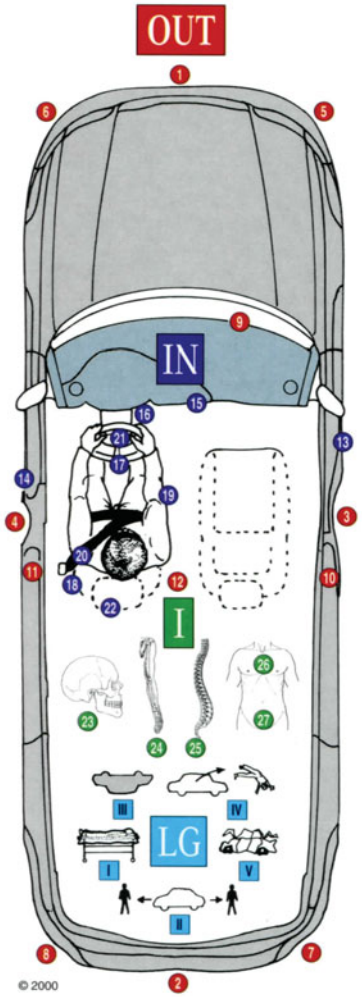
ANDREA COSTANZO

IDI

Impact Deformation Injury



Un metodo per la valutazione globale rapida di gravità dell'incidente della strada

LOMBARDO EDITORE

Costanzo:
IDI, Impact Deformation Injury

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Un metodo per la valutazione globale rapida
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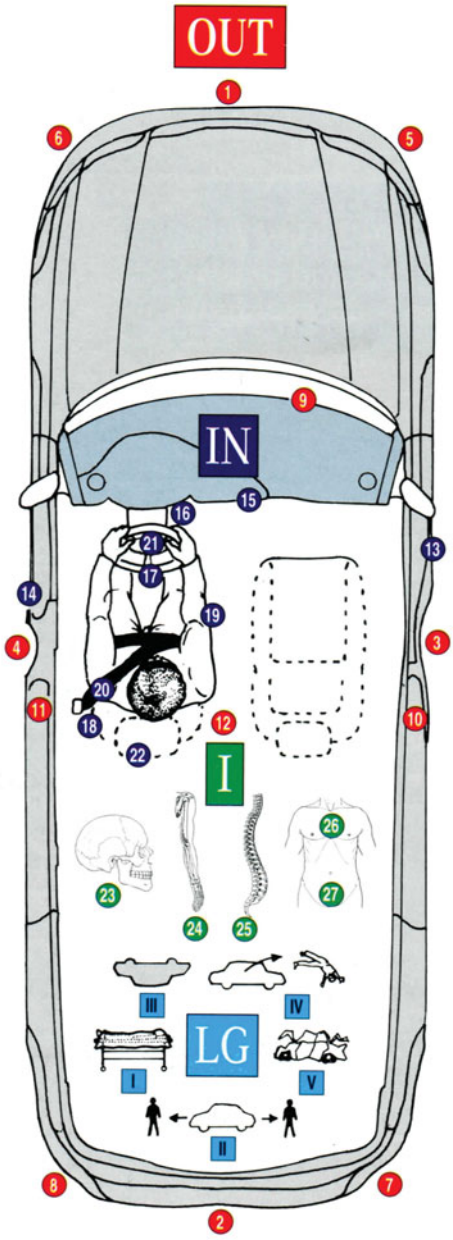
Sommario

IDI, Impact Deformation Injury

A system allowing for a fast and overall severity evaluation of the road accidents



OUT

External recognition — **Evaluation of severity**

1	☐ Front slight	1
	☐ severe	3
2	☐ Back	2
3	☐ Side right, slight	1
	☐ severe	3
4	☐ Side left, slight	1
	☐ severe	3
5	☐ Front corner right	1
6	☐ Front corner left	1
7	☐ Back corner right	1
8	☐ Back corner left	1
9	☐ Windscreen	4
10	☐ Bumper right	4
11	☐ Bumper left	4
12	☐ Roof	4

IN

Internal recognition — **Evaluation of severity**

13	☐ Door right	4
14	☐ Door left	4
15	☐ Dashboard	4
16	☐ Pedals	4
17	☐ Steering whee	4
18	☐ Seat	4
19	☐ *Posture*	
20	☐ *Seat-belt*	
21	☐ *Air-bag*	
22	☐ *Head-rest*	

