Inpatient disposition in overcrowded hospitals: is it safe and effective to use reverse triage and readmission screening tools for appropriate discharge? An observational prospective study of an Italian II level hospital

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Inpatient disposition in overcrowded hospitals: is it safe and effective to use Reverse Triage and readmission screening tools for appropriate discharge? An observational prospective study of an Italian II level hospital.

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Abstract

Background

Reverse triage (RT) identifies patients eligible for discharge and have been proposed to cope with daily surge. Nevertheless, early discharge could increase the rate of readmission.

Our aim is to test the effectiveness and safety of RT alone and with readmission screening tools (Identification Senior At Risk (ISAR), Hospital and Groeningen Frailty Index (GFI) scores) to predict appropriate discharge.

Material and methods

We prospectively assessed every 4 days (t_0) inpatients of medical divisions (High Dependency Unit (HDU), Internal Medicine (IM) and Geriatrics (Ger)) of an Italian Hospital. RT score was calculated for each patient and an RT ≤3 identified those eligible for safe discharge. ISAR, HOSPITAL and GFI were then applied. We assessed reinstituting of interventions and transferring to an increased level of care unit at 4 days as an ethical proxy of consequential medical events following hypothetical discharge. Date of effective discharge, death and readmission were measured at 4, 7, 15 and 30 days after the first evaluation.

Results

Twenty-five (9.6%) patients out of 260 in our sample had an RT≤ 3. Twenty-four (96%) of them compared to 205 (87%) of the RT>3 group (*p= NS*) were discharged. Patients with RT≤ 3 were discharged significantly earlier (3.5 versus 8 days after t_0 (*p=0.0002*)). In the RT≤ 3 group, all but one patient were alive and healthy at 7,15 and 30 days. The HOSPITAL score seemed to have the best concordance with RT (84%), in comparison with the ISAR (52%) and the GFI (48%) scores. RT showed a low sensitivity (22%) and high specificity (95%), which was even higher when using RT associated with readmission screening tools.

Conclusions

RT proved to be a safe and conservative tool, with high specificity alone and with readmission screening tools. RT correctly identifies patients that will be discharged earlier.

'What is already known about this topic?'

Reverse triage (RT) was validated during disaster simulations to identify inpatients that don't need in-hospital resources and could be safely discharged. RT have been proposed to cope with daily surge. Nevertheless early discharge could increase rates of readmission, which represent an added burden on an already strained system. Several screening tools have been proposed to predict readmission risk (Identification Senior At Risk (ISAR), Hospital and Groeningen Frailty Index (GFI) scores).

'What does this article add?'

RT with a cut off ≤ 3 is used for the first time in non-disaster setting and proved to be a safe and conservative tool with low rate of adverse events. RT identifies only a small percentage of inpatients as eligible for discharge but has a high specificity for early discharge (≤4 days from assessment). The use of RT in combination with readmission screening tools further increased its specificity.

Text

Introduction

Hospital overcrowding is nowadays a perennial problem in developed countries and a source of troubles for hospital administrators and clinicians.[1]

Access block, defined as the inability to access inpatient beds, is the main cause of overcrowding in emergency departments (ED); it hampers the delivery of good health care, results in ambulance diversion and impaired responsiveness by the emergency department, increases length of stay and health care costs and increases the incidence of adverse events.[2-4]

Reverse triage (RT) has been created by Kelen et al[5-6] to increase hospital surge capacity in case of disasters[5-9]. It consists in a method for adult and paediatric inpatient disposition, based on a risk assessment of consequential medical events (CME) in the 72 h after discharge (e.g. unexpected death, irreversible impairment, or functional reduction), that would have required an adequate in-hospital intervention.[5-7] The classification system includes 5 categories expressing the CME risk as increasing percentage (class 1 CME risk <4% - class 5 CME risk > 90%).[5]

