

# Hospital discharge: testing the “Blaylock Risk Assessment Screening Score” in a surgical department

*Sara Colognesi<sup>1</sup> Cristina Fagnani<sup>1</sup> Federica Panceri<sup>1</sup> Manuela Ruggero<sup>1</sup> Filomena Di Florio<sup>1</sup> Chiara Passoni<sup>1</sup> Valentina Fantini<sup>2</sup> Patrizia Boracchi<sup>3</sup> Annalisa Orenti<sup>3</sup> Maria Adele Fumagalli<sup>4</sup> Marco Vergani<sup>4</sup>*

<sup>1</sup> Surgical Department, Vimercate Hospital, Italy; <sup>2</sup> Gastroenterology-Pneumology, Papa Giovanni XXIII Hospital, Italy; <sup>3</sup> Department of Clinical and Community Sciences, Laboratory of Medical Statistics, Epidemiology and Biometrics “G. A. Maccaro”, University of Milan, Italy; <sup>4</sup> Hospital Management of the Health Care Professions, Vimercate Hospital, Italy

## Introduction

In recent years, Italy has experienced a reduction in available hospital beds and a decrease in the number of days of patient admission; another vital aspect to take into account are changes in family structures and relations that can lead to less informal care capacity within the family network (1).

Under such circumstances, the planning and execution of discharge is of particular concern: achieving safe and timely discharge or transfer from the hospital is a challenging activity for healthcare professionals, patients and their carers, particularly in the context of constant pressures to discharge patients from the ward as quickly as possible.

Discharge planning is a process that includes determining the appropriate post-hospital discharge destination for a patient and identifying his/her requirements for a smooth and safe transition from one level of care to another, with the aim of ensuring continuity of care and using resources efficiently (2,3,4).

A systematic review suggests that an individualized discharge plan probably leads to a small reduction in hospital length of stay, readmission rates and to an increase in patient satisfaction for older people admitted for different medical conditions (5). As a matter of fact, it is estimated that some 30% of discharges are delayed for non-clinical reasons: among them are inadequacy of discharge planning (lack of assessment and

planning for discharge, poor communication between professionals, inadequate involvement of patient and family, over-reliance on informal care) or the unavailability of post-discharge facilities (6,7).

Therefore, it is essential to identifying patients in need of discharge planning and conducting discharge management upon admission: the principle is to move from a reactive approach to a proactive one, anticipating and managing potential delays.

Simple and yet accurate and reproducible instruments are warranted to identify those patients at greater risk in encountering difficulties in the discharge process, as they can assist healthcare professionals in clinical decision making to prepare patients and families for discharge.

Several instruments exist containing a list of patient characteristics known to be predictive of a complex discharge (8, 9, 10, 11, 12). However, none of them has been widely accepted for broad use.

The Blaylock Risk Assessment Screening Score (BRASS) is a simple and easy to use instrument that explores some important risk factors, such as social support, functional status, number of active medical problems and number of drugs, to identify the risk of prolonged hospitalization and the need of discharge planning in individuals who are hospitalized (12). It comprises a 10-item scale that determines a score between 0 and 40: a result lower than 10 identifies patients which have few needs for discharge planning and a low demand for

discharge planning resources, a score between 10 and 19 identifies those affected by more complicated problems who require extensive discharge planning resources, possibly without institutionalization, and scores above 20 indicate subjects with severe problems who need extensive discharge planning resources and who are likely to be discharged to a location other than their home. It has been validated by Blaylock and Cason in a group of patients hospitalized in a medical ward (12) and it has been utilized with different results for patients admitted to the intensive care unit (ICU) (13), in medical patients post-discharge (14, 15, 16), in a rehabilitation ward (17), in cardio-surgical inpatients (18) and in those undergoing elective arthroplasty (19). These experiences suggested that suitable applications may be found in the surgical context but noted that this screening instrument still needs some improvements. As discharge planning is an interdisciplinary approach to continuity of care, the BRASS index cannot be a stand-alone tool for addressing the entire range of patient's discharge needs, but it would function in unison with other factors to provide a broader view of the situation.

## Aim

The aim of our study was to analyze the predictive validity of the BRASS index in a group of patients in a surgical ward. Secondly, we assessed variations of the tool scores and patients' characteristics during hospitalization, in order to confirm his suitability to be completed during the acceptance phase.

