

Sex-related differences in the BRASS index assessment: a case-cohort observational study

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Summary. *Background and aim.* The BRASS index is a tool used to identify patients at risk of difficult or prolonged hospitalization. The purpose of the study is to analyze whether there are differences in the evaluation of the BRASS index upon admission and upon discharge with regard to sex and to the length of hospital stay (in days). *Methods.* The BRASS assessment was performed upon admission (T0) and upon discharge (T1) for each participant, according to their sex and age. Statistical differences were evaluated on the basis of sex and the risk associated with the BRASS score. Spearman's correlations were assessed among all the variables considered. *Results.* Ninety-five patients (43 males and 52 females) participated in this study. The average age was 80 ± 9 years. The BRASS index at T0 was 12.51 ± 7.66 and at T1 13.91 ± 8.61 . The average length of hospitalization was 13 ± 7 days. There were statistically significant differences between the sex and the BRASS index risk assessment at T0 ($p < 0.001$) and also at T1 ($p < 0.001$) according to the sex variable, respectively. Correlations were also statistically significant between: sex and age ($p = 0.016$), sex and risk assessment both at T0 ($p < 0.001$) and T1 ($p < 0.001$), age and risk assessment both at T0 ($p < 0.001$) and T1 ($p < 0.001$) and age and days of hospitalization ($p = 0.005$). *Conclusions.* Data showed a significant increase in the BRASS index for female patients, both at T0 and T1. However, the BRASS assessment did not correlate with the length of hospital stay (in days). Nursing could play an important role in the BRASS assessment, both at T0 and T1, in order to better refer the patient to the most appropriate nursing setting after hospitalization.

Keywords. BRASS index, discharge, length/days of hospitalization, gender role.

Differenze in relazione al sesso nella valutazione dell'indice BRASS: un caso-studio osservazionale di coorte

Riassunto. *Contesto e scopo.* L'indice BRASS è uno strumento utilizzato per identificare i pazienti a rischio di ricovero difficile o prolungato. Lo scopo dello studio è quello di analizzare se ci sono differenze nella valutazione dell'indice BRASS al momento del ricovero rispetto al momento della dimissione in base al sesso e al numero di giorni di degenza ospedaliera. *Metodi.* La valutazione BRASS è stata eseguita al ricovero (T0) e alla dimissione (T1) per ogni partecipante, considerando anche il sesso, l'età e il numero di giornate di degenza ospedaliera. Le differenze statistiche sono state

valutate in base al sesso e al rischio connesso al punteggio BRASS. Le correlazioni di Spearman sono state valutate tra tutte le variabili raccolte. *Risultati.* Novantacinque pazienti, di cui 43 maschi e 52 femmine hanno partecipato a questo studio. L'età media era di 80 ± 9 anni. L'indice BRASS a T0 era $12,51 \pm 7,66$ e a T1: $13,91 \pm 8,61$. I giorni medi di ricovero erano 13 ± 7 . Differenze statisticamente significative si sono registrate tra il sesso e la valutazione del rischio dell'indice BRASS a T0 ($p < 0,001$) e anche a T1 ($p < 0,001$). Le correlazioni statisticamente significative si sono registrate tra il sesso e l'età ($p = 0,016$), tra il sesso e la valutazione del rischio, sia a T0 ($p < 0,001$) che a T1 ($p < 0,001$), tra l'età e la valutazione del rischio, sia a T0 ($p < 0,001$) che a T1 ($p < 0,001$), e tra l'età e i giorni di ricovero ($p = 0,005$). *Conclusioni.* I dati hanno mostrato un aumento significativo dell'indice di BRASS per le pazienti di sesso femminile sia a T0 che a T1. Tuttavia, la valutazione di BRASS non era correlata al numero di giorni di degenza ospedaliera. L'infermiere potrebbe giocare un ruolo importante nella valutazione dell'indice di BRASS sia a T0 che a T1, al fine di indirizzare meglio il paziente nel setting infermieristico più appropriato dopo il ricovero.

Parole chiave. Indice di BRASS, dimissione, giorni di degenza ospedaliera, sesso.

