TraumaRegister DGU® as basis for a global network of data on severe injuries

U Schmucker*, J Sturm*

*AUC –Academy of Trauma Surgery (AUC – Akademie der Unfallchirurgie), Landwehrstrasse 34, 80336 Munich, GERMANY

Abstract

To date, the Trauma Registry (TraumaRegister DGU® contains data of approximately 100.000 severely injured patients, 65% of which suffered from a road traffic crash. Thus, it is the world's largest data base for severely injured patients. The article describes the development of the registry and explains how it was rolled out over Germany using the established structure of the German Trauma Network (TraumaNetzwerk DGU®). In addition, this article presents three typical use cases from the fields of quality management, policy making and system-wide interventions, clinical research and injury prevention. In conclusion, the TraumaRegister DGU® is a well-established tool for various purposes related to the control and reduction of the burden of road injury. Its ongoing expansion to other countries will support the goal of international benchmarking of hospitals and trauma systems.

KEY WORDS

Injury Prevention Registry Trauma Network Quality management Road injury

INTRODUCTION

According to the World Health Organization (WHO), more than 1.3 million people are killed in road traffic crashes each year [1]. As a consequence of rapid motorization, especially in transitional countries, the death toll is expected to further increase in the next 10 years [1]. Since road injury does disproportionally affect the young and productive strata of society, road traffic crashes evolved to a substantial challenge for the national health systems and are considered a neglected epidemic. In 2011, the UN announced the "Decade of Action for Road Safety 2011-2020" and delegated the operational responsibility to the WHO. The framework of this decade consists of 5 pillars covering the major fields of activities and countermeasures. Pillar 5 of this framework is dedicated to the "Post-crash care of vicitms" [2].

The AUC – German Academy for Trauma Surgery is a 100% daughter company of the German Trauma Society (DGU) and responsible for the development, operation, and management of a broad spectrum of trauma care services, all of which are based on intensive research and development, performed jointly by the DGU, its associated working groups, and the AUC. Amongst these are clinical and prehospital courses (i.e. ATLS® for trauma physicians), a nationwide teleradiology network (TKmed®), the Trauma Network consisting of almost 900 hospitals (TraumaNetzwerk DGU®), and the Trauma Registry for severely injured patients (TraumaRegister DGU®). The latter will be addressed in detail in this article in order to explain its current and potential future use for injury surveillance.

Despite the fact, that the German Trauma Registry was initiated already in 1993 in a comparably small number of trauma hospitals, it is important to know about the development in the late 2000s, when the cases included began to increase substantially. The reason for that is, that data input into the registry was made mandatory for all trauma centers within the German Trauma Network.

The German TraumaNetwork - TraumaNetzwerk DGU®

The risk of death and all outcome parameters of severely injured patients depend directly on the efficiency of a trauma system. This correlation could be shown in several previous studies where the implementation of regional trauma networks was shown to reduce fatality rates up to 50%. Among the various causes, the existence of a rapid transportation system to an adequate target hospital with trained personnel and structural competence is of paramount significance. Since the care for severely injured patients is a highly demanding challenge for all medical professionals, a multidisciplinary and system-wide approach is inevitable when targeting a nationwide and sustainable improvement of trauma care. And although the general quality of care was already comparably high in Germany, there were significant regional variances and differences between individual hospitals [3].

As an example, the German Federal Bureau of Statistics reported road injury mortality rates that ranged from 5/100.000 (State of North-Rhine-Westphalia) to 12/100.000 (State of Western Pomerania) in 2005 [4]. In addition, previous analyses of data from the TraumaRegister DGU® revealed significant variations in the in-house fatality rates of severely injured patients [3]. Among the broad spectrum of potential causes, the heterogeneity of shock room algorithms (i.e. ATLS®), interhospital and intrahospital communication, 24/7 neurosurgical availability, and trauma specific equipment (i.e. trauma ultrasound) were considered the leading causes. In consequence, the German Trauma Society (DGU) published its “Whitebook on the Care of the Severely Injured” in 2006 [5]. This Whitebook marks an outstanding step ahead since it defines the requirements for trauma centers and their regional collaboration in terms of process and structural quality, i.e. regarding care algorithms, equipment, communication, teaching, quality assurance, research, and education of staff. A few years later, the S3-Guidelines for polytraumatized (multiple, severely injured) patient were published by the DGU and compliance with these guidelines became an immediate requirement for all trauma centers right after publication [6]. In the subsequent years after the 2006-Whitebook, the TraumaNetwork DGU® initiative was rolled-out over Germany. In order to support a nationwide compliance with the Whitebook, a dedicated auditing and certification process was set into action. Starting in 2007, trauma hospitals all over Germany could choose for an auditing by an independent certification company. As a result of this auditing, each hospital was categorized as either local, regional or supraregional trauma center. This categorization reflects each hospital’s individual capability and performance to deal with severely injured patients. After an adequate number of hospitals has been successfully audited within a defined region, these hospitals were eligible to form a so called trauma network. Finally, these trauma networks were awarded a certificate proving their very specific trauma care competence.