IDI =

I

Injury — **Evaluation of severity**

23	**Head**	
	☐ Contusion	2
	☐ Commotio	3
	☐ Fracture	4
24	**Limbs**	
	☐ Contusion	1
	☐ Sprain	2
	☐ Fracture/dislocation small segments	2
	☐ Fracture/dislocation big segments	3
25	**Spine**	
	☐ Contusion/sprain	1
	☐ Fracture	2
	☐ Fracture with dislocation	3
	☐ Fracture with neurological injury	4
26	**Thorax**	
	☐ Contusion	2
	☐ Fracture	3
	☐ Internal injury	4
27	**Abdomen**	
	☐ Contusion	3
	☐ Internal injury	4

LG

Load and Go — **Evaluation of severity**

I	☐ Death of one of the passengers	4
II	☐ Collision with a pedestrian, with a forward gear	3
	☐ with a reverse gear	1
III	☐ Vehicle roll-over	2
IV	☐ Passenger expulsion	2
V	☐ Serious cabin deformation	3

Fig. 1.

PRINCIPLES AND APPLICATION CRITERIA OF THE METHOD

At the moment, the methods used in the classification of traumatic injuries are based on two scales: the first one examines the physiological state of the patient and it is subjected to modifications during the course of such injuries; the second one gives a precise anatomical description of the lesions, giving rise to an evaluation of the relative severity of the case.

The anatomical scale is prevalently used today in assessing the severity of injuries due to a road accident. However, it is also applied in the classification of injuries produced by other traumas. This method facilitates the evaluation of local injuries and also of the total gravity of the case, whereby an only examination of such input data on anatomic injury is proved to be sufficient.

In research on "Road Traumatology" we can say that, in an effort to evaluate at best the severity of an accident, we must take into consideration three fundamental points:

(1) Type of impact.
(2) Type of vehicle deformation.
(3) Type of traumatic injury.

We can presume that the assessment of these fundamental factors can, in the first place, facilitate and contribute greatly to the organization in the first-aid and, furthermore, lead to an update in the security of the vehicle.

In this way, we can also obtain an aggregate evaluation of an accident and its aspects, giving rise to a precise description of injury, action taken and quantity of energy consumed. All this should take place through "both-indicators" furnished at the point of impact and data of deformations that have taken place.

The file card IDI, in our firm opinion, should comply with these requisites (Fig. 1).

We have divided the file card IDI into four sections in order to determine the gravity of a road accident in a simple and concise manner. They are: **Out**, **In**, **Injury**, **Load and Go**.

Each section is given a number (1 to 4) which will act as a base for evaluation in a road accident.

Let us imagine the scene of a road accident.

In our line of acting, on arrival at the scene of a road accident, the

first step consists in evaluating the type of impact and the state of the external structures of the vehicle (**Out**): for this purpose an attentive inspection, often with a glance, is sufficient (external outlook) (Fig. 2).