Introduction

In recent years, the change in the care needs of the Italian population has become evident. Among the factors that contributed to this change are the increased age of the population hospitalized and the increased frequency of chronic diseases.¹ Together, these factors forced healthcare professionals to seriously consider the time of discharge, which is nothing more than the conclusive phase of the entire hospitalization process, as well as a gateway for planning assistance beyond the hospital, focusing on the patient's needs.² Moreover, in order to coordinate and optimize the interventions, especially when it comes to complex patients, the need for an integrated connection between the various social and health organizations constituting the network of services is increasingly emerging within the Italian National Health Service.^{3,4} At the same time, it is increasingly important to provide a standardized care, through the

use of multi-professional and multi-prognostic indexes.^{5,6} Whether it is a switch from one department to another or a transfer to other structures, the discharge of a patient is a critical moment, because – depending on the context – their therapeutic regimens, operators and type of interventions are changed. Therefore, patients should be prepared for discharge, since both they and their family members should be involved in the care path.⁷⁻⁹ Moreover, the discharge can result either in the autonomy of the patient or in the taking charge of the same by the local services, so it is essential that such planning is made during the hospital stay.^{10,11} Therefore, the main objective of discharge planning is not to solve all the problems, but to reduce the possibility of a new hospitalization, to improve patient's satisfaction and to stabilize the pathological situation.

In the current literature, there are different rating scales of the patient's needs at the time of discharge.¹²⁻¹⁴ One of the tools used to qualify such needs is the Blaylock Risk Assessment Screening Score (BRASS) index, which allows the identification of the patients at risk of prolonged hospitalization or complicated discharge. This assessment can be used as soon as the patient is admitted to the hospital ward, in order to identify patients at risk of difficult or prolonged hospitalization, with particular regard to patients for whom services (or even family care resources) for extra-hospital care will need to be activated. Completed by interviewing the patients or their family members, this scale is easy to use and provides good predictive validity indications on issues related to the patient's discharge. Its administration takes only a few minutes, requires minimal training on the part of the evaluator, and can be filled in upon admission.¹² It was developed by authors Blaylock and Cason through a literature review and their experience in geriatric care and in the planning of discharge of patients over 75 years of age. The items highlighted concern: age, functional status, cognitive status, social support, living conditions, number of previous admissions, number of accesses to the emergency room and number of active clinical problems. To these items, the following were subsequently added: behavioral model, mobility, sensory deficits and number of drugs taken. The planning of the patient's needs upon discharge allows to carry out training courses aimed at ensuring that the patient adjusts to the new disease conditions. This consideration is emphasized if we consider the increase in chronic diseases compared to acute ones. To this end, it is important to establish a collaborative relationship between the healthcare staff, the patients and their families.^{13,14}

In literature, few studies are available on the subject, with particular reference on how the BRASS index can be predictive of the number of days of hospitalization.^{15,16} On the other hand, there are no studies in the literature that consider sex differences within this context.

The present study aims at better analyzing whether there are differences in the evaluation of the BRASS index at the time of admission compared to the time of discharge and, therefore, at establishing whether the number of days of hospitalization can affect this assessment. Furthermore, this analysis should be carried out considering sex as a differentiation variable, since the assessments of the impact of BRASS may differ according to the sex of the participants.

Materials and methods

Instrument

A questionnaire was created and administered to the patients admitted in the Internal Medicine ward of the Di Venere Hospital, ASL Bari (South Italy), from June to July 2019.

The data collected included:

- sex: male and female patients;
- age: patients were divided into two groups (younger and older than 75: we considered them as not elderly or elderly, respectively);
- the BRASS index assessment value at the time of hospitalization (T0) and discharge (T1);
- length of hospital stay (days).

For the BRASS index, the literature proposes a score from 0 to 40, where three risk bands are considered: with a score from 0 to 10, *low* includes subjects with low risk of problems after discharge; with a score ranging from 11 to 19, *medium* includes subjects at medium risk of problems related to complex clinical situations that require a discharge planning, but who probably are at no risk of institutionalization; with a score higher than 20, *high* includes patients at high risk of significant problems and requiring a continuity of care, probably in rehabilitation facilities or institutions also.

