BRASS score and complex discharge: a pilot study

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Summary. *Aims:* A highly functional continuity of patient care, which is linked to the reduction of the risk of long-term hospitalization, above all for 'at-risk' patients. Research into an objective, reliable instrument for redirecting individual results to organizational aims to extend the entire country, is a fundamental step to move from a reactive assistance approach to a pro-active one. *Methods:* An observational and descriptive retrospective study was carried out July - November 2014 in two Italian state hospitals, completing the BRASS Index within 48/72 hours of admission. *Results:* The study group consisted of 122 inpatients. A correlation presented itself, albeit low (ρ=0.05191), between age and the number of 'revolving door' admissions; a medium correlation (ρ=0.485131) between age and risk band (according to BRASS). *Conclusions:* The BRASS Index is straightforward and swift, and can prove a valuable tool in directing nurses' attention to those patients most at risk of prolonged hospitalization. (www.actabiomedica.it)

Key words: BRASS Index, discharge planning, nursing care, continuity of patient care, validation study

Introduction

A highly functional continuity of patient care, which is linked to the reduction of the risk of long-term hospitalization, above all for 'at-risk' patients (1, 2). Over the years, Italy has experienced a reduction of some 48% in available hospital beds (from 542 000 overnight beds to 280 000), state and private, a decrease in the number of days of patient admission of 45% (from 138 million down to 76 million), which inevitably ties into a reduction in the median period of hospital stay (from 12.9 days/patient to 7.7 days/patient) of 41% (3, 4). Due to these factors, therefore, it is difficult for at-risk patients to be discharged only when fully recovered, psychologically and physically, and thus the so-called 'frailty syndrome' manifests. As a matter of fact, the rapid and marked aging of the general population, which has characterized our nation in recent years, has inevitably brought with it an increase in all age-associated maladies. With regard to

the reduction in mortality rates, ISTAT (the Italian National Institute for Statistics) has estimated that, in the next fifty years, we may well reach an average life expectancy of over 90 years (5), since, according to ISTAT's 2011 report; the current levels are 79.4 years for men and 84.5 for women. Physical disability, of a type which impedes the basic activities of everyday life (washing, dressing etc.), is principally due to comorbidity and affects 25% of men and 34% of women over 65, and of the over 80s, 6% of men and 8% of women are entirely incapable of self-sufficiency (6).

Another vital aspect to take into account are the family, who are, down through the years, less and less capable of looking after their own relatives, since the family itself has undergone changes as time goes by. The role of the woman in the modern family has changed markedly; she is no longer someone who can give all her time to the care of the family because, due to both cultural and economic shifts, a large part of her day is generally taken up with paid employment.

Above all, the expectation and manner of children to care for their parents has altered significantly, with the growth of the role of "caregiver", either formal (professional) or informal/primary (close relative, or occasionally distant or even friend). The median age of caregivers is around 55 (range 45-64), corresponding to the spouse and/or daughter who frequently sacrifices their own health to take continuous care of the sufferer. One out of five caregivers handles the burden entirely alone, two out of three split the responsibilities with other relatives and the remaining 17% of families pay for professional assistance (care workers) (7).

Such changes dictate the needs for meeting the challenge of an aging population, which must be fulfilled; medical advancements, however, while improving survival rates, rarely provide a complete cure in the case of previously fatal conditions. In keeping with the NSP (National Sanitar Plan) objectives "... to develop the awareness and monitoring of epidemiology, to guarantee adequate patient management, ensuring the continuity of patient care both within and outside the premises of the hospital, through the concerted integration of the hospital and the community," and the priority of the NPP (Italian National Prevention Plan) 2014-2018 "to strengthen and systematize the attention paid to at-risk groups, to consider both the individual and the population at large in regard to their natural setting, evaluating criteria such as importance, coherence, governance, stewardship and development..." (8) lead to a determination, a drive to research and develop an objective, reliable tool for directing individual results to organizational aims across the whole country.

A health initiative incorporates the cutting-edge version of the Chronic Care Model as its template for operative and organizational primary care, moving away from a linear model in favor of one patient centered (9).