While in disaster setting a risk of CME of 12% (class 2) could be tolerated [6-10], RT has been proposed to cope with daily surge with a lower cut -off (<4% risk of CME – class 1), as it gives priority to ED patients with urgent needs over inpatients who can be discharged with little to no health risks.[10-14]

Nevertheless, while it is well known that appropriate discharge of inpatients could decrease the delay to admission and reduce ED crowding and related adverse events, no universal consensus about safe early discharge criteria exists. The decision whether or not a hospitalized patient is appropriate for discharge requires evaluation of multiple factors involving medical, as well as psychosocial, logistic, and economic considerations. Discharge planning should involve the clinical staff and patient/family caregivers to develop a patient-centered plan: this process should include the evaluation of medical necessities and the evaluation of the environment that could provide care after discharge.[15]

In parallel with efforts to decrease the length of stay for hospitalized patients over the past two decades, a reasonable concern has been raised that early discharge, if premature, could increase adverse events after discharge and rates of readmission, both signs of poor quality hospital care and a further burden on an already stretched system.[15-16] Premature discharge and inadequate post-discharge support could increase ‘bounce-back’ patients or the so-called “revolving door phenomenon” but there is not strong available evidence to suggest that earlier discharge is associated with readmission[17-18].

Appropriately, the ED serves as a safety net to these patients to ensure that they receive proper care: readmission can account from 3% to 47% of total ED visits in different studies[16]. However, bounce-back patients require resources of an already strained set withdrawn from patients presenting for acute care. In an era characterized by the global ageing of the in-hospital population and by a healthcare system worried with cost reduction, hospital readmission after discharge is an important clinical and health policy issue[15].

Previous studies showed that multiple factors have been associated with risk of readmission (medical co-morbidities, demographic, physiological and laboratory data, socio-economics, functional status and prior use of health care) [16-21]. Many models and screening tools for increased risk have been proposed to help in this issue, most of them have been created and widely applied in geriatric patients[19-21] and validated for the screening of readmission risk (defined as new access to health care system 15 or 30 days after discharge).

The Identification of Seniors at Risk (ISAR) is a brief self-reporting questionnaire developed to identify older persons (65 years of age and above) at risk for mortality, functional decline, readmission and institutionalization[22], widely used and internationally validated[19-22].

The HOSPITAL score is another model specifically developed to identify avoidable readmissions at 30 days. It considers 7 weighted variables derived by anamnestic, clinical and administrative parameters that have been associated with potentially preventable 30-day readmissions in derivation and validation studies[23].

Different clinical aspects were described in previous studies as good predictors of readmission. Adverse drug reactions are the main cause of up to a fourth of hospital admissions[16-18] and are ranked as the fourth to sixth leading cause of death in the USA[24], thus the use of more than 5 medications by itself was shown to correlate with readmission.

Frailty is considered to be a state of decreased physiological reserves, arising from cumulative deficiencies in several physiological systems and resulting in an impaired resistance to stressors[25]. As yet, there is no consensus on the definition and measurement of frailty: Groningen Frailty Index (GFI) was previously used to screen for risk of readmission and for the need of post-discharge support in the elderly population[25-26].

Several systems initiatives have shown promise in minimizing readmissions. These interventions include improved collaboration between the care team, patient, and aftercare provider prior to discharge; medication reconciliation; enhanced patient education and empowerment; home visits or telephone calls by clinical providers; remote monitoring; transitional care managers and early post-discharge follow-up.[16,18, 26] But in the “real world” health care professionals are often dealing with budget reduction, underperforming systems or lack of resources on one hand and fear of potential legal litigation on the other one.

To our knowledge, while the above-described tools are widely studied and used in different settings (eg. for the prognostic stratification of surgical patients or cancer patients or to screen older patients in the ED or general ward for further geriatric evaluation and support), there is not a universally validated algorithm to guide the clinician in the decision-making process of appropriate discharge.

