Hospital Discharge: Results From an Italian Multicenter Prospective Study Using Blaylock Risk Assessment Screening Score

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PURPOSE: To analyze the predictive validity and reliability of the Blaylock Risk Assessment Screening Score (BRASS) Index in a large group of patients.

METHODS: Prospective multicenter observational study was conducted in six Italian hospitals. Data were collected in three phases.

FINDINGS: Seven hundred eleven patients were recruited. The mean length of hospitalization for low-risk patients was significantly shorter than those in the medium and high-risk groups. Patients with a BRASS Index lower than 10, unlike those with a higher BRASS Index, were mainly discharged home.

CONCLUSIONS: Our results indicate that the BRASS Index is useful to identify patients at risk for prolonged hospitalization.

CLINICAL RELEVANCE: The use of a validated BRASS instrument can be useful to screen the patients, improving individual discharge planning.

Discharge from the hospital to home is not an easy process and may be characterized by several problems, such as reduced independence in activities of daily living, self-care deficits, problems in medication management, social problems, information need, and emotional problems. Some evidence suggests that the frequency of those problems is significantly higher in older adults and in women (Mistiaen, Francke, & Poot, 2007). Nurses are critical to identifying problems, particularly those of older persons and planning for safe transfer from the hospital to home or other settings.

In order to reduce these issues related to safe transfer from the hospital, discharge planning must be an important

focus of patient care. Previous studies indicate that multidisciplinary discharge care planning improves quality of life, as well as involvement and satisfaction with discharge care (Preen et al., 2005). Other studies (Haddock, 1994; Parfrey et al., 1994) indicate that a discharge plan is effective in reducing the length of hospitalization.

The Cochrane Collaboration indicated that discharge planning "is the development of an individualized discharge plan for the patient prior to leaving hospital, with the aim of containing costs and improving patient outcomes. Discharge planning should ensure that patients are discharged from hospital at an appropriate time in their care and that, with adequate notice, the provision of other services will be organized" (Shepperd et al., 2010). The Cochrane Collaboration highlights that a structured discharge plan can have modest effects on the reduction of hospitalization length and readmission rates for older people (Shepperd et al., 2010). However, in consideration of the reduction of beds in acute care units and therefore the need to discharge patients as soon as possible, even small reductions of hospitalization length may be effective. Other authors observed that the most common reasons for increased length of hospitalization were both medical and nonmedical issues (i.e., difficulty in finding a bed in a skilled nursing facility) (Carey, Sheth, & Braithwaite, 2005). Thus, the early identification of patients who are at risk for prolonged hospitalization might represent an important measure to improve adequate discharge planning.

For such assessment, simple yet sensitive and reproducible instruments that help the nurse to identify the patients at risk are warranted. Several studies (Blaylock & Cason, 1992; Boult et al., 1993; de Jonge, Bauer, Huyse, & Latour, 2003; Graf, 2008; Holland et al., 2003; Sager et al., 1996) have explored and analyzed different screening instruments designed to identify those patients at greater risk to encounter difficulties in the discharge process.

They include: The Hospital Admission Risk Profile, which can be used to screen patients in order to identify who can benefit from discharge planning (Sager et al., 1996); the Probability of Repeated Admission, which includes eight self-reported questions and can be used to screen for nonroutine discharge planning (Holland et al., 2003); the COMPRI-INTERMED, which can be used to identify complex patients admitted in medical wards. The Blaylock Risk Assessment Screening Score (BRASS; Blaylock & Cason, 1992) is a simple and easy to use instrument that explores some important risk factor, such as social support, functional status, number of active medical problems, and number of drugs.