Reviewing the literature, a range of tools for responding to a "complex adaptive system" offer themselves, to sustain the pluripathological patient, always among the most vulnerable, sometimes alone, often critical and with an increased susceptibility to iatrogenic injury and complications (10-12). Therefore, the distinct options are:

• The Flugelman index (13-15)

• The Brief Risk for Identification Geriatric Health Tool (BRIGHT) (16)
• The Problem After Discharge Questionnaire (PADQ)
• The Nurses Improving Care for Health System Elders (NICHE) (17).

However, it is the Blaylock Risk Assessment Screening Score (BRASS) Index which demonstrates by its coverage of three fundamental principles its overall utility and applicability:

• *Multi-dimensional:* the outcomes are measured by a range of parameters, both clinico-functional and psycho-social.
• *Multi-axial:* the outcomes are measured from differing points of view, spanning the subjects involved in the care process (patients, doctors, nurses, physiotherapists, social workers, caregivers).
• *Longitudinal:* the outcomes should be measured using repeated measurements across a protracted period of time.

The research hypothesis for which confirmation is sought is as follows: can the hospital system, by means of an operative instrument, avoid unplanned re-admissions? The reliability of such results would allow for the assumption of specific indicators of synthesis to be introduced into the existing regional flows.

Objectives and scale

Employing available evidence, to investigate if the introduction of the BRASS Index, into existing operational systems, can continue to prove a viable tool for: preventatively determining those patients at risk of prolonged hospitalization (18-20), in order to reduce their stay in hospital and the attendant costs and consequences (a "short stay" patient runs less risk of secondary illness or accident during hospitalization – conditions such as bed sores, delirium, accidental falls, physical strains, all of which complicate the physician's work and add to the cost) and thereby reduce the rate of re-admission to A&E units or the risk of short-term relapse.

From a clinical PoV, release represents the conclusion of the acute phase of the illness and the con-

sequent transition of patient health care management from one assistance level to another. Traditionally, this process entails the movement of the patient from the hospital to their home, but in practice, in the current environment, there can be a variety of manners of release: from one structure to another, or even, within a single structure when the patient is transferred to a different operating unit (21-23). Release is, therefore, a process rather than an isolated event, which needs to be planned from the earliest possible point, at the level of initial care and hospitalization, creating conditions in which the patients and their families are in a position to contribute meaningfully to the requisite decisions, in the case of an acute event, attendant upon permanent or temporary disability, and the concomitant familial and personal adjustments (24, 25).

Ethics

The relevant ethical approval was sought and given.

Methods & instruments

BRASS was developed as part of a system of planning for total (non-relapsing) discharge, above all for patients over the age of 65 (26, 27). Administered as part of patient hospital admission, it facilitates the identification of those at risk of prolonged hospitalization and/or a complicated discharge procedure (28, 29).

The authors Blaylock and Cason (1992) identified the following factors: age, functional status, cognitive status, social support and living conditions, number of previous hospitalizations/emergency room visits, number of active clinical problems, behavioral model, mobility, sensory deficits, number of medications. According to Brass score, three risk classes are identified:

- *low risk* (score from 0 to 10): subjects that do not require special efforts for the organization of their resignation, disability is very limited;

- *medium risk* (score 11 to 19): patients with problems related to complex clinical situations that require discharge planning, but probably no risk of institutionalization;

- *high risk* (score greater than or equal to 20): subjects who reported problems and require a continuity of care, probably, in rehabilitation facilities or institutions.

A retrospective, descriptive, observational study was undertaken in two National Health Service hospital, compiled from BRASS analyses completed within 48/72 hours of admission.

The first test period covered July – September 2014, and concerned 122 randomly selected patients from the internal medical ward, recuperating on hospital grounds at that time, and 50 patients from September to November 2014 in the cardio-surgical ward from among the patients who underwent a surgical procedure, and attributing to them a score derived from a comparison of their admission data on entering the ward (T0) with the discharge data from the intensive therapy section (T1). The size of the sample took into account the scope of the study and the overall research plan, as well as the analysis of the specific data sought.

The data was collated using Microsoft Excel 2010 and processed by means of an Epi Info TM7 statistical calculation spreadsheet. The administrative instrument, composed of nine items, was compiled by the nursing personnel for each new admission, and codified by their responses using a Likert type scale.

Results & statistical analyses

The sample taken from the medical area is made up of 122 patients (38% male, 62% female) of whom 99 patients (81.1% of the total) were evaluated on the BRASS Index within hours of their admission onto the ward. Of this latter group, 43.3% of those with a BRASS evaluation were indicated to be suitable for post-operative care (POC). Of the non-assessed patients, 62.5% were nevertheless deemed to be at risk of a complicated discharge process, albeit with only a single clinical criterion, primarily medical, to that assessment.