Participants

For the conduct of the study an authorization was requested and obtained, and the patients' privacy was guaranteed by a completely anonymized collection and processing of data: patients were in fact identified with a progressive number, just for the purpose of presenting the study.

Ethical considerations

Ethical approval was granted by the Ethical Review Board of the Azienda Ospedaliero-Universitaria "Consorziale Policlinico" in Bari, Italy, with ID number 6329.

All patients who took part in the study had provided their informed consent, and the study was conducted in compliance with the ethical principles set forth in the Helsinki declaration.

Data analyses

Data were collected in an Excel spreadsheet, and subsequently statistically processed by means of IBM's statistic SPSS program version 20.

The categorical variables, such as the sex and risk categories of the BRASS assessment, were reported with numbers and percentages, and the chi-square test assessed any differences among the groups; continuous variables – such as: age, the BRASS index at T0 and T1 and the number of days of hospital stay – were instead evaluated with means (μ) and standard deviations (SD), and an independent t-test was performed.

Subsequently, Spearman's correlations were used to relate all the variables to each other, in order to assess which ones were conditioned by sex in the evaluation of the patient's discharge.

Results

A total of 95 patients agreed to participate in this study (Table 1). Of these, 43 (45.26%) were men aged 77.37 ± 9.63 years and 52 (54.74%) were women aged 82.21 ± 7.71 years. There were statistically significant differences in the composition of the sample enrolled, both with regard to sex ($p = 0.007$) and to age ($p = 0.008$). The number of days of hospitalization for males was 13.30 ± 7.12 , while for females was 13.81 ± 6.93 ($p = 0.728$). Considering the BRASS index calculated at the time of admission, there was a statistically significant difference

($p = 0.003$) between men (10.05 ± 6.17) and women (14.54 ± 8.21). The same trend was observed considering the BRASS index at the time of discharge ($p = 0.001$) for males (10.93 ± 7.07) and females (16.37 ± 9.04).

Table 2 shows the frequencies and percentages of the total BRASS index assessed according to the three different categorical class indexes and to sex at T0 and at T1, respectively. At T0, the evaluation of the BRASS index notably shows a statistically significant difference between the three risk classes ($p = 0.001$), considering the two sexes: in fact, out of the total, 53.7% of participants presented a low risk and, of these, 33.7% were men, while the remaining 20% were women. In the medium and high risk categories, however, women were more than men: in fact, there were 17.89% of women for the medium risk and 16.84% for the high risk, compared to 6.31% of men for both the medium and the high risk. The same trend was highlighted in the evaluation of the BRASS index at T1, with a statistically significant difference between men and women ($p = 0.001$), where men recorded higher frequencies in the low risk category (30.53%), while women recorded higher frequencies in the medium (15.79%) and high (22.1%) risk categories versus males (8.42% for medium risk; 6.31% for high risk, respectively).

Furthermore, considering the differences between T0 and T1 for each risk category, it can be noted that, for the medium risk category, there were no statistically significant differences between T0 and T1 ($p = 0.994$), while there were significant differences between T0 and T1 in the high and the low risk categories ($p < 0.001$; $p < 0.001$) with two opposite trends; in fact: the

Table 1. Participants' data collected (n = 95).

Variables		No (%) or means \pm standard deviations	p value
Gender	Female	52 (54.74%)	0.007*
	Male	43 (45.26%)	
Age	Total	80.02 ± 8.92	0.008*
	Female	82.21 ± 7.71	
	Male	77.37 ± 9.63	
Hospitalized days	Female	13.81 ± 6.93	0.728
	Male	13.30 ± 7.12	
BRASS T0	Total	12.51 ± 7.66	0.003*
	Female	14.54 ± 8.21	
	Male	10.05 ± 6.17	
BRASS T1	Total	13.91 ± 8.61	0.001*
	Female	16.37 ± 9.04	
	Male	10.93 ± 7.07	

* $p \leq 0.05$: statically significant.

Table 2. BRASS score classification according to sex of participants.