The BRASS has been validated by Blaylock and Cason in a group of patients hospitalized in medical ward (Blaylock & Cason, 1992). The BRASS Index has been utilized in several other studies. Evaluation of a sample of elderly patients screened for post-discharge problems in a Dutch hospital indicated that BRASS is a good predictor instrument for indicating patients who are not appropriate for being discharged to home (Mistiaen, Duijnhouwer, Prins-Hoekstra,

Ros, & Blaylock, 1999). The BRASS Index was used to identify intensive care unit (ICU) patients at risk of complex hospital discharge needs, and the authors report that the BRASS Index is not particularly specific to identify patients at risk of prolonged ICU and hospital stay and ICU readmission (Chaboyer, Kendall, & Foster, 2002). In Italy, the BRASS was employed in 104 patients admitted to a rehabilitation ward. The results indicated that the BRASS Index was multidimensional and unreliable. In order to obtain an adequate internal construct validity and sufficient reliability as a predictor of discharge problems for a group of patients, the authors suggested a modification of the BRASS Index (Panella, La Porta, Caselli, Marchisio, & Tennant, 2012). The BRASS Index was also used in a group of Italian patients admitted to medical wards, and results demonstrated that this instrument was useful to help nurses in identifying patients in need of discharge planning (Saiani, Zanolin, Dalponte, Palese, & Viviani, 2008).

The purpose of this prospective observational study was to analyze the predictive validity and reliability of the BRASS Index in a large group of patients hospitalized in medical wards in six Italian hospitals. This study has been conducted within preliminary framework on problems of post-discharge. This framework indicated that post-discharge is influenced by some factors that can be grouped as healthcare related factors (i.e., way which patient and their caregivers are prepared for discharge), patient-related factors (i.e., demographic characteristics, changes in self-care), and factors related to the social network of patients (i.e., social network to provide support/help for the patient) (Mistiaen, Duijnhouwer, & Ettema, 1999).

Methods

Participants and Setting

A prospective multicenter observational study was conducted. Participants, all ≥ 18 years old, were recruited in the medical wards of six Italian hospitals, where they were hospitalized (convenience sample).

Before data collection, all the nurses and physicians of the hospitals where participants were enrolled were trained about the study protocol. The BRASS Index is very simple and does not require a long training.

Data Collection

Data were collected in three phases:

1. First phase: within 48 hr after the admission to the hospital, the BRASS Index and other personal data were collected (age, gender, education, and job).
2. Second phase: before discharge, the BRASS Index was completed, and some information about the destination of the patient was collected (home, nursing facility/residential care, hospice, residence of a member of his family).

3. Third phase (follow-up): about 40 days after the discharge, trained nurses contacted the patients or their family by phone, in order to evaluate if they encountered problems after discharge, if patients were again hospitalized or had access to the emergency room (ER). The interview was conducted with open and closed questions.

In noncognitive patients, data were obtained with the aid of the family or caregiver.

In this study, nurses and physicians did not modify their usual care and protocol of discharge.

Measures

The BRASS Index is an easy and quick instrument, used for the first time by Blaylock and Cason in 1992, which allows to identify the risk of prolonged hospitalization and the need of discharge planning in the individuals who are hospitalized (Blaylock & Cason, 1992).

This instrument consists of 10 items, and total score ranges from 0 to 40 (Table 1). Patients can be categorized in three groups: patients with a low score (less than 10), which have few needs for discharge planning and a low demand for discharge planning resources; patients with a moderate score (score between 10 and 19), represented by patients affected by more complicated problems who require extensive discharge planning resources, possibly without institutionalization; and patients with a high score (greater than 19), which includes subjects with severe problems and who need extensive discharge planning resources, including a high probability of further institutionalization.

Two persons from the medical staff with a good knowledge of English translated the BRASS Index into Italian, and the translation was independently reviewed by a supervisor. A back-forward translation was then performed, and the content validity was tested by a group of nurses and physicians. The Italian version of the BRASS Index used in the study was consistent with the translation performed by Saiani et al. (2008).

Data Analysis

A descriptive statistic was performed with regard to the data collected, calculating mean, and standard deviations, absolute and relative frequencies.

The data in the groups were compared with the use of analysis of variance for quantitative variables and chi-square test for qualitative variables.