Analyzing the sample overall, there is a median patient age of 80.25 years (SD±12.97) with a confidence interval (CI) of 95% equal to 2.3, a mode value of 93 years, a median of 85 years with a range from 34

years to 97 years; average stay of 8.17 days (SD±4.27) with a CI 95% equal to 0.76, a mode value of 6 days with a median of 8 days, total range being 2 to 26 days. Of 122 patients, 35 were re-admitted at least once into the A&E department (28.7% of the total), of whom 48.6% were experiencing the selfsame condition which caused their original admission. Of this 48.6% revolving door group, 35.3% were, according to their BRASS score, at medium risk of full discharge. Obviously, this segment of the sample excludes those re-admitted for previously scheduled activities, for example, bronchoscopy. Recalculating the average stay with weighting for 'revolving door', we come to a median stay of 10.73 days (SD ±6.98) with a CI 95% equal to 1.25 (Fig. 1).

For those who are re-admitted, the time between admissions is as follows (Fig. 2):

- 11.43% were re-admitted within 7 days of their original discharge
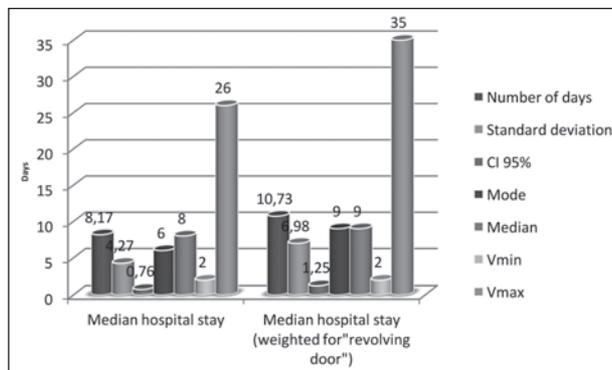- 28.6% were re-admitted 8 to 15 days after their original discharge
- 11.43% were re-admitted 16 to 30 days after their original discharge
- 28.6% were re-admitted more than 30 days after their original discharge
- the remaining 20% were re-admitted more than 60 days after their original discharge
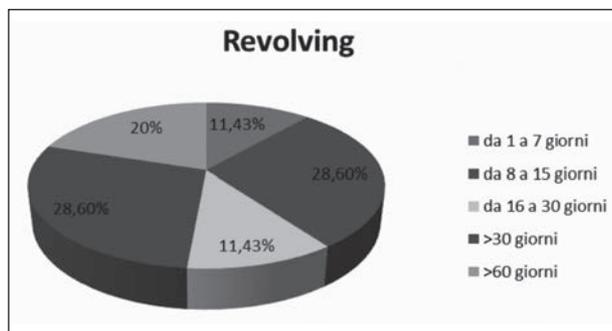
However, of all 122 patients in total, 32% of their re-admissions were for the same conditions as the original hospital stay, since they did not follow a recuperation regime, the patient being sent home or to another part of the hospital (in all probability due to a shortage of available beds). Of these 32% of the sample, the 41% present the same diagnostic cause for re-admission into the A&E departement as the original discharge from the in-patient ward; 38.5% of these were, according to their BRASS Index score, low risk for prolonged hospitalization, with 25.6% being medium risk. The other patient who required a second hospitalization for a different disease from first hospital stay were re-admitted for cardiac or gastrointestinal disease, or complication from accidental fall: age related events but not connected with the reason of the previous admission at hospital.

The 99 BRASS score assessed patients were subdivided into three categories based on score-predicted risk, as detailed below (Table 1):

- 28.3% high risk: median age 85.54 years (SD±7.06) with a median stay of 7.54 days (SD±3.47) (of the 28 high risk patients, 5 had at least one earlier re-admission, of whom 3 were in a monitored discharge regime);
- 29.3% medium risk: median age 81.69 years (SD±12.42) with a median stay of 9.07 days (SD±5.48) (of the 29 high risk patients, 13 had at least one earlier re-admission, of whom 8 were in a monitored discharge regime);
- 42.4% low risk: median age 73.05 years (SD±14.73) with a median stay of 7.83 days (SD±4.37) (of the 42 high risk patients, 10 had at least one earlier re-admission, of whom 4 were in a monitored discharge regime).