The following step is a recognition of the internal part of the vehicle,

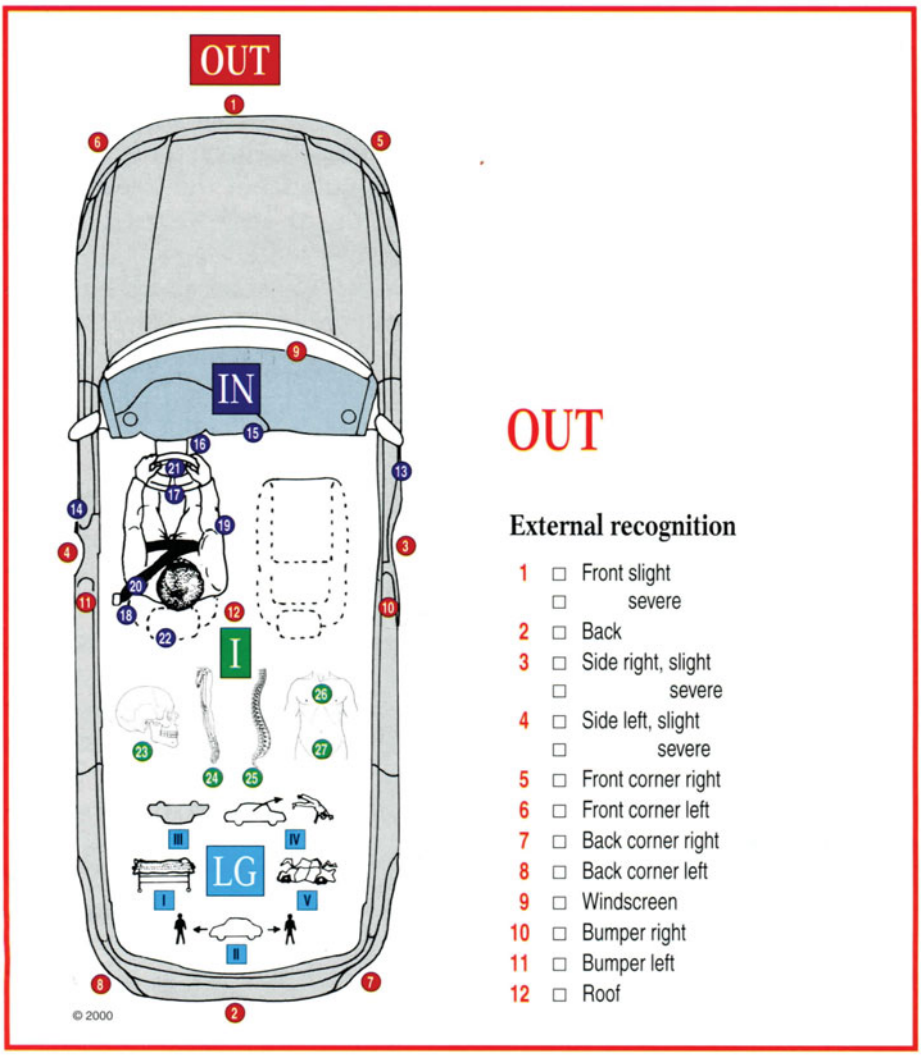


Fig. 2.

taking note of existing deformations (**In**), where, again, an attentive inspection is sufficient (Fig. 3).
The third phase (**Injury**) is more specific since it concernes the assessment of injuries inflicted on the body of the victim. There are five sections: *head*, *limbs*, *spine*, *thorax* and *abdomen* (Fig. 4).