The correlation between variables was assessed using the Cohen kappa: if κ was < 0.20 the correlation was poor; between 0.21 and 0.40 it was fair; between 0.41 and 0.60 it was moderate; between 0.61 and 0.80 it was good, and if κ was > 0.81 it was very good (Altman, 1992).

Reliability: In order to assess inter-rater agreement in a subset of patients, two nurses completed the BRASS Index, and the score obtained was correlated using Cohen kappa.

Table 1. BRASS Index

BRASS Index

Age
0 = 55 years or less
1 = 56 to 64 years
2 = 65 to 79 years
3 = 80+ years

Living situation/social support
0 = Lives only with spouse
1 = Lives with family
2 = Lives alone with family support
3 = Lives alone with friends' support
4 = Lives alone with no support
5 = Nursing home/residential care

Functional status
0 = Independent in ADL & instrumental ADL
Dependent in
1 = Eating/feeding
1 = Bathing/grooming
1 = Toileting
1 = Transferring
1 = Incontinent of bowel function
1 = Incontinent of bladder function
1 = Meal preparation
1 = Responsible for own medication administration
1 = Handling own finances
1 = Grocery shopping
1 = Transportation

Cognition
0 = Orientated
1 = Disorientated to some spheres[a] some of the time
2 = Disorientated to some spheres[a] all of the time
3 = Disorientated to all spheres[a] some of the time
4 = Disorientated to all spheres[a] all of the time
5 = Comatose

Behavior pattern
0 = Appropriate
1 = Wandering
1 = Agitated
1 = Confused
1 = Other

Mobility
0 = Ambulatory
1 = Ambulatory with mechanical assistance
2 = Ambulatory with human assistance
3 = Non-ambulatory

Sensory deficit
0 = None
1 = Visual or hearing deficits
2 = Visual and hearing deficits

Number of previous admission/ER visits
0 = None in the last 3 months
1 = One in the last 3 months
2 = Two in the last 3 months
3 = More than two in the last 3 months

Number of active medical problems
0 = Three medical problems
1 = Three to five medical problems
2 = More than five medical problems

Number of drugs
0 = Fewer than three drugs
1 = Three to five drugs
2 = More than five drugs

[a]Spheres = person, place, time, and self.

Moreover, Cronbach's alpha was used to assess internal consistency reliability.

Validity: To examine predictive validity of the BRASS Index, we tested the following hypotheses:

- the length of hospitalization is higher in the high-risk BRASS category;
- patients in the low-risk category are discharged more frequently home;

Furthermore, we calculated the sensitivity and specificity of the BRASS Index in identifying:

- patients not discharged home or discharged home with assistance (family/caregiver or nursing assistant)
- rehospitalization or access to ER
- problem after discharge (such us physical complaint, difficuly with drugs, and difficulty in mobility)

For testing the sensitivity and specificity we used the cut-off score of 10. This cut-off was previously used by Mistiaen, Duijnhouwer, Prins-Hoekstra, et al. (1999) to study the sensitivity and specificity in indentifying patients with problems or unmet needs after discharge.

Then, optimal cut-off scores were investigated by using the receiver operating characteristic (ROC) and the area under the curve (AUC) was calculated: AUC = 0.5 indicated test not informative; AUC between 0.5 and 0.7 indicated test with low accuracy; AUC between 0.71 and 0.9 indicated moderate accuracy; AUC between 0.91 and 1.0 indicated high accuracy; and at AUC = 1 the test was considered perfect (Swets, 1988).

Data were stored in a Microsoft Access 2000 database; statistical analysis was performed with the MedCalc Version 10.3.2.0 (Mariakerke, Belgium) and with SPSS Statistical Software (SPSS, Inc., Chicago, IL, USA). The level of significance adopted for the statistical tests was 5%.

Ethical Aspects

Approval for this study was obtained by the local Ethic Committee of the Coordinating Centre. Upon recruitment, subjects received information about the study and entered the study after they had signed an informed consent.