Based on this data, employing a Pearson (Rho) correlation, it emerges that: there is a correlation, albeit low ($\rho=0.05191$), between age and the 'revolving door' re-admission; a medium correlation ($\rho=0.485131$) between age and the BRASS score assessed risk band;

Figure 1. Median and weighted median values for number of days stay (hospitalization)

Figure 2. "Revolving door" distance from original admission

Table 1. BRASS score stratification and characteristics of the sample

BRASS score	Total N° (%)	Median Age ±SD	Median Stay ±SD	Revolving door N° (%)	POC N° (%)
≥ 20	28 (28,3%)	85,54±7,06	7,54±3,47	5 (17,8%)	3 (60%)
11-19	29 (29,3%)	81,69±12,42	9,07±5,48	13 (44,8%)	8 (61,5%)
0-10	42 (42,4%)	73,05±14,73	7,83±4,37	10 (23,8%)	4 (40%)

a very low correlation ρ=0.009) between the BRASS score assessed risk band and the number of days of hospital stay; a very slight inverse correlation between age and the number of days of hospital stay (ρ=-0.0577) (Fig. 3).

Notwithstanding the fact that, based on currently available data, there may be a correlation between the BRASS score, post-operative care and the 'revolving door', the statistical analysis does not appear to confirm such a contention. Indeed, laying the contingency tables out in a 2x2 grid, and calculating Relative Risk (RR), Attributable Risk (AR), Account Attributable Risk (AAR), Chi test, sensitivity (S), specificity (Sp), positive predicted value (pv+) and negative predicted value (pv-), efficacy (Eff) and test bias (tb), the results are not favorable. Specifically, the correlation of BRASS and 'revolving door' gives an RR=0.98 and, since this is very close to 1, which indicates an absence of correlation between the selected variables, sensitivity is a mere 28%, with a specificity of 70%. χ^2 being far below 5 (=0.042) combined with a p value above 5% (p=0.8371) indicates that the data does not provide significant statistics (CI 95% 0.81-1.19). Correlating BRASS score and post-operative care, we obtain an RR of 0.84, with p and χ^2 values which are statistically non-significant in this case also (CI 95% 0.71-1.01), sensitivity and specificity are almost interchangeable, and in both cases vastly less than 1.

Calculating the RR between post-operative care and 'revolving door' these appear to be linked, in that RR=1.3 (>1), but both the Chi2 test (=1.814) and the p value (0.1780) seem to indicate that this data should not be considered statistically significant. Much the same can be said in regard to the final proven correlation between the link connecting those who began post-operative care with a BRASS score indicating medium risk and the entire 'revolving door' group (RR>1 but χ^2 <5 and p value>5%) (Table 2).

The most complex patient management and evaluation in post-operative care would seem to be those patients at medium risk rather than those at high risk, according to their BRASS scores, in that they (medium risk) make up the majority of 'revolving door' cases, either with the same diagnosis as during their stay or for other causes, and most of them are re-admitted through the A&E department (based on the re-admissions through the same hospital's departments which were recorded on film from July 1 to December 4, 2014).

It should be emphasized, therefore, that the same patients who were the subjects of the research, in most cases, were admitted at least once within 2014 to the same hospital, prior to the period being studied, in other words between January 1 and June 30, 2014.

In the surgical period in question, with a study group of 50 patients, there were 120 admissions, a median hospital stay of 39.43 days (SD±11); the median age of the study group was 65.9 years (SD±16); the median BRASS and T1 scores were 15 (SD±9). There were 17 unplanned readmissions, of which 9 had high risk BRASS scores for T0 and 8 low/medium. Upon readmission, of these 17, 16 had high risk BRASS scores in T1. This demonstrates the increased BRASS score attendant upon cardio-surgical intervention, wherein the score moves from medium to high risk, indicating a need for change in the clinical aspects of the process and the treatment of patients. Furthermore, even the relative risk (RR) in both results is in excess of 1 (RR in T0=4.5 cf. RR in T1=15.53), and therefore all patients with an elevated BRASS score are exposed to serious risk of requiring further intensive care unit.