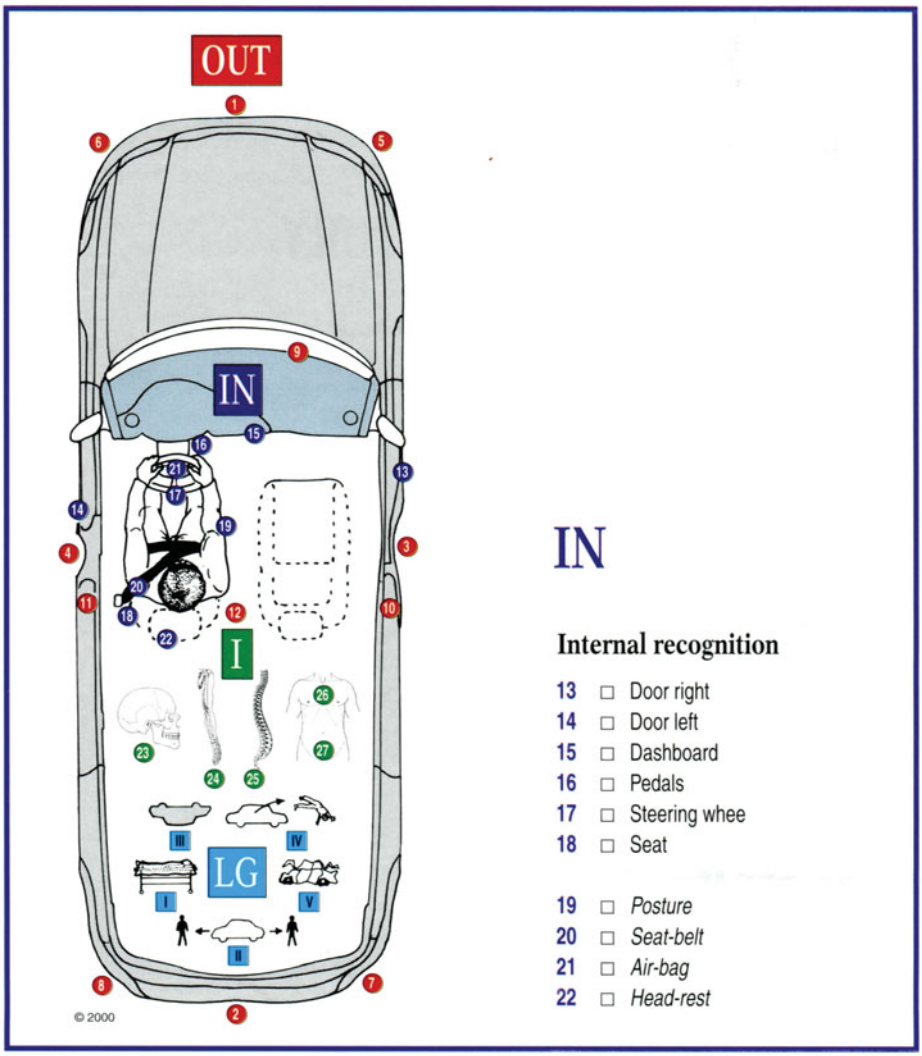


Fig. 3.

The last phase (**Load and Go**), refers to those cases which necessitate the immediate transfer to a hospital for care (Fig. 5).
Load and Go is a matter of discretion:

- Death of one of the passengers.
- An involved pedestrian.

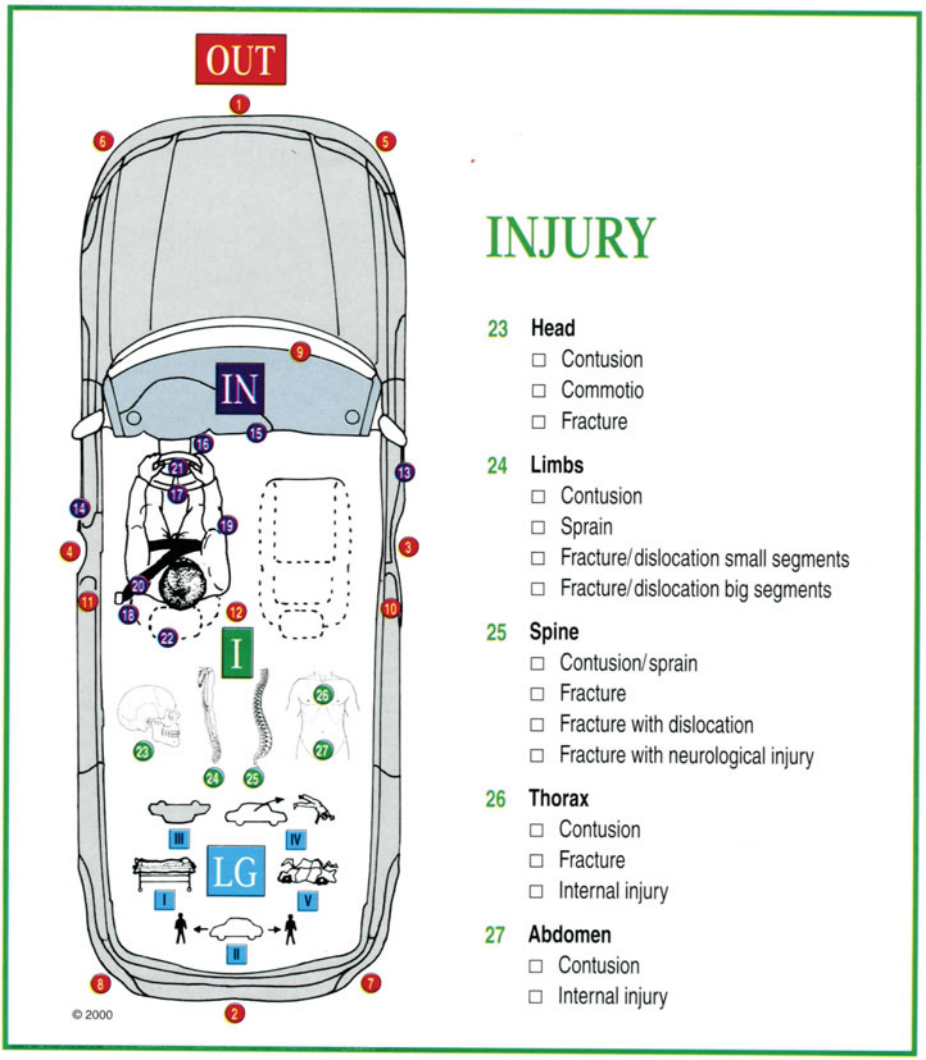


Fig. 4.