Results

Population Characteristics

A sample of 712 patients was recruited in this study; analysis was conducted in 711 patients (49.8% male and 50.2% female, mean age 72.19 years) for whom all relevant information were available (Table 2). At the recruitment, the mean score of the BRASS Index was 12.54 (standard deviation [SD] = 8.46), and we found significant statistical differences between the mean ages of patients in the different risk groups (Table 3). A very good correlation was observed between the admission score and the discharge score (12.54 SD = 8.46 vs. 12.41 SD 8.31; κ = 0.834; IC 95% 0.810 to 0.858).

The mean quantity of drug assumption was higher at the discharge than at the admission (mean [SD] 1.21 (0.77) vs. 1.31 (0.74); p = .0126).

Validity

The mean length of hospitalization was different in the groups (Table 4). A total of 495 patients (69.62%) were discharged home, 76 (10.69%) were transferred to other wards, and 82 (11.53%) were discharged to residential care

Table 2. Patients' Sociodemographic Characteristics

Variables	n (%)
Age (mean [SD])	72.19 (15.40)
Gender	
Male	354 (49.8)
Female	357 (50.2)
Education	
No qualification	33 (4.6)
Elementary school	353 (49.6)
Middle school	189 (26.6)
High school	104 (14.6)
University	30 (4.2)
Missing information	2 (0.3)
Job	
Worker	37 (5.2)
Clerk	42 (5.9)
Manager	4 (0.6)
Dealer	15 (2.1)
Business man	9 (1.3)
Student	7 (1)
Housewife	33 (4.6)
Retired	536 (75.4)
Unemployed	12 (1.7)
Freelance professional	14 (2)
Missing information	2 (0.3)

Table 3. BRASS Score and Patient Age

BRASS score	Patient n (%)	Age Mean (SD)*
< 10	313 (44.0)	64.98 (15.7)
Between 10 and 19	227 (31.9)	76.37 (12.8)
> 19	171 (24.0)	79.83 (11.9)

*p < .05.

Table 4. BRASS Score and Day of Hospitalization

	BRASS score	Patient n (%)	Day of hospitalization Mean (SD)**
1	< 10[a]	311 (43.7)	8.45 (8.9)
2	Between 10 and 19	227 (31.9)	14.41 (2.8)
3	> 19	171 (24.0)	17.51 (18.8)

[a]Two data not available.
**p < .05.

or hospice. A proportion of 5.06% of patients, after the hospitalization, went to live with a family member (Table 5).

The number of patients discharged home was higher for the group with a low risk than for those in the medium and high-risk categories (p < .0001). There were significant differences between the various BRASS categories in mortality rate, which was higher in people with a BRASS index > 19.

Among patients discharged home, 11 patients belonging to the low risk group, 22 to the medium group, and 13 to the high-risk group received some kind of assistance.

Table 5. Patients' Characteristics at Discharge

	Tot n (%)	BRASS < 10 n (%)	BRASS Between 10 and 19 n (%)	BRASS > 19 n (%)	p
Home	495 (69.6)	283 (57.2)	158 (22.2)	54 (7.6)	.0001
Residential care	62 (8.7)	4 (6.4)	19 (30.6)	39 (62.9)	.0001
Hospice	20 (2.8)	0 (0)	4 (20)	16 (80)	.0001
Residence of a member of the family	36 (5.1)	2 (5.5)	11 (30.6)	23 (63.9)	.0001
Deceased	22 (3.1)	2 (9.1)	4 (18.2)	16 (72.7)	.0001
Moved to a different ward	76 (10.7)	22 (28.9)	31 (40.8)	23 (30.3)	.0197

Table 6. Patients Discharged Home or to the Residence of a Member of His Family and Education

BRASS of patients discharged home or to the residence of a member of his family	Education n (%)	Not education n (%)	p
< 10	144 (50.53)	141 (49.47)	ns
Between 10 and 19	117 (69.23)	52 (30.77)	p < .0001
> 19	49 (63.64)	28 (36.36)	p = .0227

The sensitivity of the BRASS Index in identifying patients not discharged home or discharged home with assistance was 81.3%, while the specificity was 64.81%.

