Use of traffic crash as a risk assessment scale in hospitalized seniors: a perspective observational study

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Abstract. *Background and aim:* According to the World Health Organization (WHO), falls represent the second main cause of accidental and involuntary deaths worldwide, which led to define them as one of the "four giants of the geriatrician" that particularly affect the elderly aged ≥ 65 years. The study's aim is to evaluate whether the Traffic Crash scale is valid in identifying patients at risk of falling by comparing it to the Conley scale currently used. *Methods:* Prospective observational study evaluating the fall risk using TC on a sample of patients aged ≥ 65 years, hospitalized in General Medicine Ward and Gastroenterology, after informed consent and favorable opinion of the AVEN Ethics Committee. The results are compared with those obtained from the Conley scale, and with those obtained from the indications of the Business Operating Instruction. The method of administration occurred concurrently and distinctly on the same patient by two researchers in order to demonstrate the scale inter-rater reliability. *Results:* The final sample was made up of 88 patients. Data shows that 46 out of 55 patients (84%) are medium / high risk for both scales. According to the indications of the Company Operating Instruction, the entire sample is at risk. The inter-rater reliability was confirmed with Cohen's K which is equal to p = 1. *Conclusions:* The TC scale is comparable to Conley scale, for the fall risk identification but specifically the stratification is low-medium-high. Therefore, in future, this will make it possible to implement personalized prevention interventions in care planning. (www.actabiomedica.it)

Key words: Fall risk, Older adults, Tools, Assessment, Hospital, hospitalization, Rating scale, Scale, Score, Fall's Prevention

Background

Falls are defined as "a sudden, unintentional, unexpected downward shift from the orthostatic or seated or clinostatic position" (1). This definition includes patients who fall asleep on the chair while sleeping, patients found lying on the floor and falls despite support (1). They are further classified by Morse by type: 14% accidental, 8% unpredictable physiological and 78% foreseeable physiological which could be identified and therefore prevented (2).

According to the World Health Organization (WHO), falls represent the second main cause of accidental and involuntary deaths worldwide, with an annual global mortality recorded and updated on January 16, 2018 of about 646,000, which led to define them as one of the "four giants of the geriatrician", together with depression, memory deficit and urinary incontinence which particularly affect the elderly aged ≥ 65 years (3).

The cost of these numbers involves the physical, psychological and even economic spheres: already a

single first fall can lead to fear of falling again, decrease in safety and progressive loss of autonomy, associated with anxiety and depression. This results in a lower performance of daily activities with an increase in disability and a decrease in the quality of life, in what is defined as "post-fall syndrome" (4), while the direct costs deriving from falls in elderly patients ≥65 years of age they are estimated at $ 19 billion (5).

If the fall causes serious damage or death of the patient, it is a sentinel event and based on their monitoring report by the Ministry of Health in 2015, the patient's fall event represented the highest number of reports and resulted in death in 35.6% of cases, major trauma in 15.9% and surgical reoperation in 10.58% 6). Furthermore, the relationship between the nursing contribution and the patient's results regarding the prevention of falls has been demonstrated (7), considered a Nursing Sensitive Outcome (8).

In order to assess the risk of falling, various scales are present in the literature (9), currently the most used are the Conley scale (10) and the Morse scale (11), but several studies show that these instruments are not completely reliable for prediction of the risk of falling. (12–14) The Australian FROHP scale demonstrated only moderate levels of accuracy in the pilot study (15), the translated and adapted version in Taiwan showed good validity, but was tested on a small sample (16) and in any case not there is a version of the FROHP translated and adapted for the Italian context.

On the basis of the NICE 161 revision (17), the Emilia Romagna region was able to radically change the approach to the evaluation and management of the event that fell from a multifactorial perspective and identified the main risk factors, such as: at least one previous fall in the previous year, fear of falling, environmental barriers, cardiological drugs, drugs with a psychotropic effect but also polypharmacology (at least three active ingredients excluding the two previous categories), in association with an environmental assessment also carried out periodically by designated offices (18).

Currently, the Piacenza Local Health Authority has implemented the regional guidelines (18) and has given instructions to the Operational Units (O.U.) to compile a check list for the identification of risk factors and to carry out an environmental assessment, but too often this is still not done, increasing the risk of missed care. In other cases, the Conley scale is still used, mistakenly considered the gold standard for identifying risk.