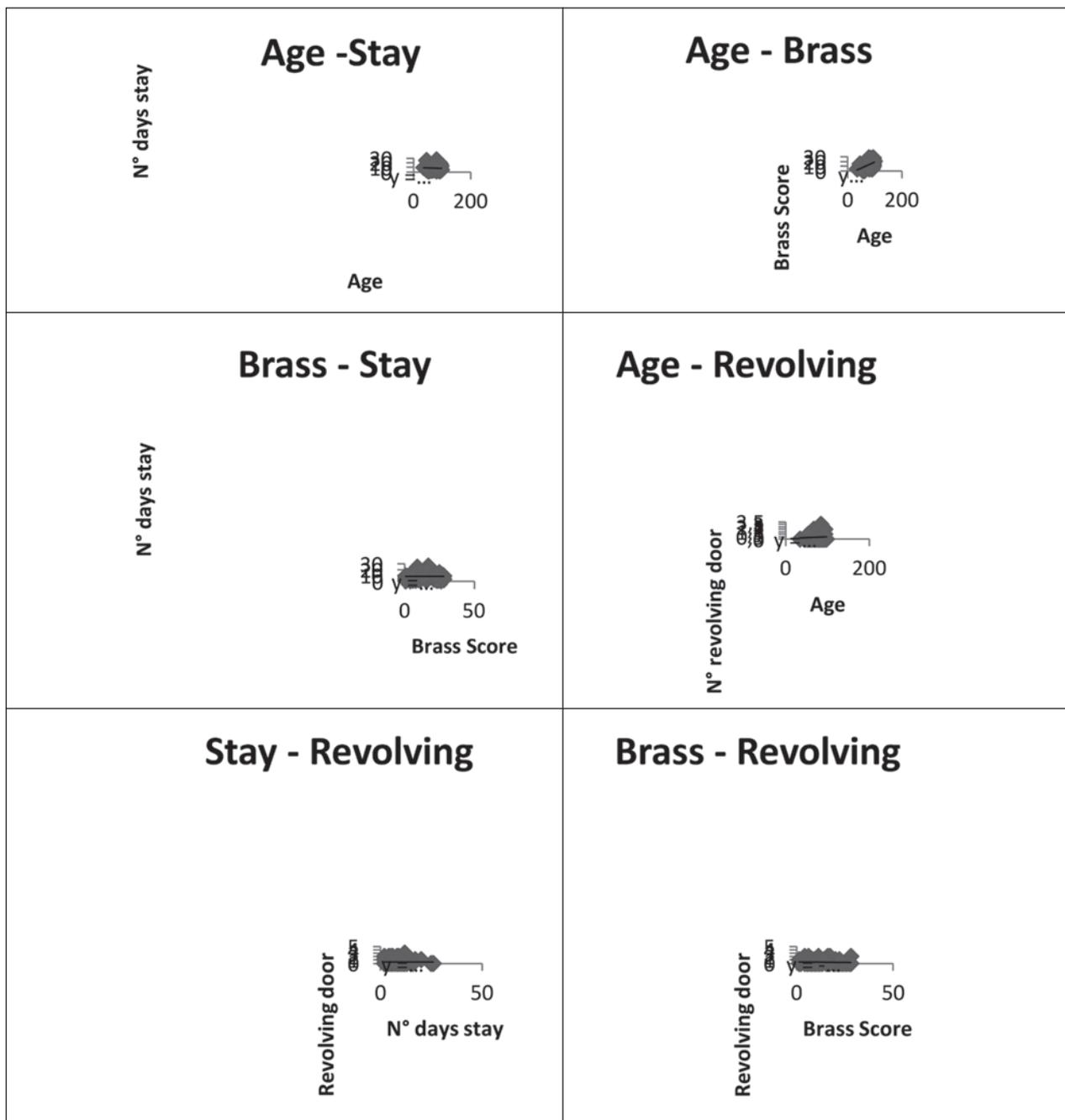Calculating the AR (Attributable Risk), which is to say those risk factors identified in examination

Figure 3. Pearson correlations in the medical area

for re-admitted patients which, if entirely eliminated, could remove the need for said re-admission, it shows, in both periods, that the patients have an elevated score both in T0 (AR=0.7 i.e. 70%) and in T1 (AR=0.88 i.e. 88%). The Pearson correlation indicates that a correlation exists between the median age of the study group

and the re-admission rate (0.3487) of moderate significance; a weak, but direct correlation (ρ=0.2829) between the type of operation and patient readmission; a clear and direct correlation (ρ=0.5726) between the number of days stay and readmission into intensive therapy, of medium significance. In summary, evaluat-