A total of 379 patients were discharged with educational support. Among them, 310 were discharged home or to the residence of a family member. In the medium- and high-risk groups, the number of educated patients was higher than not educated patients (Table 6).

In the third phase of the study, 578 patients were assessed by a telephone follow-up; 13 of them had died. On average, the follow-up call occurred 53.91 days (ds = 15.86) after discharge.

A total of 31.15% patients had some problems after the discharge, 87 (15.4%) patients had ER visits, and 140 (24.78%) had a new hospitalization.

The BRASS Index sensitivity in identifying rehospitalization or ER visits was 68.64%, and specificity was 60.10%, while the sensitivity and specificity in identifying problems after discharge were 65.34% and 59.13%.

In order to identify the cut-off that optimizes the balance of sensitivity/specificity, we used the ROC curve analysis. The cut-off identify was dependent on the outcome chosen: in order to identify patients not discharged home or discharged home with assistance, the optimal sensitivity/specificity balance was reached with a score of 14 (sensitivity: 70.6% and specificity: 78.4%), and the AUC was 0.815 (Figure 1); to identify rehospitalization or ER visits, the score was 13 (sensitivity: 62.7% and specificity: 69.4%), and the AUC was 0.699 (Figure 2); finally to identify problems after discharge, the score was 15 (sensitivity: 50.6% and specificity: 75.6%) and the AUC was 0.662. (Figure 3).

Figure 1. ROC Curve Analysis to Identify Patients Not Discharged Home or Discharged Home With Assistance
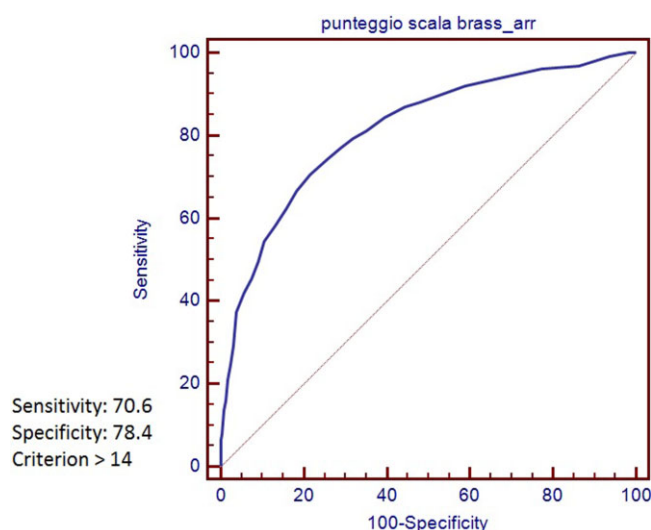
Reliability

Internal consistency measured by Cronbach's alpha was 0.683. The mean value of inter-item correlations was 0.253. The highest correlation was between "functional status" and "mobility." Inter-rater agreement was tested in a subgroup of patients (n = 60), and the results indicated very good agreement ($\kappa = 0.929$; IC 0.902–0.957).

Discussion

Blaylock and Cason (1992) have validated the BRASS Index in 206 patients (mean age: 52; SD = 17), and the results showed that the mean age of patients with an index less than 10 was 48 (SD = 16), and they remained in the hospital for about 8 days. Those patients with scores between 10 and 19 were 58 years old (SD = 14) on average and had a hospitalization length of about 14 days, whereas the mean age of those with an index above 20 was 69 (SD