Moreover, other variables (e.g. American Society of Anesthesiologists [ASA] score, multidrug-resistant bacterial infections, ulcer pressures...) were analyzed with hopes of recognizing the relation to delayed discharge and to facilitate the accurate identification of patients who need discharge planning.

## Methods

### *Design*

A prospective observational study was conducted with adult patients ( $\geq 18$  years old) in the surgical department of Vimercate hospital. Standards for

Reporting Diagnostic Accuracy guidelines were followed in reporting this study.

### *Data collection*

All adult patients ( $\geq 18$  years old) consecutively admitted in the surgical department of Vimercate hospital between 7th November 2016 and 30th June 2017 were recruited. We excluded patients admitted to Week Surgery, the Gynecology Unit and with short-term hospitalizations ( $< 24$  hours).

Data were collected in two phases:

First phase: within 48 hours of the hospitalization, BRASS Index and personal data were collected (age, gender, type of admission).

Second phase: before discharge, BRASS Index was completed, and the destination of the patient was registered. Additionally, the following information were gathered:

- American Society of Anesthesiologists [ASA] Score;
- multidrug-resistant bacterial infections (Clostridium Difficile, carbapenem-resistant or carbapenemase-producing Klebsiella pneumoniae, Methicillin Resistant Staphylococcus Aureus [MRSA]);
- pressure ulcers;
- intensive care unit stay;
- medical complications.

Before data collection, all the nurses of the hospital where participants were enrolled were trained about the study protocol. This study did not involve any modification on usual care or protocols of discharge.

### *Sample Size*

According to the primary purpose, a predictive validity of BRASS index (computed as Area Under the ROC Curve) of approximately 0.8 was expected and a percentage of patients discharged at home without assistance of 64% was assumed (18). Provided an accuracy of the estimate of 5% (semi-width of the 95% confidence interval), a sample size of 375 subjects was required. These estimates were derived from interim analyses.

### **Data analysis**

Socio-demographic characteristics of patients were summarized using absolute numbers and percentage in the whole sample. The distribution of BRASS score groups (<10, 10-19, ≥20) within the categories of patients' clinical characteristics and discharge location were summarized using numbers and percentages.

The distribution of length of hospitalization within the BRASS categories were summarized as median and interquartile range. Functional status characteristics of patients at admission and discharge were summarized as number and percentages. To examine predictive ability of the BRASS Index for identifying patients discharged to their home with assistance or discharged to residential care, the Areas Under the ROC Curve (AUC) were computed and reported with pertinent 95% confidence intervals. Sensitivity and specificity were estimated using cut offs of 10 and 20 for the BRASS index. Values were reported using a 95% interval confidence estimated with binomial distribution, exact method. In the subset of patients with surgical intervention, multiple linear regression analysis was performed to explore the association between length of hospitalization (response variable) and type of admission, ASA score, multiresistant bacterial infections, pressure ulcer, Intensive Unit Care stay, medical complications. As all the covariates except ASA score were dichotomous, regression coefficients could all be interpreted as the mean difference of length of hospitalization between the two categories of each covariate. For ASA score regression coefficients could be interpreted as the mean increase of length hospitalization for each 1 point increase in the ASA score. Results are reported

as mean difference with 95% confidence intervals and p-values of the t-statistics to test the null hypothesis of 0 mean difference. To investigate the association between type of discharge and the above-mentioned covariates a multiple logistic regression model was performed. Results are reported as odds ratio with 95% confidence intervals and p-values of the z-statistics to test the null hypothesis of odds ratio equal to 1.

### *Ethical considerations*

The approval from the Ethic Committee was obtained for the present study. In conjunction with the Declaration of Helsinki (20), written informed consent was obtained from all participants and they were advised of their right to withdraw from the project at any time without providing explanations.