The aim of the present study is to evaluate the use of RT in inpatient of an internal medicine ward, a geriatric ward and a high dependency unit to predict appropriate discharge. A secondary aim is to test the safety of RT, alone and in association with predictors of readmission, in detecting patients at low risk of adverse events (death, clinical deterioration with transfer to a higher level of care, bounce-back).

Materials and methods

All adult patients admitted in the High Dependency Unit (HDU), Geriatrics (Ger) and Internal Medicine (IM) wards in a middle size (350 beds) suburban teaching hospital in Orbassano (Torino) were prospectively sampled and surveyed. From 16 October 2017 to February 2018 we canvassed every 4 days (t_0) the inpatients of the above-mentioned divisions. We excluded from the study patients admitted or discharged the day of the t_0 and patients who didn’t want to participate in the study or were not able to give informed consent.

If the patient accepted to be included and signed the informed consent, the chart was examined by the investigator to collect the demographic and clinical data and to calculate the scores described above (RT, ISAR, Hospital, GFI).

The investigator was blind about inpatient disposition; clinical decisions (procedures and disposition) were left to the ward’s physicians not aware of the results of the scores. Four days later (t_4) we surveyed again the population, enrolling new patients and following the ones that were already in the study.

The following data were obtained from chart review: basic demographic information, arrival date, enrolment date (t_0) and discharge date, inpatient unit type and the source of admission (non-elective vs elective and transfer from another division or another hospital).

RT score

RT score includes a list of 28 critical interventions, defined and weighted on a scale of 1 to 10, based on the risk of a consequential medical event (CME) after withdrawal [5]. The CME is defined as unexpected death, impairment, or reduction in function for which a critical intervention would be initiated [5]. In our study at t_0 we examined the patients' chart for the critical interventions applied in the last 24 h; when more than one critical intervention was present, we considered the higher weighted to define the RT score (range 3 - 10).

The classification system defines 5 categories:

1) <4% risk of CME: patients eligible for discharge, without the need for community health care.
2) patients who should be transferred to a low acuity ward or community health care instead of remaining in their current location (< 12% risk).
3) patients who should be transferred to another medical facility with moderate capabilities, as a CME is likely to occur (33%) if critical intervention is delayed.
4) patients who are likely to need continued highly skilled care and acute-hospital resources (61% risk).
5) patients who cannot be transported because they are too unstable (92.3% risk)[5-6]

When the patient was classified in category 1 according to the previously described risk tolerance (RT≤3) we considered that the patient could potentially be discharged.
In this subgroup, we applied the following instruments to screen for bounce-back risk

Instruments for readmission screening:

ISAR

The ISAR consists of six assessment items: the availability of help at home, increased dependency, history of hospital admissions, visual problems, memory problems, and polypharmacy (associated use of more than 3 drugs). Response to these items is dichotomous and a patient has to be considered at risk if the answers to two or more questions are positive [22].

HOSPITAL

The HOSPITAL score is calculated assigning 1 to 5 points for the following 7 variables: at discharge Hemoglobin <12 g/dL, discharge from the Oncology service, Sodium <135 mEq/L; having a Procedure or complex imaging during the hospital stay; Index admission Type: non-elective, number of hospital Admissions in the previous year, and Length of stay ≥5 days. The final score is the sum of the variables points and its range is 0-13. A score ≤4 is considered at low risk for readmission[23].

GFI

Groningen frailty Index (GFI) is a 15 item screening instrument to determine the level of frailty available in a professional and self-report version. It measures the loss of functions in physical domain (mobility, fatigue, vision, hearing, multiple health problems), social domain (emotional isolation) and psychological domain (depression and anxiety) as well as cognitive dysfunction. Answers are dichotomous and a score of 1 indicates a problem of dependency. The range is from 1 to 15. Geriatric experts agreed that a score of 4 or more represents moderate frailty.[25]

Finally, the number of drugs prescribed was registered[24].