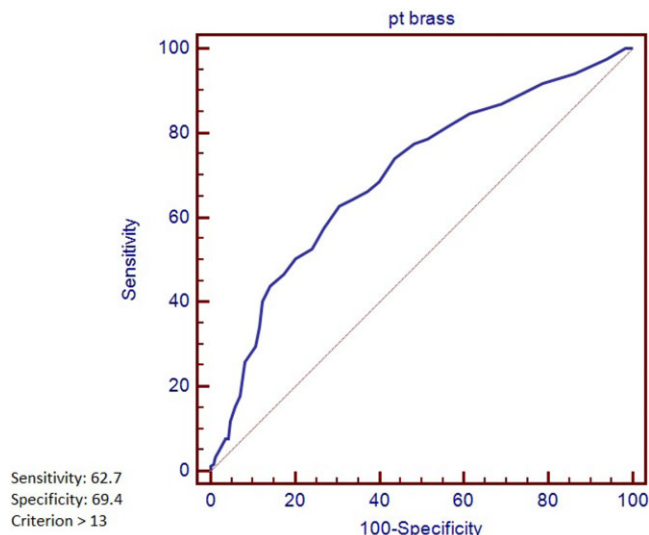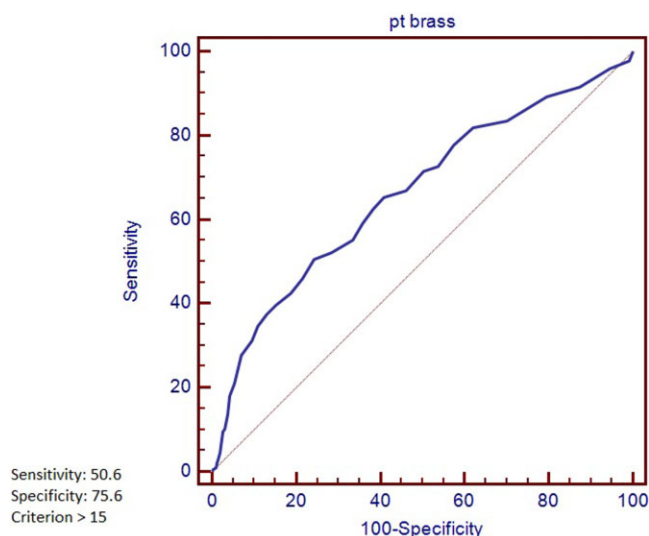**Figure 2. ROC Curve Analysis to Identify Rehospitalization or ER Visits**

Sensitivity: 62.7
Specificity: 69.4
Criterion > 13

Figure 3. ROC Curve Analysis to Identify Problems After Discharge

Sensitivity: 50.6
Specificity: 75.6
Criterion > 15

= 11), and their average hospitalization length was 19 days. The BRASS Index was tested also on patients 65 years of age and older from Holland (Mistiaen, Duijnhouwer, Prins-Hoekstra, et al., 1999) and Italy (Panella et al., 2012; Saiani et al., 2008) and in patients from the ICU (Chaboyer et al., 2002).

In this multicenter study, we recruited a large number of patients, hospitalized in medical wards in Italy. In accordance with Mistiaen, Duijnhouwer, Prins-Hoekstra, et al. 1999), the length of hospitalization is correlated to the

BRASS score: patients with a score higher than 19 experienced longer hospitalization as compared to those with a score lower than 10. Also the destination of patients after discharge correlated well with the BRASS Index risk group: the majority of patients with a lower BRASS score returned to their residence, whereas a great number of patients with a high score were discharged to residential care, hospice, or the residence of a family member. These data suggest that the BRASS Index is able to identify patients at risk of prolonged hospitalization as well as those that are not discharged in their home. Data concerning sensitivity and specificity support these results.

The sensitivity and specificity of the BRASS Index in order to identify problems after discharge or to identify patients more likely to require a rehospitalization or an access to the ER did not prove to be reliable. Hypothetically, this might be due to an adequate discharge planning and education of patients and/or relatives, as indirectly supported by the fact that the proportion of patients educated was higher (medium risk: 69.23% vs. 30.77%, $p < .0001$; high risk: 63.64% vs. 36.36%, $p < .0227$) in the medium- and high-risk groups. These data suggest that the attention paid by nurses to the patient education before discharge is an important part of discharge planning. The effectiveness of the educational process on the reduction of readmission was reported by Parker et al. (2002). In particular, it was shown that discharge education improves clinical outcomes in patients with chronic heart problems (Koelling, Johnson, Cody, & Aaronson, 2005).