Currently, there are 894 registered hospitals, 573 of which have already been audited. These hospitals have formed 34 certified Trauma Networks. The majority of these hospitals were categorized as local trauma centers (53%), followed by regional (33%) and supraregional trauma centers (14%). In the upcoming year 2013, the auditing process will cover all of the missing hospitals. So, at the end of 2013, it is expected that almost 900 audited hospitals will collaborate in a total of 55 certified Trauma Networks. These hospitals represent almost 100% of the German hospitals that regularly care for

severe trauma cases. The following figure 1 shows the distribution of trauma centers and trauma networks in 2011. With regard to the established network of hundreds of trauma hospitals it is obvious, that the TraumaNetzwerk DGU® evolved to the backbone of the TraumaRegister DGU®, especially after data input to the registry became mandatory for all certified trauma centers. More information can be found at the English website www.dgu-traumanetzwerk.de

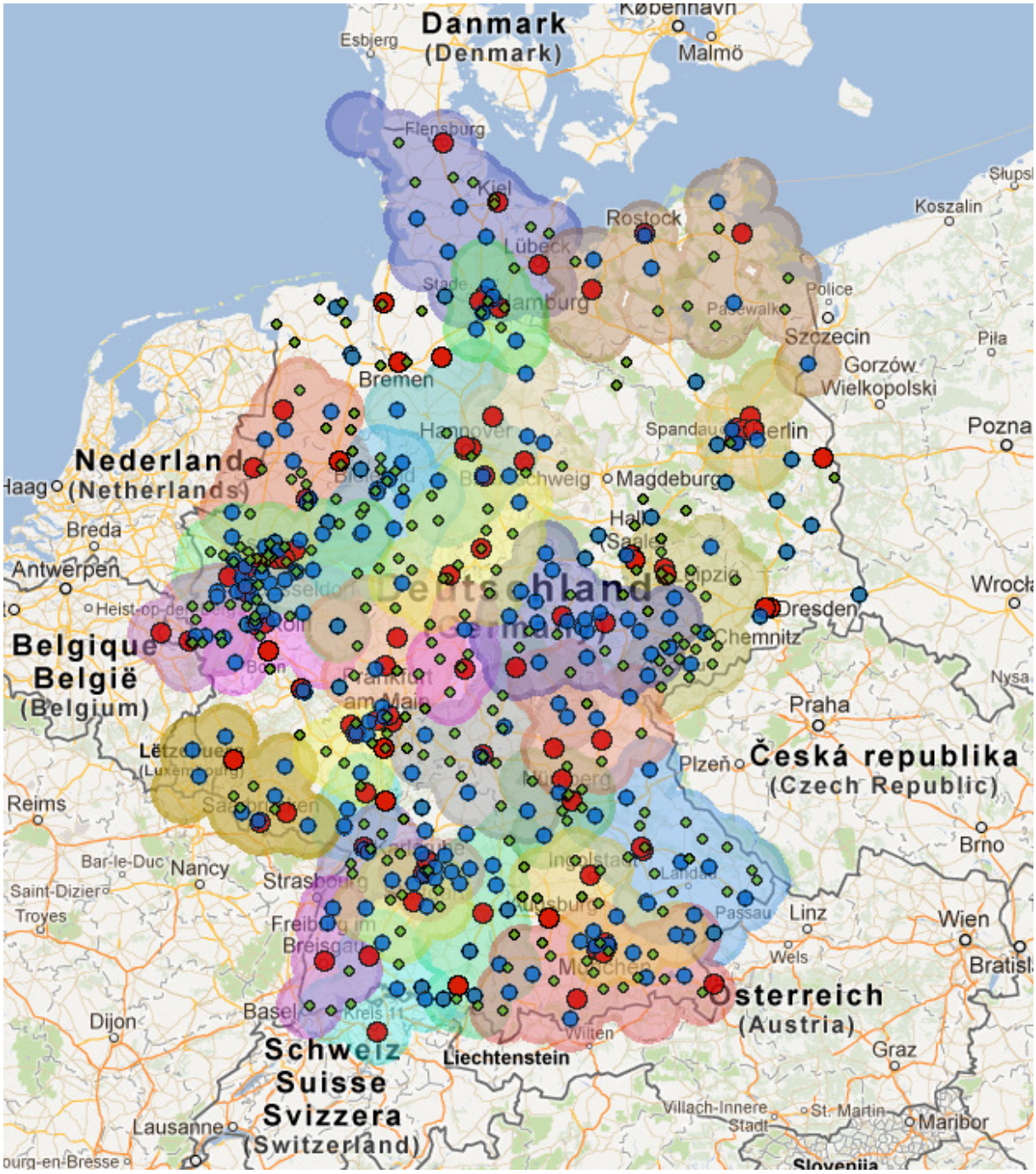

Figure 1. Supraregional (red), regional (blue), and local (green) trauma centers within the trauma networks (colored areas)

THE TRAUMA REGISTRY – TraumaRegister DGU®

The TraumaRegister DGU® was established in 1993 as an instrument for the external comparison/benchmarking of the type and outcome of care for severely injured patients. Cases with potential need for intensive care who were admitted over the shock room were eligible for documentation (inclusion criteria). Patients who died in the prehospital area as well as those from burns, drowning, poisoning, or hanging were excluded (exclusion criteria). The documentation of cases consists of about 120 data points per patient covering the prehospital phase, the early in-hospital phase, intensive care, and treatment until discharge. All injuries are coded according to the Abbreviated Injury Scale (AIS) 2005 version. Codes from the previous version (AIS-98) were matched appropriately. The documentation contains of multiple details on the chain of care, including several scores and scales to estimate the risk for complications and the risk of death.