Follow up and outcomes:

As it is unethical for research purposes to influence discharge decisions or withdrawal of interventions, we left any clinical decision to the physician in charge. We used CME, restart of critical intervention or transfer to a higher level of care at t_4 and t_7 as an ethical proxy to test the safety of the RT in the short term.

Selected patients with RT ≤ 3, considered eligible for discharge, were followed at 4 days (t_4), then one week (t_7), 15 and 30 days after the inclusion in the study (t_0) to assess the following outcomes:

- discharge date and type of post discharge-care
- CME with the initiation of a critical intervention as described in RT [5]
- transfer of the patient in HDU from IM and Ger or transfer in the Intensive Care Unit
- readmission in any Emergency Department or in any hospital ≤7 days after discharge ("revolving door" effect) [16]
- readmission to any Emergency Department or in any hospital 15-30 days after discharge [17]
- death

Outcomes at 7, 15 and 30 days were assessed by searching our hospital electronic records and by performing phone calls (to obtain informations about readmissions in other institutions) if the patient was already discharged.

For further investigation of RT safety with regards to readmissions, the long term outcomes were assessed by searching the hospital database at 60 days and 180 days from t_0 for the following outcomes:

- new ED visit followed by discharge / admission / death in the ED
  - new admission followed by discharge / death

The institutional review board approved the study. Data were collected, registered and analysed anonymously.

Data were described using means and standard deviations for quantitative continuous variables, median and interquartile range (IQR) for discrete variables. Absolute frequencies and percentages were used to describe qualitative categorical variables. Based on the not normal distribution of the data assessed by Shapiro Wilk test, comparisons were made by Mann-Whitney, Kruskall - Wallis or Anova test for continuous variables and for categorical variables by Chi Square test or Fisher exact test when the hypotheses for conducting a Chi-square test were not satisfied. Finally, sensitivity (Se), specificity (Sp), positive (PPV) and negative predictive value (NPV) and positive likelihood ratio (LR+) for early discharge (defined as discharge ≤4 days from the t_0) were calculated for RT alone and associated with the readmission screening scores. All tests were two-sided and a p-value of 0.05 was considered significant. Analyses were performed using SAS V9.2 and R version 3.4.2[27]

Results

We canvassed globally 23 days, enrolling 260 patients (81 in the High Dependency Unit, 79 in Geriatrics and 100 in Internal Medicine). All the patients were admitted by non-elective urgent access, with the majority from the Emergency Department and few transferred from other wards (details in table 1).
Mean RT value was uniformly elevated in our cohort (7.2 ± 2 in the whole population, 7.2 ± 2 in HDU, 7.5 ± 1 in Ger, 7 ± 2 in IM). Only 25 patients had a RT≤ 3 corresponding to 9.6% of the whole population.

Table 1 shows demographic data for all the patients, the source of admission and comorbid conditions in patients grouped by RT cut-off. No significant differences were found in demographic data and comorbid conditions between patients potentially eligible for discharge (25 patients with RT≤3) and the rest of the patients (235 patients with RT>3). (Table 1)

Results of ISAR, HOSPITAL and GFI scores and number of patients in their respective low-risk categories are summarized in Table 2. No significant differences were found for ISAR and Hospital between the 3 divisions. On the contrary, in the geriatric ward, all the patients in the RT $\leq$3 group were considered "frail" at GFI, with a significant difference in comparison to HDU and IM (71% of frailty in HDU, 58% in IM, p=0.02).
Between the studied scores, Hospital seems to have the best concordance with RT results, highlighting low risk of discharge in 84% of patients in RT < 3 group (see table 2 for further details).
The mean number of drugs prescribed at discharge outnumbered the cut-off that predicts readmission (5 drugs) in all the three divisions.

229 patients out of 260 were finally discharged (205 in the RT>3 group, 24 in the RT≤ 3 group respectively), whereas 29 out of 260 died (28 in the RT>3 group, 1 in the RT≤ 3 group respectively) and 2 were still hospitalized at the end of the study period.