- A roll-over vehicle.
- A catapulted passenger.
- Severe cabin deformation.

In the case of **Load and Go** the definition of pedestrian should also be applied to a "non -passenger", such as a cyclist or a motorcyclist. Col-

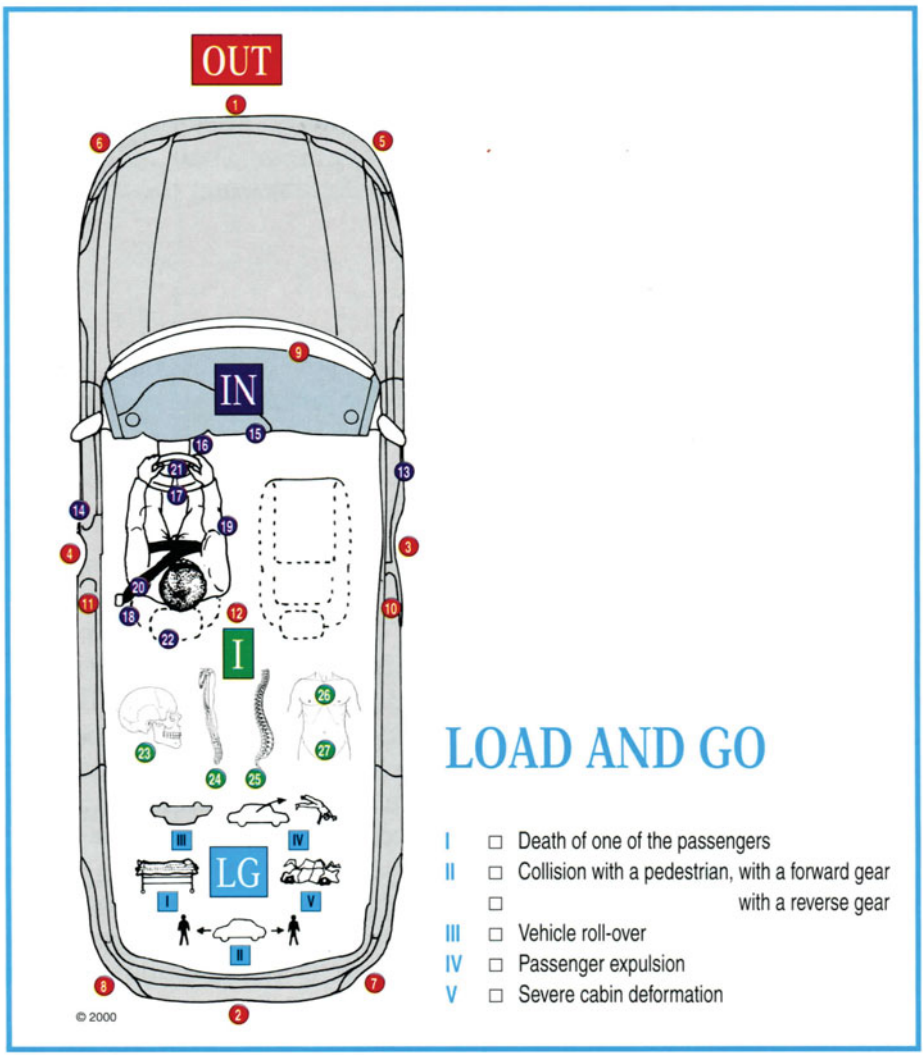


Fig. 5.

lision with a pedestrian in rear gear cannot be considered as a condition of **Load and Go**, but it is maintained for use in statistics and in forensic medicine.
The maximum value in each of the four parts of the card (the numerical evaluation from 1 to 4) gives us the complete index of the gravity in a road accident: IDI, precisely.
The maximum value must not exceed 64. In the case of a death, IDI will still be 64.
Looking at the IDI card in the part **In** (internal recognition) certain headings do not give any evaluation of gravity. Specifically, these regard posture, safety belt, air-bag, and headrest. Their assessment will be useful only when used in statistics. Establishing the following criteria

- correct driving position on impact,
- use of the safety belt,
- open air-bag due to impact,
- headrest in position,

will furnish useful elements for the study of problems related to road security and liability.