### **Results**

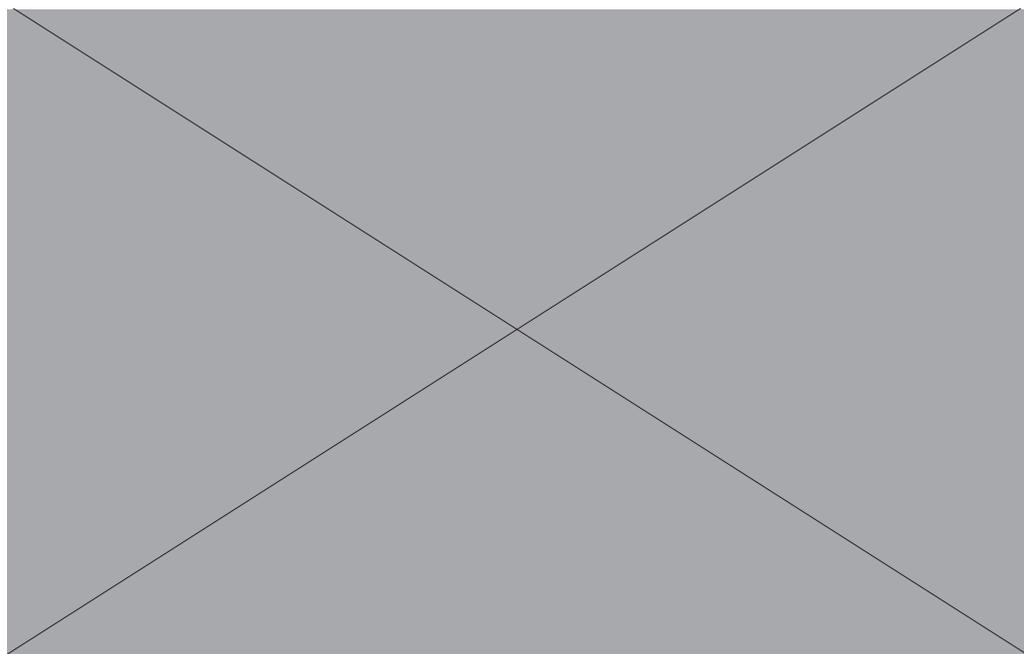
A total of 428 patients was recruited in this study (Figure 1), whose socio-demographic characteristic are presented in Table 1. Individuals had a median age of 65 years (interquartile range 48-75) and an equal proportion of emergency or elective admission; most of them had surgery (75%).

The median length of hospitalization was 5 days and differed in BRASS Index risk groups: patients in the high-risk category had a median length of hospitalization higher than those in the low and medium (Table 3).

At discharge, patients' characteristics were similar to admission: within 48 hours of hospitalization 42 (9.8%) individuals were disoriented, confused or agitated and for 39 (9.1%) of them the situation did not change after hospitalization. Thirty patients were discharged with new medications.

Furthermore, a slight decrease was observed in functional status, particularly in the following activities of daily living: transferring, meal preparation, transportation (Table 4).

During hospitalization, 4 patients shifted from low to high risk category of the BRASS Index. According to the regression model for repeated measures, mean variation of BRASS Index was 0.1893



**Figure 1.** Flow chart of participants' recruitment

**Table 1.** Patients' socio-demographic features

Patients' socio-demographic features	N°	%
<b>Gender</b>		
Female	194	45.3
Male	234	54.7
<b>Age (years)</b>		
18-39	61	14.3
40-59	116	27.1
60-69	80	18.7
70-79	117	27.3
80-89	47	11
>89	7	1.6
<b>Living conditions</b>		
Lives with spouse	268	62.6
Lives with family	85	19.9
Lives alone	71	16.6
Nursing home/residential care	4	0.9

(range -10; +13) and it was not statistically different from zero.

A total of 124 patients (29%) were discharged to residential care or after the hospitalization went to live at home with a caregiver (Table 5).

Sensitivity of the BRASS Index in identifying patients discharged to their home with assistance (cut off score 10) or individuals discharged to residential care (cut off score 20) was low (52.42% and 14.75%). Specificity, however, was higher, with a value of 96.7% (95% CI: 94.03 - 98.41) for a BRASS cut-off of 10 and increasing to 97% with a BRASS cut-off of 20 (95% CI: 94.7 - 98.49). Areas under the curve (ROC) were, respectively, 86.3 (95% CI: 82.38 - 90.21) and 82.8 (95% CI: 77.22 - 88.39) indicating the accuracy of the measured test to be of moderate quality.

Multiple linear regression results are summarized in Table 6. All the variables included (emergency admission, higher ASA score, pressure ulcer presence, multiresistant bacterial infections, medical complications and Intensive Unit Care stay) were predictive of a longer length of postoperative stay.