Mean LOS was 12 [8-20] days: LOS was significantly shorter in HDU patients (9 [6-16] in HDU, 15 [10-29] in Ger, 12 [8-19] in IM, p <0.001 according to Kruskall-Wallis test).

Discharge happened by a median of 7 [4-13] days after t_0 in the whole population (5 [3-12] days after t_0 in HDU, 8 [4-15] days after t_0 in Ger, 8 [5-13] days after t_0 in IM respectively, p =0.084 according to Kruskall-Wallis test).
Table 3 describes the type of post discharge-care provided. There was no difference in the type of post-acute care provided in the subgroup of patients with RT≤ 3 compared with those with RT>3. All the 167 patients discharged directly at home were sent for referral to their General practitioner (GP). In the discharge instructions, we recommended referral to GP to all patients. Indeed in Italy the GP prescription is mandatory to obtain the majority of the drugs without additional fee.

Main outcomes are detailed in Table 4, showing the two group of patients classified by RT values as potentially eligible for discharge (RT≤3) or still needing hospitalisation (RT>3).
Figure 1 examines the differences in outcomes in the two groups classified according to RT (Mann Whitney test for comparison between two groups). In the RT ≤ 3 group, there was a higher percentage of discharged patients (24 out of 25 (96%) versus 205 out of 235 (87%)) but the result did not reach statistical significance.

When examining the timing of discharge we observed a significantly shorter interval from t_0 in the RT≤3 group (3.5 [2-7] days) in comparison with the RT>3 group (8 [4-14] days)(p=0.0002). This difference was significant in the entire population (p=0.0002), as well as in the HDU and Ger examined separately (, (p=0.001 in HDU, p= 0.03 in Ger, p=0.09 in IM) according to Mann-Whitney test). We didn't see any other significant difference between the other outcomes in the two subgroups.

In the group of patients considered eligible for discharge by RT, all but one patient were discharged by a median of 3,5 days [2-7] (table 4). Sixteen out of 25 (64%) patients were discharged before 4 days from t_0. Patients in HDU were discharged significantly earlier (1.5 days from t_0 versus 3.5 in Ger and 5.5 in IM, p=0.02).
Since we used the follow up as an ethical proxy of discharge, we described in details in table 5 further interventions that RT≤3 patients had before actual discharge.
Twenty-one patients ((84%) were discharged without further interventions after different intervals.We observed a restart of interventions before discharge in 3 cases (type and timing detailed in table 5). There were no significant differences in age, ISAR, HOSPITAL and GFI in patients that had an intervention before discharge compared with patients that didn't have any intervention before discharge. Moreover no significant differences in the above mentioned scores were found in patients discharged after different intervals from assessment (1,2,3,4 days and more than 4 days).

All but one patient were alive and healthy at 15 and 30 days, none needed to be transferred to a higher level of care. ~~No bounce-back, nor ED consultation were reported in the 30 days after discharge.~~

Table 6 describes the outcome readmission assessed at 30 days (by phone call and search of hospital records), at 60 days and 180 days (by search of hospital digital records only). Results are described for the entire population and in the two subgroups grouped by RT results. The number of patients that readmitted at least once, the total number of readmissions, the number of readmissions per patients and the readmission type were not significantly different in patients with RT≤3 and in patients with RT>3.

Similarly the timing of early readmission (namely before 60 days from t_0) and long term readmission (namely after 60 days from t_0) calculated in days from t_0 and from discharge was not different in the RT≤3 group compared to the RT>3 group. The timing of readmission was not different in the group of patients discharged home compared to the group with some type of post-acute care provided. On the other hand, the group of patients discharged home after hospitalisation had a greater number of readmissions by comparison with patients that underwent any type of post-acute care. The statistical significance was preserved in both subgroups of RT≤3 and RT>3 patients.

RT showed a low sensitivity and high specificity when applied alone to the entire study population to assess the outcome "early discharge" (≤4 days after t_0) (table 7)

When considering RT in association with Hospital score we observed an increase in the specificity (to 96%), in the PPV and in the LR+, with a stable NPV and only a small reduction in sensitivity (20%).