In the late 2000s, an alternative questionnaire was introduced. This so called "questionnaire QM" (QM= quality management) was reduced to approximately 40 data points in order to ease data collection. Since data collection is mandatory for all certified trauma centers in Germany, the reduced questionnaire QM was specifically designed for smaller trauma centers, whose in-house resources were not capable of large-scale data collection. So, the questionnaire QM still recruits important data on injuries, applied care, and outcomes and can be used for quality management purposes. On the other hand side, the regular standard questionnaire is predominantly used for quality management and research purposes. All questionnaires and more information can be found at the registry's English website > www.traumaregister.de

Current Status

Since the year 2009, it's mandatory for all trauma centers to enter register data either per standard or per QM-questionnaire. Consequently, the total number of cases increased significantly. To date, the Trauma Register DGU® hosts data of approximately 100.000 severely injured patients, 65% of which suffered from a road traffic crash. Hence, it is the world's largest detailed registry for severely injured patients. Figure 2 presents the number of hospitals that actively entered data into the registry. It is noteworthy, that the nationwide roll-out of the TraumaNetwork DGU® structure in 2009 resulted in a substantial increase of participating hospitals. Subsequently, the numbers of cases did also increase over the years which is depicted in figure 3. Nevertheless, it is important to know, that especially smaller trauma centers did register in the last couple of years. Hence, the increase in cases is not proportional to the number of hospitals since smaller trauma centers usually care for smaller number of patients.