To cope with this problem, it was decided to design a new staircase, the "Traffic Crash", built from existing stairs such as Conley (10), Morse (11) and Tinetti (19) and also includes the assessment of risk factors identified by the Emilia-Romagna Region (18), in order to give operators a tool with which they are more accustomed to working, a scale, but more suitable for the purpose than that in use. Furthermore, unlike the other scales, the Traffic Crash, in addition to being a means to more fully identify the risk of falling, the low-medium-high stratification and suggests a behavioral code to be included in the care planning that takes into consideration the indications provided by a review of effective interventions such as additional physiotherapy and educational interventions (20).

Objective

The aim of this study is to evaluate whether the Traffic Crash scale is valid in identifying patients at risk of falling by comparing it to the Conley scale currently in use. In particular, the aim is to verify whether patients identified as "at risk" by the Conley scale are identified as "moderate risk" and "high risk" by the Traffic Crash, the final objective is therefore to verify the non-inferiority of Traffic Crash respect to the Conley scale. In addition, we will check whether the Traffic Crash identifies patients with "moderate risk" and "high risk" patients with the risk factors included in the Business Operating Instruction.

The second goal is to evaluate the inter-rater reliability of the Traffic Crash scale.

Methods

A prospective observational study was conducted, carried out from July 2019 to October 2019, and took into consideration the General Medicine Ward and Gastroenterology O.U. of the Hospital Unit (H.U.) of Piacenza and Internal Medicine of the H.U. Val Tidone. The sample consists of patients over the age

of 65 or older who have been provided with adequate information and have been asked to express their consent to participate in the study. It was chosen to include these O.U. in relation to the number of beds in the various wards, the number of average accesses during the period under consideration and the type of hospitalized patient (mainly elderly and multi-pathological patients; high rate of clinical complexity and non-self-sufficiency). Of the 113 patients who met the study inclusion criteria, 88 (78%) were evaluated while 25 (22%) were excluded, as they did not express consent. The administration of the scale took place concurrently and distinctly on the same patient by two researchers in order to demonstrate the intervalutator stability of the same. Each patient has been associated with a progressive number so as not to report any personal data in the evaluation scales and in the data collection table.

Instruments

The Traffic Crash scale (figure 1) consists of 5 main items that investigate:

History of the fall

Deambulation

Use of drugs that can change your alertness

Gait

Mental state and cognitive impairment, assessed with MMSE (21)

Each item is divided into sub-categories with which a descriptor is associated, each of the descriptors is assigned a score.

The sum of the scores obtained determines the risk of falling which can be attested in:

0 no risk of falling

< 20 Low risk of falling

20 - < 50 Moderate risk of falling

> 50 High risk of falling

Each score also corresponds to a color code, from which derives the name "Traffic Crash" to be affixed to the patient's bed in order to make the risk of falling immediately visible to the operator:

"No risk of falling" and "Low risk of falling" green code

"Moderate risk of falling" yellow code

"High risk of falling" red code

For each level of risk, targeted interventions were devised to prevent the risk of falling.

Please, insert Figure 1 here.

The Conley scale is made up of two items:

• Previous falls:

- fall in the past three months

- presence of dizziness or lightheadedness

- loss of urine or feces while going to the bathroom

• Cognitive impairment:

- impaired gear,

- motor agitation;

- deterioration of judgment / lack of sense of danger.

The sum of the scores can result:

• Values between 0 and 1 indicate the low risk of falling.

• Values between 2 and 10 indicate the high risk of falling.

The risk factors identified by the Emilia-Romagna Region and incorporated in the Company Operating Instruction are: at least one previous fall in the previous year; fear of falling; environmental barriers; cardiological drugs; psychotropic drugs; polypharmacology (at least three active ingredients excluding the two previous categories). The assessment of the presence of even one of the following factors is sufficient to consider the patient at risk of falling.

To check:

- Upon patient entry, taking charge (within 24 hours)

- As clinical conditions and therapy vary

- On the occasion of the fall event

- On the occasion of changes in walking

- At regular time intervals in prolonged hospitalizations

- Before a transfer to another Operating Unit or facility and before discharge

Data Analysis

The results of the Traffic Crash scale have been inserted in an Excel table (cf.) and compared both with those obtained from the Conley scale and with those obtained using the indications of the Business Operating Instruction. They have been classified as "low" and "high" risk for the Conley scale and "low", "moderate"

Scheda TC (Traffic Crash)

La Traffic Crash è un metodo rapido e semplice per innalzare l'attenzione di tutti gli operatori sul rischio di caduta di un residente. Tale scheda deriva dal progetto semaforo.