Table 2. Correlations and significant statistics

Correlation	RR	χ^2	p value	CI 95%	Vp+	Vp-	S	Sp	Eff	Tb
Brass/Revolving door	0,98	0,042	0,837 1	0,81 1,19	0,8	0,18	0,28	0,7	0,36	0,3
Brass/POC	0,84	3,551	0,059 5	0,71 1,01	0,74	0,12 5	0,43	0,35	0,42	0,58
POC/Revolving door	1,3	1,814	0,178 0	0,90 1,90	0,57	0,56	0,34	0,77	0,57	0,60
POC+Brass M/Revolving door	1,41	0,909	0,340 4	0,70 2,84	0,62	0,56	0,53	0,64	0,59	0,87

ing the BRASS and T1 scores for patients against readmissions, a significant statistic emerges (ρ=0.7076).

To address the matter of readmissions, other correlations need to be studied. One example is the correlation between the cardiac surgical interventions and unplanned readmissions (ρ=0.2929), in which the value emerges between 0 and 0.3, a weak but positive significance: the readmissions are predicated not on type of operation, but rather on factors intrinsic to the patient themselves, i.e. the number of comorbidities present. The correlation between the Age/Readmission variables is direct and positive with a moderate significance (ρ=0.3487), and we cannot deduce that age is not "the one, sole variable" in determining so-called "at-risk patients" and, consequently, unplanned readmissions, since the BRASS score is implemented in a specific context, one which seeks to eliminate certain causes for the readmission of patients. Rather, there exists a moderate significance, positive relation between the length of hospitalization and readmissions, and clearly the longer the stay, the greater the risk of a patient being exposed to an infection within the hospital, putting the discharge of said patient at risk (ρ=0.5726). Of particular interest is the correlation illustrated in this final dispersion graphic, which provides evidence of a powerful correlation between an elevated T1 score and readmissions, with a result of ρ=0.7076. Putting in place a validated operational tool like the BRASS score, we can reduce unplanned readmissions, guaranteeing continuity of patient care, and reducing both health and economic costs (Fig. 4).

Finally, only 10% of medical are patients studied died. The most fragile patients were placed in dedicate

routes in outpatients settings such as path for heart failure and followed in outpatient controls of follow up to prevent further admissions. No patient died after cardiac surgery and continues to be monitored on an outpatient basis. It is so difficult to estimate the percentage of people who may be re-admitted at hospital in other A&E departement being vast the territory investigated, but all surgery patient are followed postoperatively and the folders don't show furter readmission after discharge. Only 8 patients underwent the cardiac urgery of emergency state and access from A&E departement, of wich, only 2 not belonging to corripected catchment area.

Limits of the study

Although the most accurate study possible in the circumstances was conducted, it must be acknowledged that it took place over a limited period of time and involved a sample of only 122 patients in total, and but 50 of those were cardio-surgical. Furthermore, the data results are less than comprehensive in that: the occupancy rate of beds in the post-operative care structures was not assessed, nor were the above-mentioned "precautionary stays" taken into account, the BRASS scores are not assessed in regard to discharges from the hospital nor in the matter of follow up.