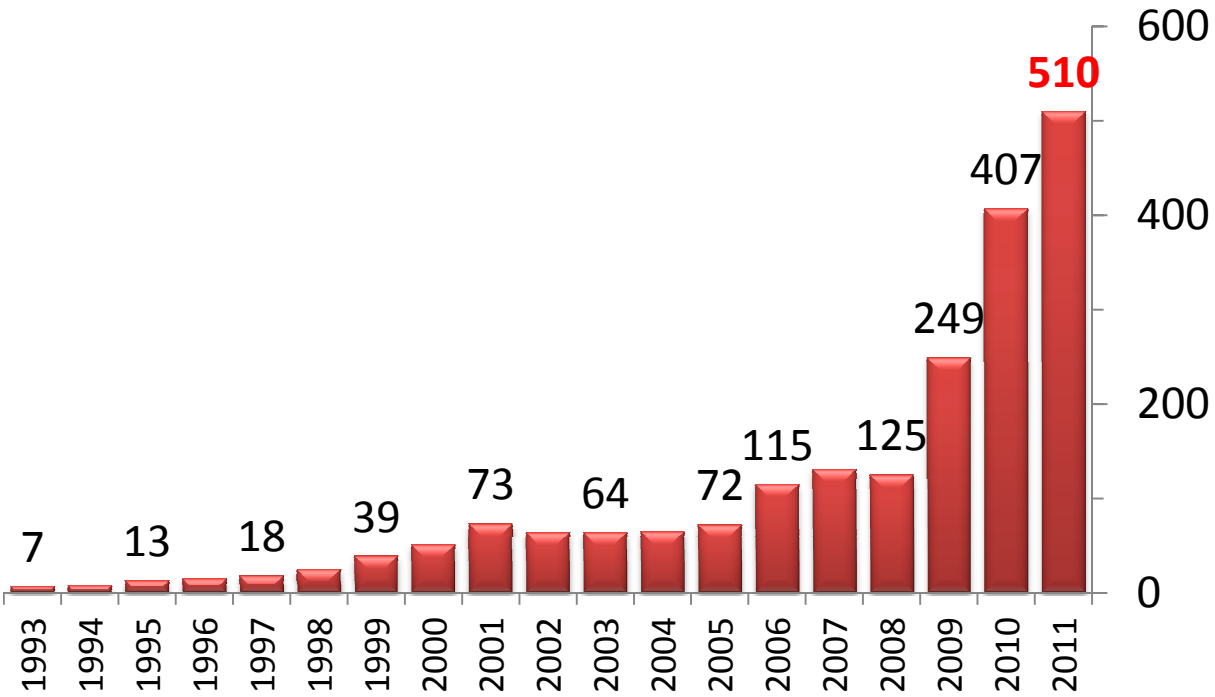

Figure 2. Development of participating hospitals (x-axis: no. hospitals)

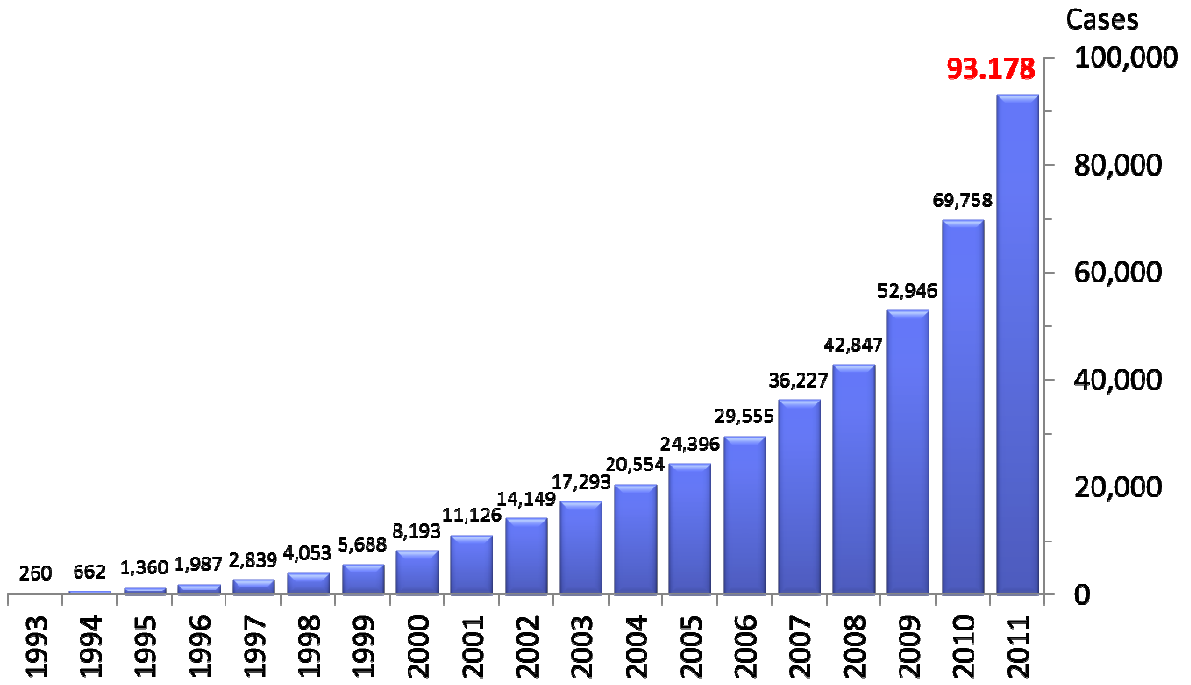

Figure 3. Development of cases in the TraumaRegister DGU® (x-axis: no. cases)

In 2013, approximately 900 trauma centers in 55 certified trauma networks will cover almost 100% of Germany. In consequence, the TraumaRegister DGU® will cover >90% of all severely injured patients in Germany beginning in 2013. It is expected, that the input of cases will reach its ceiling at approximately 25.000-30.000 cases per year beginning in 2013.