L'appartenenza finale ad una specifica classe di rischio darà modo all'equipe di assegnare un codice colore, (verde, giallo o rosso), che verrà posizionato al letto dell'utente come avvertimento del pericolo di caduta.

Nome_____Cognome_____data___/___/_____

Stanza_____Nucleo di Degenza_____

Variabili			Punteggio
Storia della caduta	☐ No	Il paziente non è mai caduto in precedenza durante il ricovero o comunque non cade negli ultimi 3 mesi	☐ 0
	☐ Si	Il paziente è già caduto in precedenza durante il ricovero o comunque è caduto negli ultimi 3 mesi	☐ 10
Deambulazione		Il paziente non necessita di aiuto nella deambulazione, è allettato e non deambula, è in carrozzina/poltrona con vincolo	☐ 0
		Il paziente deambula solo con l'aiuto di stampelle, bastone, girello o latri ausili, deambula assistito, paziente in carrozzina senza vincolo	☐ 10
		Il paziente non chiede aiuto nella deambulazione ma si appoggia a mobili o muri	☐ 20
Uso di farmaci che possono modificare lo stato di vigilanza	☐ No	Il paziente non assume farmaci	☐ 0
	☐ Si	Il paziente assume farmaci	☐ 10
Andatura	Normale	Il paziente passeggia a testa eretta, oscilla liberamente le braccia, cammina a grandi passi senza esitazioni. Non deambula	☐ 0
	Debole	Il paziente è curvo, ma in grado di alzare la testa senza perdere l'equilibrio, utilizza ausili o mobili come guida, appoggiandosi, cammina a piccoli passi	☐ 10
	Compromessa	Il paziente ha difficoltà ad alzarsi, fa diversi tentativi, cammina a testa bassa, cammina accompagnato, trascina i piedi	☐ 20
Stato mentale	Assente/lieve	MMSE $\geq$25 e $\leq$ 30	☐ 0
	Moderato	MMSE $\geq$19 e $\leq$ 24 - ($\geq$25 e $\leq$ 30, ma sopravvaluta le proprie abilità)	☐ 10
Deterioramento cognitivo	Severo	MMSE $\leq$ 18 o se MMSE non applicabile	☐ 20
Punteggio totale			......

☐ Nessun rischio di caduta	☐ Rischio basso di caduta	☐Rischio moderato di caduta	☐ Rischio elevato di caduta
0	$\leq$ 20	> 20 < 50	> 50
SEMAFORO VERDE		SEMAFORO GIALLO	SEMAFORO ROSSO
Codice comportamentale PAI-V		Codice comportamentale PAI-G	Codice comportamentale PAI-R

Figure 1. Traffic Crash Scale

and "high" for the Traffic Crash, while for the presence or absence of the risk factors indicated by the Region it has been assigned a "yes" or a "no".

For the analysis of the data, charts were built using Microsoft Excel. Descriptive statistics operations were performed, such as frequencies and percentages, concerning the risk identified in the patients in the four-month period under consideration and inferential statistics operations to assess the intervalutator stability of the Traffic Crash scale by calculating Cohen's Kappa.

Ethical Considerations

The study has been conducted in agreement with the Ethical Principles for Medical Research Involving Human Subjects of the Helsinki Declaration and it has been approved by the International Research Board of the University of Parma.

On 26/07/2019, the Director of UOC Clinical Government approved the authorization for the observational study in question, by protocol no. 2019/0074081.

After obtaining the favorable opinion of the AVEN Ethics Committee and the authorization of the Management all the healthcare setting where the study took place was contacted and was asked for their availability to participate in the research. An explanatory document of the study was sent to the Coordinators of the Operating Units in order to inform them, and to agree on the access times in the structures. All eligible participants were informed of the purpose and characteristics of the study and received a clear informative written document, explaining the design, aims, procedure and ethical considerations of the research. Informed consent was obtained from all participants after a full description of the study. Those who signed the consent have been informed that participation in the study was voluntary and that they could withdraw their consent to participate at any time.

