.59–0.87	0.68	0.52–0.85	0.44	0.33–0.56
Walter indicator*	0.64	0.55–0.73	0.69	0.58–0.80	0.54	0.27–0.81	0.62	0.51–0.72
Dichotomous variables								
ISAR >3 points	0.62	0.53–0.71	0.68	0.52–0.85	0.54	0.36–0.72	0.60	0.49–0.71
Barthel Index <60	0.62	0.53–0.70	0.56	0.37–0.75	0.58	0.40–0.76	0.63	0.52–0.73
At least one pressure ulcer	0.57	0.48–0.67	0.41	0.25–0.58	0.47	0.29–0.64	0.65	0.54–0.77
Dementia	0.58	0.49–0.67	0.59	0.40–0.78	0.61	0.44–0.79	0.55	0.44–0.66
SilverCode >11	0.53	0.44–0.62	0.67	0.48–0.87	0.65	0.46–0.84	0.43	0.33–0.53
Walter indicator >6 points*	0.55	0.45–0.65	0.50	0.31–0.70	0.56	0.22–0.90	0.55	0.44–0.67

*Walter indicator: introduced in a sensitivity analysis in a subsample (n = 223).

care geriatric specialized units, as a potential alternative to conventional acute hospitalization. Given the limited availability of diagnostic and intervention technology in the SCU, the selection of candidate patients is cardinal to avoid unexpected mortality and retransfers to the acute hospital, which would represent a burden for the patient and for the system. The prompt detection of problems requiring long-term care (eg, pressure ulcers) is also important to guarantee adequate resource utilization and the turnover of patients.

In our sample, the ISAR questionnaire, both as a continuous and a dichotomous variable, together with the presence of pressure ulcers, was associated with an increased risk of a discharge destination different from previous living situation (death, acute or long-term care transfer). Using ROC curves, ISAR and Walter screening tools showed the best prediction among the considered variables, although, according to generally accepted standards, prediction was only poor. Looking at disaggregate outcomes, ISAR and SilverCode were fair predictors of acute retransfers from intermediate care.

Our results are in line with previous research testing these same tools, although in different settings and circumstances. In a number of studies, the ISAR predicted adverse outcomes in the 3 to 6 months after discharge from the ED (including death, institutionalization, functional decline, worsening depressive symptoms, further visits to ED, rehospitalizations, use of hospital and community health care resources), but always with poor predictive validity (AUC 0.6–0.7).^{14–16} Similarly, poor predictive values were observed when the ISAR was adapted to the acute setting.¹⁷ In a large cohort of older Italians, ISAR and SilverCode tools showed poor-fair comparable predictive value for mortality and hospital admission.¹² On the other hand, ISAR remains a promising tool for the ED: in a systematic review comparing 15 scales, which incorporated functional related items, ISAR had the best predictive validity and psychometric properties.¹⁸ Recently, the ISAR has been proposed as a screening tool for complex interventions to reduce functional decline after ED visits.¹⁹ The Walter prognostic indicator, on the other hand, showed poor-fair predictive values for mortality in hospitalized older adults,²⁰ but had not been tested in the ED before. An additional difference of our study, compared with the quoted ones, all conducted in nonselected samples, could contribute to explain the poor predictive validity: the selection of patients by a geriatric expert team in the ED, performing a geriatric assessment, might have resulted in a relatively homogeneous sample, limiting the screening ability of the 3 tools. Further studies could compare candidate selection through a short geriatric screening tool with a complete comprehensive geriatric assessment.

Although lacking a satisfactory prediction of discharge destination after the intermediate-care process, the ISAR, in our sample, demonstrated a strong independent association with the outcome. This might be attributable to its ability to capture aspects of the comprehensive geriatric assessment (function, cognition, geriatric syndromes, and medications), which, both isolated^{21,22} or combined,²³ represent risk factors for negative outcomes in the elderly.

A risk tool to be used in the ED should be quick, informative, reliable, and inexpensive. ISAR combines demographics with resource utilization and basic clinical elements, is short and quick, and might be assessed by virtually almost all trained professionals. SilverCode is based on demographics, diagnostics, and resource utilization, so that might be even automatically calculated from administrative records, but it does not incorporate aspects of geriatric assessment. Although in our study these tests were performed at admission in our intermediate-care unit, the easiness and previous validation reference studies suggest that translation to ED is feasible. On the other hand, the Walter indicator, which incorporates a broader clinical assessment, is more complex and expensive, mainly due to laboratory testing, which in fact reduced its availability in our sample.

Limitations are described as follows. First, the use of routine clinical data from our electronic records limits the availability of other potential variables and scales, and might reduce reliability and quality of data, although personnel were trained and stable. However, this aspect also highlights the strength of a real-world study, performed in real clinical conditions, and would facilitate potential translations of the results to the routine practice. Second, this pathway might be specific for our health care system, even if the identification of alternatives to conventional hospitalizations is a very actual concern in different systems, for demographic and epidemiologic reasons. As another limitation, the relatively small numbers of adverse events limit the speculation regarding prediction of disaggregate outcomes (ie, transfers back to the acute hospital). Larger studies are needed to address these aspects. Among other strengths, the large and homogeneous sample of older complex patients, and the availability of a real-world comprehensive geriatric assessment.

Conclusion

To optimize care for older, chronic patients in the ED,^{24–26} alternatives to conventional hospital admissions are gaining increasing interest. A range of different resources would allow providing the right care in the right place. In this scenario, selecting the appropriate candidates for every option is crucial. Our results suggest possible

tools to select older adults to be transferred from the ED to intermediate care, but larger, multicentric and possibly transnational studies are needed to confirm these results. Furthermore, we think that screening tools might also help, in future studies, to select candidate patients to be included in specific intervention studies based on innovative interventions and pathways.²⁷

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