BRASS index according to sex/ Score Risk classification		High risk (≥ 20)		Medium risk (11-19)		Low risk (0-10)		p value*
		No	%	No	%	No	%	
BRASS T0	Total	16	16.84	23	24.20	51	53.7	
	Female	21	22.10	17	17.89	19	20.0	0.001*
	Male	5	5.26	6	6.31	32	33.7	
BRASS T1	Total	27	28.40	23	24.20	45	47.4	
	Female	21	22.10	15	15.79	16	16.84	0.001*
	Male	6	6.31	8	8.42	29	30.53	
p value*		<0.001*		0.994		0.001*		<0.001*

p value: χ^2 test between females and males, both at T0 and at T1; *p ≤ 0.05 : statically significant.

Table 3. Correlations among sex, age, risk level at T0 and at T1, hospitalization days.

	Sex	Age	BRASS Risk level T0	Hospitalized days	BRASS Risk level T1
Sex	-	0.016*	<0.001**	0.549	<0.001**
Age	0.016*	-	<0.001**	0.005*	<0.001**
BRASS, Risk level T0	<0.001**	<0.001**	-	0.246	<0.001**
Hospitalized days	0.549	0.005**	0.246	-	0.195
BRASS, Risk level T1	<0.001**	<0.001**	<0.001**	0.195	-

*Correlation is significant at the 0.05 level (2-tailed); **correlation is significant at the 0.01 level (2-tailed).

number of women in the high risk category increased at T1 (16.84% at T0 vs 22.1% at T1), while the number of women in the low category risk decreased at T1 (20% at T0 vs 16.84% at T1).

Table 3 shows the correlations obtained considering all the variables included in this study, namely: sex, age, the risk of discharge at T0, the number of days of hospitalization and the risk of discharge at T1.

There were statistically significant correlations between age and sex ($p = 0.016$), between sex and the assessment of the risk index in the assessment both at T0 ($p < 0.001$) and at T1 ($p < 0.001$). Age also significantly correlated with the risk assessment both at T0 ($p < 0.001$) and T1 ($p < 0.001$), and also with the number of days in hospital ($p = 0.005$), while for the sex variable there was no significant correlation with the number of days in hospital ($p = 0.549$). Finally, it can be noted that the correlations between the risk assessments of the BRASS index at T0 and at T1 were statistically significant ($p < 0.001$), and also that the BRASS index both at T0 and at T1 significantly correlated with the variables of age ($p < 0.001$) and sex ($p < 0.001$). This elaboration shows that the days of hospitalization did not significantly correlate with any of the other variables considered ($p > 0.05$), with the exception of age ($p = 0.005$).

Discussion

The present study aims at better analyzing whether there are differences in the evaluation of the BRASS index upon admission compared to upon discharge according to sex and the length of hospitalization in days.

In literature there are numerous studies that report the predictivity – and therefore the usefulness – of the BRASS index in identifying patients who are at increased risk of prolonged hospitalization or in planning future discharges and in placing the nurse at the center of the process, as case managers in this complex context.^{9,11,14} For this reason, it could be considered strategic to generate guidelines within the departments so that the nursing staff can also have a support base for the establishment of the discharge plan, a source that can act as a guidance, because the nurse's job is to take care of the patient, and this task should not be considered concluded with discharge, but should go beyond, where necessary, with the continuity of care.¹⁷ Moreover, other studies suggested that, in order to better estimate the significance of the BRASS index and its predictive utility, it was necessary to consider a more homogenous population.^{18,19}

However, our data disagreed with the current literature,^{15,16} since the BRASS index evaluation, both at T0

and at T1, did not significantly correlate with the number of days of hospitalization, so it did not predict a prolonged or short hospitalization. However, our data shows how an assessment of BRASS upon admission can be a good reference to understand how much improvement in hospital admission there has been in relation to the risk categories, without considering the number of days of hospital stay. In this sense, our study – although conducted on a small sample size – could be considered a pilot within this vision of using the BRASS index in clinical practice not only as a predictive tool, but also as a comparative tool, to better quantify the benefit of hospitalization for the patient.