Results

88 patients aged ≥ 65 years admitted to the General Medicine Ward and Gastroenterology of H.U. of Piacenza and General Medicine Ward of the H.U. Val Tidone, in the quarter examined. In reality, the sample should have been 100 patients based on statistical considerations but the time available allowed to include 88 patients; 35 of them were assessed in the General Medicine and 14 in theO.U. of Gastroenterology of H.U. of Piacenza; while 39 in General Medicine of the H.U. Val Tidone (figure 2).

Unlike the Conley scale, the Traffic Crash stratifies the identified risk in low, medium, high. With it, the 88 patients evaluated are arranged on three levels:
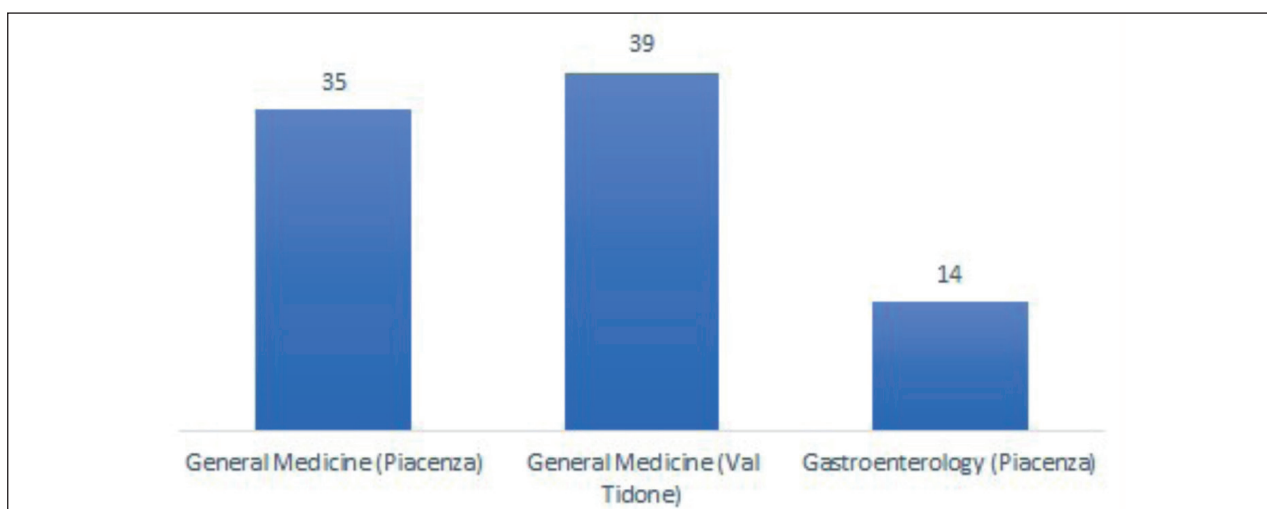
33 are low risk; 51 medium risk; 4 high risk.

Figure 2. Evaluated Patients

The Conley scale identified at "high" risk 56 (64%) of 88 patients and 32 (36%) not at risk (figure 3).

Instead, Traffic Crash defined 55 (63%) patients at "moderate / high" risk and 33 (37%) at low risk (figure 4). Analysis of the data obtained through the compilation of the Conley scale and the Traffic Crash shows that 46 (84%) patients out of 55 are at moderate / high risk for both scales (42 medium risk, 4 high risk).

Among the objectives of the study was the verification of the inter-rater reliability of the Traffic Crash scale; in order to achieve this, it was completed simultaneously and separately by two operators on the same patient. Stability was verified with Cohen's Kappa which turns out to be p = 1 (figure 5).
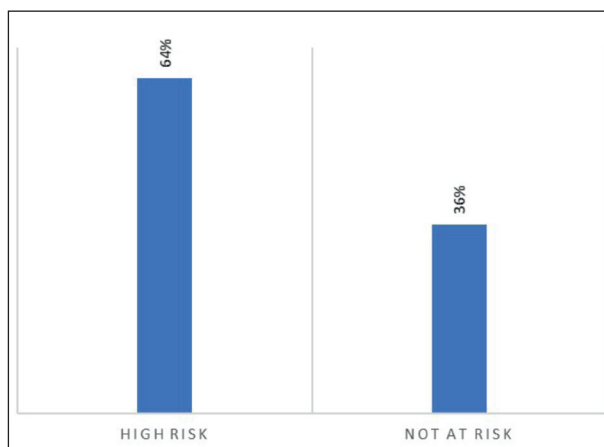