Mistiaen, Duijnhouwer, Prins-Hoekstra, et al. (1999) demonstrated that the BRASS Index is a good instrument for screening patients who are not discharged home and to identify patients who have problems after discharge. However, they suggested that the sensitivity/specificity balance can be improved by changing cut-off scores.

Our analysis of ROC indicates a new cut-off for optimizing sensitivity/specificity. For identifying patients not discharged home or discharged home with assistance, optimal sensitivity/specificity balance is reached with 14 (sensitivity: 70.6% and specificity: 78.4%) and the AUC indicates that instrument has moderate accuracy. While for identifying rehospitalization or ER visits, the cut-off is 13, and for identifying problems after discharge, it was 15, but in both, the AUC indicates that the BRASS Index has low accuracy. These data suggest that the BRASS Index cannot be used in clinical practice for indentifying rehospitalization or ER visits or for identifying problems after discharge.

The very high correlation between BRASS scores at admission and discharge indicated that the risk of prolonged hospitalization does not change; this suggests that patient screening within 48 hr from admission in the ward is adequate. These data are in agreement with previous studies (Mistiaen, Duijnhouwer, Prins-Hoekstra, et al. 1999; Saiani et al., 2008).

Reliability values lower than 0.7 make the tool inadequate for any measurement (Panella et al., 2012). In our study,

internal consistency reliability was questionable (0.683), but it is higher than it indicated in previous studies (Mistiaen, Duijnhouwer, Prins-Hoekstra, et al., 1999).

Data about inter-rater agreement suggest the absence of ambiguous items. The nurses indicated some doubts about the completing of the tool. In particular, in the item "What is the patient's living situation/social support?" in cases where the patient lives in nursing facilities or in the residential care, the score is higher than in other situations. The nurses report that, in Italy, if the patient lives in nursing facilities, residential care has a lower risk of prolonged hospitalization than other patients.

Our data suggest the possibility of the BRASS Index to predict mortality in the hospital (Table 6). In order to screen the patient and develop the individual discharge planning, we think that the presence of a dedicated nurse could be effective. Hickey et al. (2000) evaluated the effect of inpatient case management in identifying patients who needed discharge planning, indicating some positive effect.

Some items present in the BRASS Index evaluate the factors categorized, in the preliminary framework on problems post-discharge (Mistiaen, Duijnhouwer, E., & Ettema, 1999), as patient-related factors and factors related to the social network of patients. We think that health-care-related factors can be controlled by adequate discharge planning structured on the basis of the results of the BRASS Index. These issues can be explored in future studies.

Limitations

We acknowledge that this study has several limitations. First, owing to the characteristics of the convenience sample, the results might be poorly generalizable in other samples of patients. Second, the presence of open questions, in the interview conducted in the follow-up, may have generated some problems in data collection, particularly for questions where we explored the problems eventually encountered after discharge (e.g., difficulty in categorization the answers).

Conclusion and Implications

In conclusion, our data suggest that the BRASS Index may be a useful tool for screening patients in order to identify those who are at increased risk of prolonged hospitalization and those who need a discharge program. The BRASS Index also can be recommended for clinical practice, since adequate patient screening can have positive effects in reducing hospitalization. The assessment with the BRASS Index is not complex at all; it is simple and quick (for compilation only about 3 min is necessary) and, in according to Saiani et al. (2008), our data indicate that the instrument can be completed one time within 48 hr from the admission.

This instrument may support the nurses in the clinical decision and in the diagnostic process to identify patients with risk of prolonged hospitalization and who need dis-

charge care planning. Discharge planning is a nursing focus of concern as indicated by NANDA-I, Nursing Intervention Classification, and Nursing Outcome Classification. Nurses equipped with reliable and valid tools that assist them in clinical decision making to prepare patients and families for discharge may play an essential role for the delivery of patient centric care. Future studies should be conducted to verify the BRASS Index's predictive validity in other care areas such as the ER and with other categories of patients such as those undergoing surgery.

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