STATISTICAL STUDY

A research was commissioned by "Ministry of Infrastructures and Transport" and was implemented by "Società Italiana di Traumatologia della Strada" in collaboration with "118 – Emergency Services" distributed through North, Central and South Italy, for a duration of one calendar year, from 1st March 2000 to 28th February 2001. The aim of this study was to verify dynamic-environmental risk factors, with particular reference to infrastructure, vehicle-type and behaviour of the parties involved. This is anticipated to be invaluable in determining measures to lower the incidence of serious injury and mortality on the motorway.
Furthermore, a study was conducted on the correlation between severity of a road accident (through a scale in points: Impact Deformation Injury=IDI) and Injury Severity Score (ISS), that consists in a solid and validated anatomic index of the seriousness of injury according to international standards.
15,341 cases have been examined, 14,097 of which with minor

injuries (below 16 ISS points) that were excluded in this research. In 1244 cases (8.11%) major injury occurred (more than 16 ISS points). 227 cases where death occurred before or during the initial attempts of first-aid, representing 18.35% of all major injury cases, were also excluded; the remaining 1017 subjects (81.65%) with a ISS score of 16 points or more were all included in the study.
A strong correlation was observed ($R^2 > 0.75$, $p < 0.01$) between an important impact-deformation of vehicle (IDI points) and severity of anatomic injury suffered by the subject (ISS points) (Fig. 6).

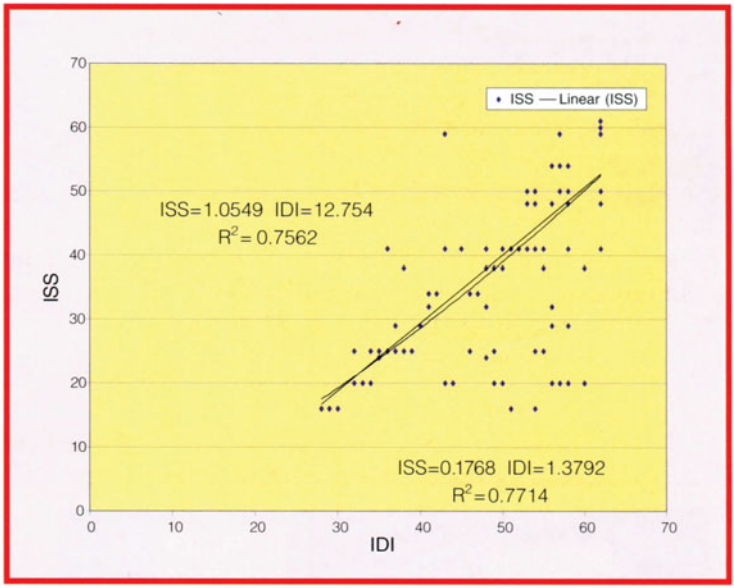


Fig. 6.

Furthermore, for IDI values > 54, there is a relative risk in mortality, in significant numbers (1.26 at 1; $p < 0.01$). In other words, a value of IDI > 54 corresponds to a mortality rate of about 40%, while IDI < 54 means mortality at 32% (Fig. 7).
Therefore, IDI entails a good prediction of risk in severe injury and high IDI values (serious deformation of the vehicle) correlate well with risk of death.
For the above reasons IDI points have been used (together with other indicators, like mortality rate, ISS points, RTS points, etc.) as an

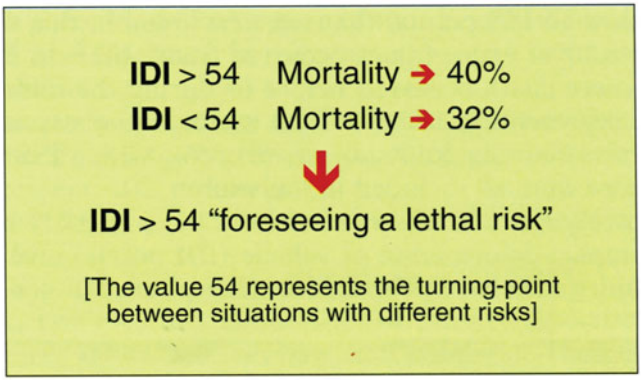


Fig. 7.

index over severity of injury in the phase of attribution of relative share to single factors of risk.

The serious deformation of the motor-vehicle, with particular reference to the deformation of driver and passenger cabin, takes place in 63.12% of serious motorway damages. The medium IDI points is 49.13. In the control group, represented by driver and passenger cabin undeformed, the medium IDI value is 41.47 points.