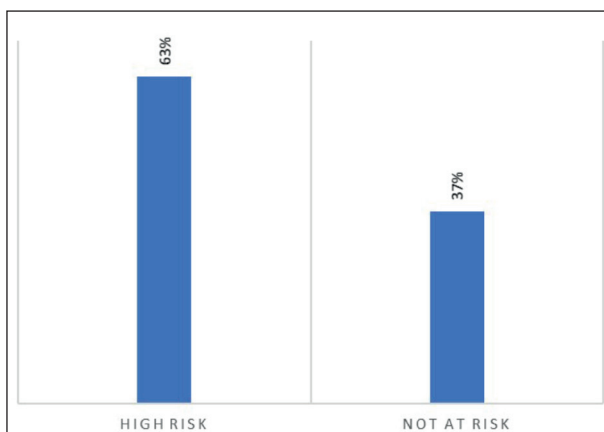**Figure 3.** Fall risk using Conley scale

Figure 4. Fall risk using Traffic Crash scale

Discussion

Although the fall event is one of the main outcomes monitored in the companies, the data in the literature show only a rating scale considered effective in preventing risk, the Tw-FRHOP scale (16), which takes into consideration in its items the main factors of fall risk identified by NICE. (17) However, the predictive accuracy of risk was not examined in this study, and the scale was implemented in a single ward with validation related to the criteria, conducted within three days of hospitalization; this was not accompanied by a wide application in all hospital wards or by the registration of subsequent hospitalizations and fall conditions among patients (16).

The Emilia Romagna Region has given indications to abandon the use of the scales and to verify the presence or absence of other risk factors (4), but nurses struggle to put the indications into practice given the convenience and immediacy of tools such as scales. Conley, which is the scale used in the Piacenza H.U. does not consider any significant risk factors (13) instead taken into consideration by the Traffic Crash scale.

From the analysis of the data collected during the period under consideration, it emerged clearly that the Traffic Crash scale is superimposable on the Conley for the identification of the fall risk, but specifically the stratification at the bottom, medium, high, while the Conley only in " at risk "or" not at risk ". So it can be said that the Traffic Crash in addition to stratifying also suggests that the zero risk does not exist.

Based on the risk factors indicated in the Company Procedure (18), all patients assessed are at risk of falling, therefore it can be inferred that the latter is overestimated, especially because it is not stratified. In the hospital setting, an overestimation of the risk is acceptable, also taking into account the turnover and the care load of the O.U. but in a residential structure the use of a more specific tool such as the Traffic Crash may be indicated.

The Traffic Crash also provides a series of preventive interventions based on the risk stratification to be implemented also with a view to optimizing resources.

About the reliability, the result was p = 1, the data is commonly considered acceptable for values of p > 0.75, therefore it can be said that the Traffic Crash scale is not operator sensitive.

Traffic Crash_1	Traffic_Crash_2								
	0	10	20	30	40	50	60	70 |	Total
0 |	1	0	0	0	0	0	0	0 |	1
10 |	0	21	0	0	0	0	0	0 |	21
20 |	0	0	11	0	0	0	0	0 |	11
30 |	0	0	0	25	0	0	0	0 |	25
40 |	0	0	0	0	20	0	0	0 |	20
50 |	0	0	0	0	0	6	0	0 |	6
60 |	0	0	0	0	0	0	3	0 |	3
70 |	0	0	0	0	0	0	0	1 |	1
Total |	1	21	11	25	20	6	3	1 |	88

Kappa Traffic_crash_1 traffic_crash_2; Two-outcomes, multiple raters:

Kappa	Z	Prob>Z
-0.0175	-6.68	**1.0000**

Figure 5. Cohen's Kappa

Conclusion

The study has some limitations such as the reduced number of subjects sampled compared to the expected and the non-implementation of the foreseen interventions by the scale that can be studied in future works.

The Traffic Crash can be a valid tool for assessing the risk of falling for guests of a residential structure or for patients hospitalized in long-term care with the advantage of also indicating the personalized interventions for prevention to be included in the care planning and make the use of the resources available to the structures.

In the future it would be interesting to study the effectiveness of the scale in question in a residential setting by implementing the planned preventive interventions.

Conflict of interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article

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