Moreover, the validity of the BRASS index could be very helpful, if we associate this index with other conditions of the patient, in order to better establish a predictive discharge tool. In our study, the BRASS index alone could not statistically be considered a predictive tool of hospitalization days. Therefore, it could be helpful to be able to provide healthcare professionals with additional information on the BRASS index.²⁰

Furthermore, the study showed that the BRASS index cannot be used as a predictive index of days of hospitalization, although it allows to have an overall picture,²¹⁻²³ which can be useful in order to create an improved, more complete and valid multi-prognostic discharge index, which could constitute a valuable tool for the continuity of care and the activation of personalized paths for each patient, because – through its items – it allows to know the patients, to understand their problems, and therefore to ensure them a personalized continuity of care plan.

On the other hand, few are the studies in the literature that differentiate the BRASS index according to the sex variable, as in our study, or that apply an assessment of the same to the moment of hospitalization also. From the data obtained, it is clear that the BRASS index differs significantly between the two survey times, but also that this difference is not related with the number of days in hospital. Hence, it could be inferred that there are other factors affecting the evaluation of the BRASS index, which in any case are independent of hospitalization. In this direction, both the literature²⁴ and our data suggest the need for further studies, that can better assess the weight of each item included in the evaluation of the BRASS index, such as comorbidity or the multiple drugs intake, so that its predictivity can be assessed considering more homogeneous types of patients.

In addition, our study allows to make another type of consideration regarding the BRASS index. Sure, the index is calculated upon discharge, but a BRASS index assessed also upon admission allows us to understand the level of risk of the patient. Our data shows a reduction in the level of risk at T1, and therefore it can be assumed that hospitalization improved for all patients. Therefore,

an evaluation at T0 could be useful to understand the degree of improvement brought to the patient with hospitalization, regardless of the number of days of hospital stay. Further future studies could be desirable in the evaluation of the discharge indexes that can take into account the variable of sex, given that the data of our study, as well as those present in the literature, emphasize the existence of gender differences also in the evaluation of discharge. In this regard, the female sex proves to be at risk upon hospital discharge, compared to the male sex. This data is in agreement with the literature.

However, we think that this study suffers from several limitations. First of all, the limited sample, due to which the results might be poorly generalizable in other study samples. Nevertheless, this study can be considered a first of its kind since, in addition to the predictivity of the BRASS index on a sample of the reference population, it tried to quantify the existence of any differences based on sex and, at the same time, it tried to compare to the BRASS assessment at T0 and T1, which could better interpret hospitalization as a possibly (or not) ameliorative process with regard to the needs of the patient. In this regard, data show a significant increase in the BRASS index for female patients upon both admission and discharge. However, the sex difference is not evident in the number of days of hospital stay.

In conclusion, the BRASS index is a valid tool to identify patients at risk of a difficult discharge, but it is also a tool that could bring nurses back into the path of the continuity of care, because it allows to have an overall view of the patient and to plan a personalized discharge path for the same, because after all this is what the nurse is required to do: take care of the patient.

Key messages

- The BRASS index is a tool used to identify patients at risk of difficult or prolonged hospitalization. The purpose of the study is to analyze whether there are differences in the evaluation of the BRASS index upon admission and upon discharge with regard to sex and to the length of hospital stay (in days).
- There were statistically significant differences between the sex and the BRASS index risk assessment at T0 ($p < 0.001$) and also at T1 ($p < 0.001$) according to the sex variable, respectively. Correlations were also statistically significant between: sex and age ($p = 0.016$), sex and risk assessment both at T0 ($p < 0.001$) and T1 ($p < 0.001$), age and risk assessment both at T0 ($p < 0.001$) and T1 ($p < 0.001$) and age and days of hospitalization ($p = 0.005$).
- Nursing could play an important role in the BRASS assessment, both at T0 and T1, in order to better refer the patient to the most appropriate nursing setting after hospitalization.

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Informed consent: all patients who took part in the study had provided their informed consent, and the study was conducted in compliance with the ethical principles set forth in the Helsinki declaration.

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