Despite the fact that the majority of data are from German trauma centers, the TraumaRegister DGU® initiative has reached international significance. In so far, the data base can be considered a pioneer in international trauma hospital and trauma systems benchmarking. The registry's 2011 annual report listed the participating hospitals as follows: Germany (487 trauma centers), Austria (13), Slovenia (4), The Netherlands (3), Luxembourg (2), Belgium (1), Switzerland (1), United Arab Emirates (1), and China (1). In this context, the registry's initiative of a global roll-out has received extraordinary attention within the last couple of years. To date, the neighboring countries Switzerland and Austria, but also other European countries like Spain, are interested in use the registry as a model for their own national registries. In promoting a European roll-out, the TraumaRegister DGU® is also a pioneer and key actor in the development of cross-border approaches that might be the foundation of a future European Trauma Registry. The following chapter presents different purposes and use cases of the registry. They are to be seen as examples since a complete overview cannot be given in this article.

USE CASES OF THE TraumaRegister DGU®

Quality management

In modern health systems, quality management is performed at various levels. A solid data base is inevitable for any such efforts to improve the quality of health care. For example, data can be used by the hospital management and physician in order to improve clinical pathways and equipment that help to save time and resources (timelines, algorithms, equipment). But also community rescue services and other players can benefit from a systematic understanding of how, where, and when patients are rescued, transported, and cared for.

The TraumaRegister DGU® provides data for quality management on different levels. First of all, an annual report is provided to each of the participating hospitals. Each report does clearly present numerous benchmarks from the total chain of care. These include several timelines (e.g. time from emergency room to operation room), several indicators related to clinical algorithms (e.g. rate of endotracheal intubation), documentation quality (appropriateness and completeness of patient charts), and many other quality indicators. To summarize, the following data are automatically presented to each participating hospital: Comparison of mortality and prognosis, basic longitudinal data, indicators of structural and process quality, analysis of individual cases, data on incident and injury mechanism, quality of documentation, trauma scores and outcome scores, injury patterns, and general data. Examples of the annual reports can be found at the English website www.traumaregister.de

As an example, figure 4 illustrates the significant decrease of time spent in the emergency room prior to transport to the Operation room or the Intensive Care Unit.

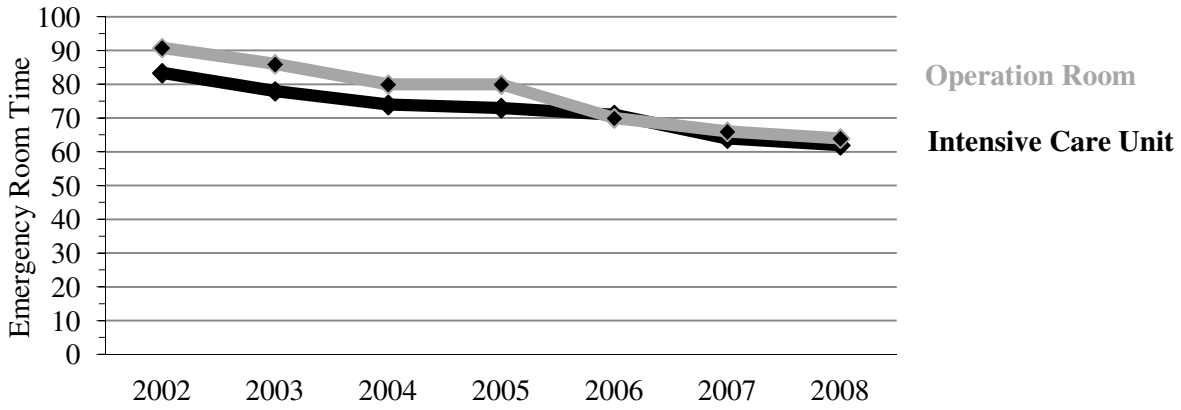

Figure 4. Emergency room time per target (operation room versus intensive care unit)

Last but not the least, the so called RISC-Score is automatically calculated for each individual patient. The RISC-score is an estimation of the risk of deaths and based on anatomical and physiological variables. In the annual report, the overall fatality rate of patients from ONE hospital can then be compared to the benchmarks of ALL OTHER hospitals in the registry. However, it is important to know, that each hospital does only receive detailed data on their own hospital and own patients, while the benchmarking results from pooled data of other hospitals. Figure 5 shows the graphic demonstration of expected mortality as derived from RISC prognosis compared to the real, observed mortality. In this example, “Your hospital” had a lower mortality in 2011 compared to 2010, although not significant. Interestingly, “Your hospital” had a significantly higher mortality when compared to the pooled mortality from all other trauma centers.