Discussion

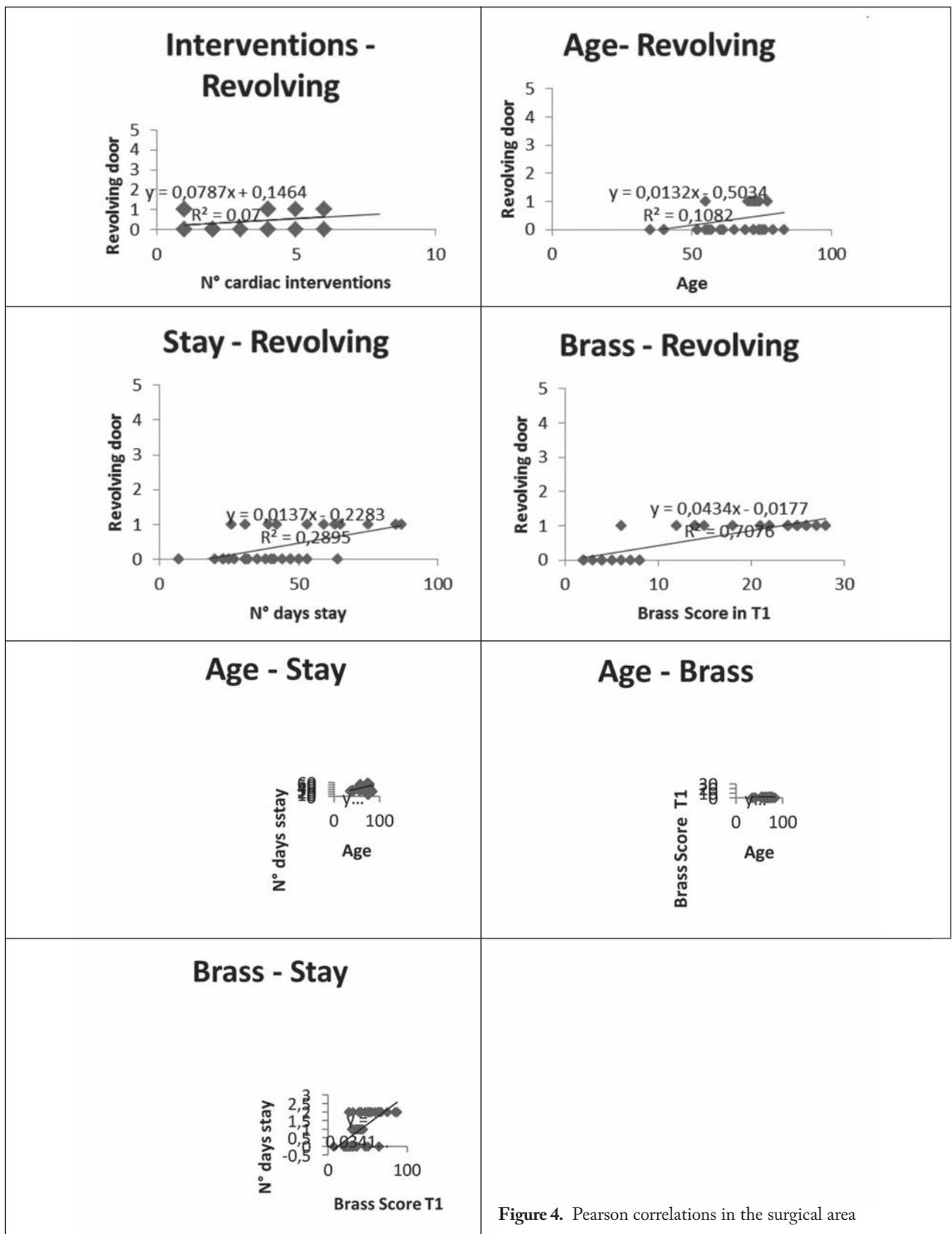The starting hypotheses cannot, from a medical standpoint, be considered entirely validated: those pa-

Figure 4. Pearson correlations in the surgical area

tients, for example, with a BRASS score indicating low risk were, conversely, a higher and disproportionate percentage of readmissions; it cannot be said that high risk patients are those who are most frequently readmitted, setting aside their often complicated original discharge process, even if they are, those assessed as medium risk remain a latent possibility of such. It can be seen that there is no direct, causal correlation between BRASS and 'revolving door' (the shorter the interval between admissions, the more it must be allowed that the discharge may not have been suitable, setting aside the matter of post-operative care undertaken).

The BRASS score can aid in the categorization of patients, sending up specific red flags ahead of the actual discharge, warning of probable complications. Clearly, this cannot be a stand-alone tool for addressing the entire range of pre-set goals laid out in the examination process, it would function in unison with the output from other instruments to cover a variety of parameters and provide a broader view of the situation, with factors suitably weighted, as was the case with the research of Mistiaen et al.. This does not preclude the possibility that, given the structuring of the BRASS Index, suitable application may be found in other contexts too, as the di Cunic et al. and Dal Molin et al. studies show, and the surgical context should be considered (30). The results highlight the need for operative indicators, and finally to report on hospitalization stays with the same pathology and a consistent level of effective care (31).