Moreover, results from generalized linear model including the exploratory covariates as the previous model revealed that a higher ASA score and an emergency admission was related to an increased probability to be discharged to residential care (Odds Ratio 2.83 (95% CI: 1.70 - 4.92), p-value<0.001 for ASA score and 3.77 (95% CI: 1.99 - 7.34) for emergency admission, p-value<0.001). Concerning the association between discharge with assistance the following

**Table 2.** BRASS Index at admission

	<b>BRASS &lt; 10 N (%)</b>	<b>BRASS ≥ 10 and ≤ 19 N (%)</b>	<b>BRASS ≥ 20 N (%)</b>	<b>Total N (%)</b>
<b>Functional status</b>				
Independent	307 (100)	0	0	307 (100)
Dependent	46 (38)	55 (45.5)	20 (16.5)	121 (100)
<b>Cognition</b>				
Orientated	352(87.3)	45 (11.2)	6 (1.5)	403 (100)
Disorientated	1(4)	10 (40)	14 (56)	25 (100)
<b>Behavior pattern</b>				
Appropriate	353 (86.5)	47 (11.5)	8 (2)	408 (100)
Wandering/agitated/confused	0	5 (29.4)	12 (70.6)	17 (100)
<b>Mobility</b>				
Ambulatory	323 (98.8)	4 (1.2)	0	327 (100)
Ambulatory with mechanical assistance	20 (60.6)	13 (39.4)	0	33 (100)
Ambulatory with human assistance	4 (23.5)	8 (47.1)	5 (29.4)	17 (100)
Non-ambulatory	6 (11.8)	30 (58.8)	15 (29.4)	51 (100)
<b>Sensory deficit</b>				
None	342 (86.1 )	50 (12.6)	5 (1.3)	397 (100)
Visual or hearing deficits	11(39.3)	5 (17.9)	12 (42.8)	28 (100)
Visual and hearing deficits	0	0	3 (100)	3 (100)
<b>Number of previous admissions/ Emergency Room visits</b>				
None in the last 3 months	297 (84.6)	40 (11.4)	14 (4)	351 (100)
One in the last 3 months	46 (70.8)	15 (23.1)	4 (6.1)	65 (100)
Two in the last 3 months	9 (81.8)	0	2 (18.2)	11 (100)
More than two in the last 3 months	1 (100)	0	0	1 (100)
<b>Number of active medical problems</b>				
Three medical problems	309 (89.3)	31 (9)	6 (1.7)	346 (100)
Three to five medical problems	40 (54.8)	23 (31.5)	10 (13.7)	73 (100)
Three medical problems	4 (44.4)	1 (11.2)	4 8(4.4)	9 (100)
<b>Number of drugs</b>				
Fewer than three drugs	223 (92.2)	17 (7)	2 (0.8)	242 (100)
Three to five drugs	96 (78.1)	23 (18.7)	4 (3.2)	123 (100)
More than five drugs	34 (54)	15 (23.8)	14 (22.2)	63 (100)
<b>Total</b>	<b>353 (82.5)</b>	<b>55 (12.8)</b>	<b>20 (4.7)</b>	<b>428 (100)</b>

**Table 3.** BRASS score and length of hospitalization

	<b>Patient N (%)</b>	<b>Length of hospitalization Median (interquartile range)</b>
<b>BRASS &lt; 10</b>	353 (82.5)	5 (1-198)
<b>BRASS between 10 and 19</b>	55 (12.9)	9 (2-72)
<b>BRASS ≥ 20</b>	20 (4.6)	11 (2-36)

**Table 4.** Functional status on admission and discharge

<b>Dependent in:</b>	<b>Admission N(%)</b>	<b>Discharge N (%)</b>
Eating/feeding	31 (7.2)	29 (6.7)
Bathing/grooming	84 (19.6)	78 (18.2)
Toileting	77 (18)	82 (19.1)
Transferring	86 (20)	95 (22.2)
Incontinence of bowel function	26 (6.1)	31 (7.2)
Incontinence of bladder function	47 (11)	49 (11.4)
Meal preparation	82 (19.1)	97 (22.7)
Responsible for own medication administration	39 (9.1)	46 (10.7)
Handling own finances	36 (8.4)	40 (9.3)
Grocery shopping	71 (16.6)	74 (17.3)
Transportation	105 (24.5)	124 (29)

**Table 5 – Discharge location**

	<b>BRASS &lt; 10 N (%)</b>	<b>BRASS between 10 and 19 N (%)</b>	<b>BRASS ≥ 20 N (%)</b>	<b>TOTAL</b>
Home	294 (96.7)	10 (3.3)	0	304
Home with assistance	36 (57.1)	16 (25.4)	11 (17.5)	63
Moved to another hospital	1 (33.3)	2 (66.7)	0	3
Residential care	22 (37.9)	27 (46.6)	9 (15.5)	58
TOTAL	353	55	20	428