When RT was associated to frailty indicator (ISAR and GFI), we observed the highest specificity (98% for both), PPV (69% and 75% respectively) and LR+ (5.99 and 7.98 respectively), but the sensitivity was very low (13% for both). (details in table 4)

Discussion

Reverse triage, a system for inpatient stratification according to their resource need, has been previously validated to predict safe early discharge in disaster simulations and has been suggested for daily use to guide patient disposition. However, to our knowledge to date, there is no evidence supporting its use in a different context. Furthermore, it was never studied in combination with the readmission risk assessment.

RT is a tool designed to identify patients that don't need any further in-hospital resources at the time of assessment, with no risk of CME in the following 72h and that can be considered for discharge. In our study, the RT cut off of 3 (<4% of risk of CME after discontinuation of an intervention) identified as "eligible for release" less than 10% of the inpatient's cohort. Our findings are in line with previous reports[28,29] of high in-hospital bed occupancy rate by complex patients needing a great number of resources (as shown by the high mean value of RT in our population). In these settings, early discharge is feasible only for a small portion of patients.

Interestingly, we did not find any direct correlation between the possibility of discharge and demographic data or co-morbid conditions, as highlighted by the similar values observed in the groups stratified by RT.

A higher percentage of discharged patient was found in the RT≤3 group, but the trend didn't reach significance.

On the other hand, RT seems to be useful to predict patients that could be discharged earlier as highlighted by the evidence of a significantly earlier discharge in the RT≤3 group. This result is stronger in the HDU subgroup, but also present in the other divisions. An explanation could be that HDU physician's mission is stabilisation of acute illnesses and is paying great attention to resource allocation and sparing critical resources for the most unstable patients. In the critical care units, it is

extremely common to apply decisional skills very similar to the RT proper health care ethic. In addition, in the Ger patients, the RT score < 3 proved to correlate with the timing of discharge. According to the original RT score use and to these findings, we then evaluated the operational characteristics of RT score for the outcome "early discharge" (namely before 4 days from assessment[5-10,11]).
RT score showed a high specificity and a high negative predictive value. The RT>3 patients were discharged after a longer hospital stay (more than 4 days) or were still in the hospital at the end of the study period. Moreover, the majority of deaths occurred in this category. Unfortunately, RT score showed a low sensitivity and an average positive predictive value.

Our secondary aim was to confirm the safety of the RT score. This was supported by the lower rate of the restart of critical interventions in the RT≤3 group, the absence of transfer to a higher level of care and the absence of adverse events. The only patient in this group that died had metastatic cancer, he developed hospital-acquired pneumonia a few days after t_0 assessment and died 10 days afterwards. In our small sample, RT score proved to be a conservative and safe tool and it confirmed the previously described risk profiles classification system in the short term (t_4). Moreover, it proved to be safe in the medium and long-term with all but one patient alive and healthy in the 15 and 30 days follow up. A small portion of patients underwent some interventions during the days of hospitalisation after t_0 but there were no evident correlation between these interventions and the timing of discharge nor with the subsequent prolonged length of stay. However this dataset is small which imposes an important limitation on the interpretation of the results.
We were worried about the possibility that an early discharge could result in a higher readmission rate and thus we implemented the decisional algorithm adding 3 readmission screening tools commonly described in the literature to RT score. As expected, it resulted in a further increase of specificity, positive predictive value and positive likelihood ratio.
ISAR and GFI have proved to be the most conservative of the three tools and probably the least useful because of their very low sensitivity. Particularly in the geriatric population, all the patients eligible for discharge happened to be in the frail category. The number of drugs prescribed at discharge was also quite useless because nearly all the patients showed a high number of drugs in their discharge summary. Instead Hospital score, when used with RT score, increases specificity and positive predictive value, with only a small reduction in sensitivity. Thus, we could hypothesize that the association of RT score and Hospital score could positively implement the decisional algorithm of early discharge. We did not observe any bounce-backs in the short term (<30 days from discharge), regardless to the individual readmission risk. We did not intend to screen for readmission the RT>3 patients, that were not potentially eligible for discharge. When expanding the assessment to medium and long term readmissions we did not find any difference in the probability of readmission in the two RT categories. This is a further demonstration that appropriate discharge is not associated with increased readmission rate and a further confirmation of RT safety.
There were not differences in the type of post-acute care provided in the two RT groups.
On the other hand, we highlighted that the probability of readmission, as well as the number of readmissions, were strictly related to the type of post acute care provided. Indeed the patients discharged directly at home experienced a higher number of readmissions, both in the medium and longer term, both in the ED and in the hospital. These results could suggest the use of readmission risk evaluation routinely before discharge to identify patients that could benefit more of a strict discharge support. In this context, RT identifies patients eligible for discharge and HOSPITAL score could screen the ones for whom a further post acute care support could be useful.