Therefore, the operative tool in question may be employed in a cardio-surgical ward and/or in intensive therapy, given that the majority of the patients are over 65 and, according to the scientific evidence, are senior patients at risk of readmission, which may be prepared and planned at the time of discharge. With a standard deviation of ± 16, the test group is representative of the aforementioned motivations, however other, younger patients can be found who belong to a different, less rigid category, linked to the specific context under observation; which, irrespective of cutting-edge technology, is always a case requiring a higher and more complex level of care. Indeed, the cardio-surgical patient has a high score for discharge from intensive therapy (T1) and unplanned readmissions are, generally speak-

ing, among patients with a high BRASS score, considering that such a score is augmented by admission into the cardio ward after being in the critical care unit. The research shows, above all, that not all senior patients in the wake of an acute surgical procedure require a monitored discharge, but, at the same time, without an instrument which can ascertain at the point of admission those subjects who would not benefit from such, the risk remains of underestimating the need for continued care (32, 33). Furthermore, the data obtained has confirmed that physical and/or cognitive dysfunction prior to the hospitalization, as well as being associated with a negative outcome for the procedure, are indicators in senior patients of a requirement for planned enhanced care and support and likewise of an extended stay, placement in some form of nursing home, frequent readmission and increased numbers of deaths and fiscal costs (34, 35).

Conclusions

The concept of continuity of patient care cannot overlook the evaluation of the quality/efficacy relationship in the field of cost management and reducing the costs of misunderstandings such as 'fixing the problem', without losing sight of the available time and resource limitations (34-36). The priority is to keep the ultimate objective in mind – to spread health through the services which enhance the patient's quality of life (37, 38).

The interaction of the hospital and the community represents one of the mainstays of appropriate patient management, an indispensable element in reducing patient (and carer) discomfort, bringing down the number of readmissions and enabling the quick and disseminated identification of those services which will facilitate treatment and recovery (39, 40).

Best clinical practice has, among its objectives, the extended implementation of the use of a minimal, single scale set for assessing patient care, covering all points on the network: internal (hospital), hospital-communal, communal (41). Users, above all those most at risk and their families, ask now, more than ever, for a sympathetic ear for their suffering, and the acknowledgment that, even where a cure is impossible,

assistance can be rendered, even if that is 'only' being on hand (42, 43). There may also be social reasons for a delayed discharge: the patient might not have accommodation suitable to their revised needs, regional services may be unable to be engaged or in specific locations there could be a communication breakdown between the hospital and the community (44). It is estimated that some 30% of discharges are delayed for non-clinical reasons (45).

The BRASS Index is straightforward and swift, can be compiled within 48 hours of admission (20), and can prove a valuable tool in directing nurses' attention to those patients most at risk of prolonged hospitalization, although not for the correct identification of those who will require readmitting, either directly or through the A&E department (46), the assessment differing between the need for hospital admission and surgical ward admission. The BRASS Index has been shown to be a useful tool also in regard to occupational therapy (47), although some fine tuning is called for. It looks at the patient from the standpoint of analyzing their functional abilities and support network, as well as their mental state and clinical care situation.

If, on the one hand, a significant reduction in available resources is observed, rendering them unequivocally inadequate to meet rising needs and costs all around, on the other it is vital that, throughout society, the socio-medical system has the structure in place for meaningful dialogue, with certain precepts in place: the categorization of a person's true needs by means of effective analysis employing standardized, rigorous and reproducible tools; the opportunity to create a network encompassing all sectors and institutions involved, as interdependent cogs of a greater whole (31).

Planned discharges heighten the profile of both therapy and patient satisfaction, along with that of the family and health care operatives; such discharges improve the perceived quality of health service and reinforce the sense of teamwork. The discharge plans, already in place from day three, improve the chances of a successful return home and shorten the period of hospitalization (48, 49).

The duration of the stay is directly related to patient needs, which can reduce the probability of a recurrent hospitalization in short order (frequent readmission) and cut the odds of consequent complications

(50, 51, 52). Furthermore, this enhances the capacity for teamwork and mutual recognition of difficulties and nature of each member's contribution to the team and its work (50).

The classification of waste in these sectors shows both overloaded and underutilized services and the shortfall in care coordination among the various care environments and the resultant limited sharing of relevant scientific data to inform both medical and management decisions; all of which leads to informational asymmetry, inequality and waste; in short, systemic inefficiency (53).

Therefore, sustainability should aim to improve knowledge generation, knowledge management and knowledge translation in the health care field.

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