**Table 6.** Summary of multiple linear regression for length of stay (n= 320)

<b>Variable</b>	<b>Mean difference (95% Confidence Interval)</b>	<b>p-value</b>
Emergency admission, yes vs no	2.28 (-1.01 - 5.57)	0.174
ASA Score, 1 point increase	2.68 (0.73 - 4.64)	0.007
Ulcer pressure, yes vs no	1.44 (0.00 - 2.87)	0.050
Multiresistant bacteria infection, yes vs no	12.42 (4.83 - 20.01)	0.001
Medical complications, yes vs no	75.00 (65.06 - 84.95)	<0.001
Intensive Unit Care stay, yes vs no	17.97 (13.31 - 22.64)	<0.001

covariates were considered: Emergency admission, ASA Score, Ulcer pressure, Multiresistant bacteria infection. Even in this case the results revealed that a higher ASA score and an emergency admission were related to an increased probability to be discharged with assistance (Odds Ratio 3.28 (95% CI: 2.11 - 5.25), p-value<0.001 for ASA score and 3.94 (95% CI: 2.32 - 6.80) for emergency admission, p-value<0.001).

## Discussion

In this study, we recruited a large number of patients hospitalized in a surgical ward in Italy.

In accordance with previous publications (14,16, 19), length of stay was associated to BRASS Index: patients with a greater score experienced longer hospitalization whereas the majority of patients with a low score had a shorter length of stay. These data suggest that the BRASS Index was able to identify patients

at risk of prolonged hospitalization and figures concerning sensitivity and specificity support the hypothesis that patients with greater scores are likely not to be discharged to their home. The high specificity indicated that there is a high propensity to consider individuals with a BRASS score higher than 10 likely to be discharged to their home with assistance or to residential care: it will allow health care professionals to focus efforts on specific targeted patients and prepare for possible discharge issues, organizing rehabilitation in hospital or temporary nursing home care if care services at their home are not sufficient. Sensitivity was low, but this is consistent with the results of Cunic *et al.* (19) and Mistiaen and colleagues (14). A possible explanation for this finding can be found in the definition of residential care, which in this study included rehabilitation hospitals, as they can be considered a part of the care plan rather than the final patient's discharge location. Secondly, BRASS Index poorly explores personal resources, and, for example, it does not take into account that existing caregivers cannot provide assistance: this can underestimate the number of individuals needing a discharge planning. Also, a low sensitivity value could be due to a decline in patients' functional status prior to admission compared to discharge; furthermore, the analysis of BRASS Index mean variation suggests that evaluation did not change significantly during hospitalization, and patient screening within 48 hours from admission in the ward is adequate to ensure an effective discharge planning. Only in a very few situations the assessment at discharge differed from the one performed at admission, thus reinforcing the importance of a continuous evaluation of individuals' current and evolving care requirements (4), as well as a constant attention to data collection (for example, family resources or patient's planning needs may not be known at admission).

Like other studies (14, 15, 16, 19) we argue that the BRASS Index is a promising instrument for discharge planning. However, our data suggest there are other patient-specific factors that correlate with prolonged length of hospital stay and the location at discharge: type of admission, pressure ulcer, ASA score, multidrug-resistant bacterial infections, medical complications and Intensive Unit Care stay showed a significant correlation with longer hospitalization or an increased probability

to be discharged to their home with assistance or to residential care. If used, they may improve the sensitivity of the assessment, targeting the at-risk population and simplify the screening process without too much effort.

## Conclusions

The BRASS Index is a useful tool to evaluate patients in order to identify those who are at higher risk of prolonged hospitalization and those who need a discharge program: it is simple and quick to conduct and data indicate that need to be completed just once within 48 hours from the admission.

This would facilitate necessary arrangements for safe hospital discharge and timely and efficient continuity of care, allowing for more hospital beds and resources to be available for future surgical procedures.

To better identify patients, other factors such as ASA score or a pressure ulcer onset may be included in conjunction with the BRASS Index to improve the accuracy of the assessment. Further research could focus on these factors in order to keep screening simple and improve their effectiveness.

Although the most accurate project possible in the circumstances was conducted, it must be acknowledged that results of this study may not be completely generalizable because the sample was restricted to a single hospital. In future research, it would be beneficial to include samples from various surgical wards

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