The seriousness of injuries was different in the various groups exam-

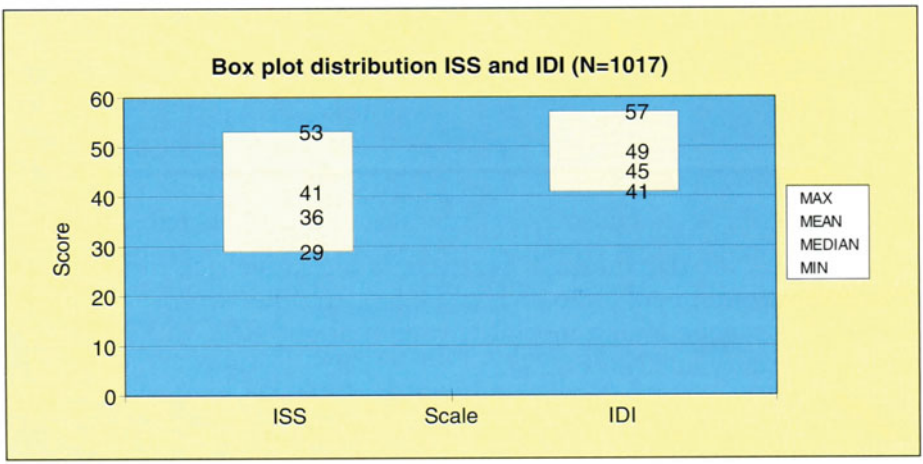


Fig. 8. A link between ISS and IDI can be established on the basis (box plot and whiskers plot) of the central inclination (mean and median) and the range between maximum and minimum values.

ined; an injured person extracted from an intact driver and passenger cabin corresponds to ISS 31.21 points; on the other hand, persons extracted from deformed driver and passenger cabin correspond to a medium ISS value that is 47.43 points or higher (Fig. 8).
The correlation coefficient between the methods IDI and ISS resulted to be 0.86 (Fig. 9).

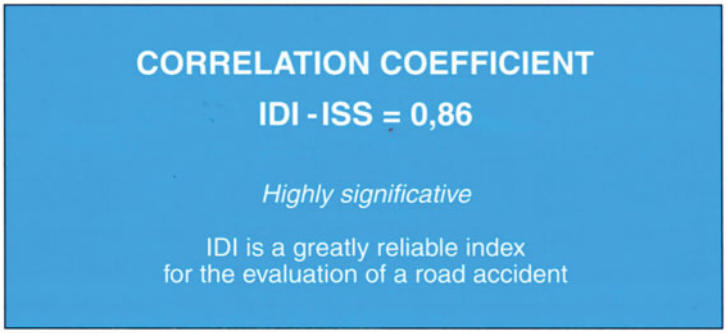


Fig. 9.

This considerable difference in injury seriousness makes us suppose that the deformation of driver and passenger cabin is a determinating factor for severe injuries. In fact, the rate of mortality of injured persons extracted from seriously deformed driver and passenger cabins is higher than the value of the control group: 47.67% *vs* 28.56%.
According to statistics, this factor is responsible for 26% of the deaths.
A confirmation of the reliability of this methodology can be also obtained from the mathematical correlation among ISS, IDI and the transportation time of the traumatized subject from the accident place to the hospital (Fig. 10).
It is known that, in case of a serious accident, the transportation time is longer because the rescue teams have first to take care of the stabilization of the traumatized people.
The application of IDI system has demonstrated its utility in term of legal medicine, with an evaluation of damage to an individual in a road accident. In the course of the study and the research undertaken by the "Italian Society of Road Traumatology", the system for analysis of a road accident has been applied to cases that had already been evaluated by medical examiners of insurance companies.