Limitations
The main study limitation is that patients RT≤3 were not effectively discharged at t_0, and only 65% were discharged before 4 days from the t_0, thus their outcome could have been biased by other minor interventions during these days of hospitalisation. We tried to overcome this limitation by using as an ethical proxy of discharge a follow-up period free of critical interventions, transfer to a

higher level of care and negative outcomes. Moreover we collected data about further interventions in these patients grouped by different categories of discharge date from t_0 , and we didn't observe any specific pattern at this analysis.
Another limitation is due to the small number of patients in the RT≤3 category. Our numbers are in agreement with actual European in-hospital bed utilisation data[28-29], but further studies are needed to confirm these findings.
In patients eligible for discharge, we studied readmissions at 30 days in a more extensive way (using hospital records and phone calls to assess for any other ED and any other hospital admission) according to previous studies that tested the readmission screening tools in this time-frame. Then we performed further assessment of readmissions in the medium (60 days) and long term (180 days) after t_0, for alla study patients but this was limited to our hospital records only, due to practical constraints. This could bias our results, but we were more interested in testing the safety of RT and readmission screening tools for early readmission in patients eligible for discharge at RT. Further studies are needed to better infer on this subject.
Another possible bias is that more unstable patients and cognitively impaired patients without a caregiver were not able to give informed consent and thus have been excluded from the study. This could have underestimated the number of frail patients and the rate of negative outcomes. The impact of this should be lower in the "eligible for discharge" population which was our primary focus.

Conclusions

Due to its novelty and to the small number of patients, our study could be considered a pilot for investigating the use of some new decisional tools for safe inpatient disposition and appropriate discharge. We confirmed also in our small sample and in the ordinary daily context the feasibility of RT score as a safe and conservative support to appropriate discharge. This classification identified only a small percentage of inpatients accountable for release but showed a good correlation with the timing of discharge. We could suggest evaluating in future studies the use of RT score associated with Hospital score in the decisional algorithm for inpatient disposition with the aim of reducing readmissions.

Figure 1

Figure 1
Figure 1 shows frequencies of occurrence of the main outcomes (death and discharge) in the two groups (according to RT cut-off) in the three divisions and in the overall population.
HDU= High Dependency Unit, Ger= Geriatry, IM= Internal Medicine, TOT = overall population.
Black vertical hatching= discharged in RT>3 group, white diagonal hatching=dead in RT>3 group
Black horizontal hatching = discharged in RT≤3 group, black= dead in the RT3 ≤3 group
*p values are calculated according to Mann Whitney test for comparison between two groups (z=0.65 p=0.5)

Authors contributions:
Valeria Caramello[a] MD contributed to study design, data collection, analysis and interpretation, Statistic, Drafting article, Critical revision of article, Approval of article
Giulia Marulli[a] MD contributed to study design, data collection, analysis and interpretation, Statistic, Drafting article, Critical revision of article, Approval of article
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