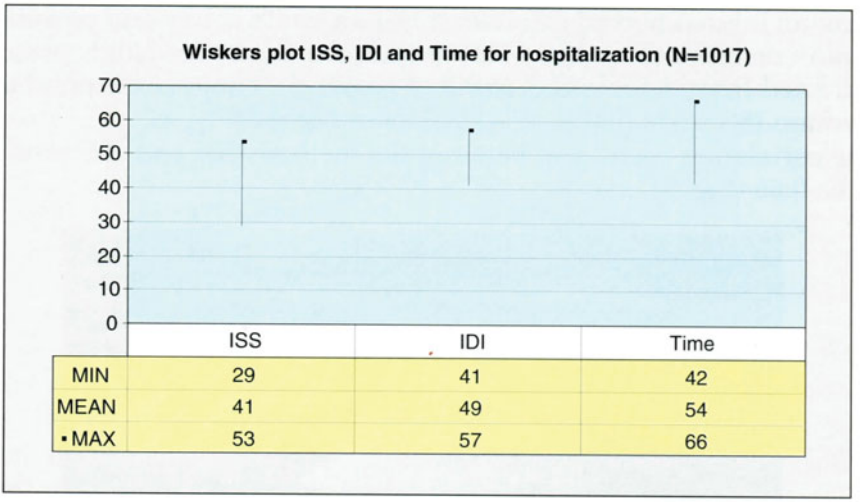


Fig. 10. The distribution of ISS, IDI and Time for hospitalization give rise to similar variable condition (a rise in IDI corresponds to a rise in ISS and, again, in time necessary for admission to hospital, and vice versa).

The IDI index is the result of our specifically oriented studies, and demonstrates an excellent predictive capacity of some aspects, such as the degree of global gravity of a road accident, serious injuries, functional invalidity.

This analysis method finally represents an useful instrument to support the decision-making in the choices of health politics addressed to the road accidents prevention.

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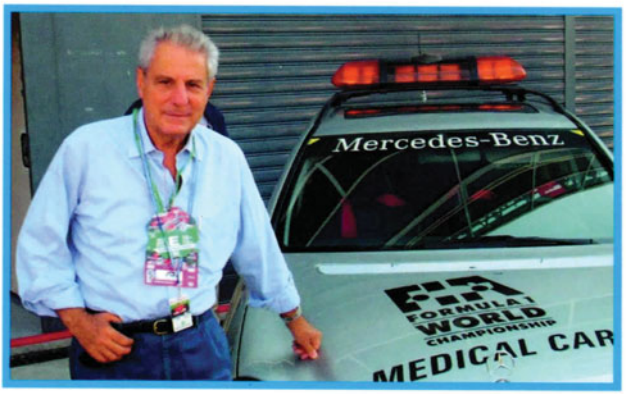

Andrea Costanzo, internazionalmente riconosciuto come una delle massime autorità scientifiche nel settore della Traumatologia della Strada e della Sicurezza Stradale, è Professore di Ortopedia e Traumatologia nell'Università "La Sapienza" di Roma e Docente di Traumatologia della Strada nelle Università di Roma "La Sapienza" e "Tor Vergata" e nell'Università di Bologna. È presidente della Società Italiana di Traumatologia della Strada (SocITraS) e della Commissione Sanità della Lega Italiana dei Diritti dell'Uomo (LIDU), vice-presidente della Società Italiana di Medicina dei Trasporti (SOCIMET) e membro dell'Association for the Advancement of Automotive Medicine (AAAM), del cui Board of Directors ha già fatto parte, del Comitato Tecnico per la Sicurezza Stradale dell'AIPCR, della Consulta Nazionale della Sicurezza Stradale del CNEL e di vari comitati ministeriali ed interministeriali istituzionalmente preposti a specifici compiti nel campo della sicurezza stradale. Da circa vent'anni coordina il Settore Medico per la Sicurezza Stradale dell'Automobile Club d'Italia (ACI). Ha collaborato con alcune industrie automobilistiche per la progettazione di sedili ed abitacoli atti a prevenire patologie vertebrali e per la ricerca di soluzioni tecnico-ergonomiche volte a migliorare la sicurezza di guida. È autore di circa 250 pubblicazioni scientifiche in materia di Ortopedia, Traumatologia, Ergonomia e Biomeccanica degli impatti. Molti degli studi cui si riferiscono tali pubblicazioni sono stati oggetto di relazioni in congressi nazionali ed internazionali. Dirige i Corsi di Perfezionamento in Traumatologia della Strada promossi dalla SocITraS in Italia e presso l'Università di Coimbra. Questi Corsi sono accreditati per l'attribuzione dei crediti formativi ECM presso i Ministeri della Salute italiano e portoghese. È membro dell'European Interest Group in Injury Scaling (EIGIS) e coordinatore scientifico dei Corsi di addestramento all'uso dell'Abbreviated Injury Scaling (AIS) organizzati su licenza esclusiva dell'AAAM.

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