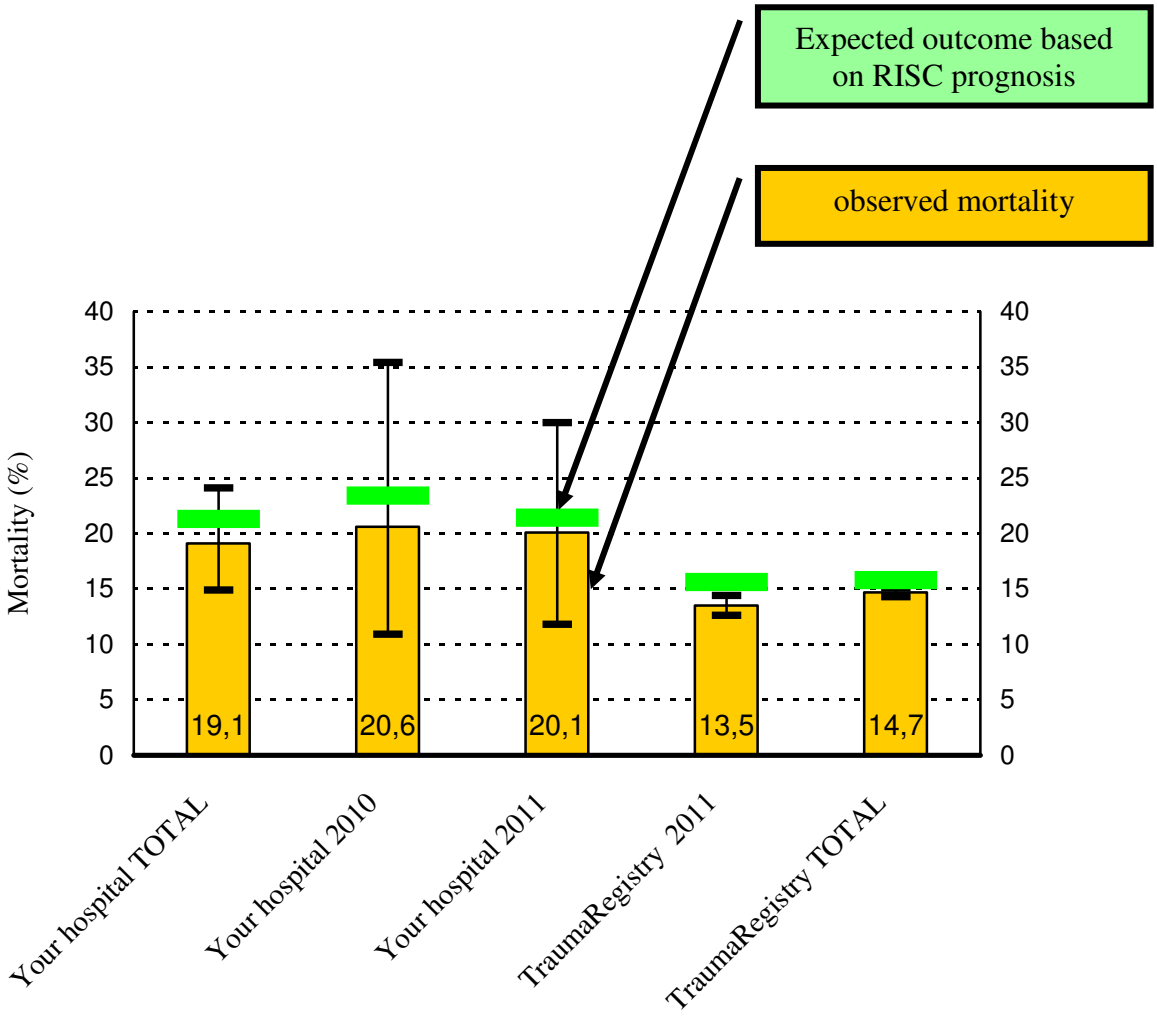

Figure 5. Expected versus observed mortality in various samples.

Policy making and system-wide interventions

Background: In Germany, the federal crash statistics are based on police reports. The medical outcome of a road crash has to be reported to the federal statistics bureau using one out of four categories:

1. No injury

2. Minor injury = any injury with ambulant treatment or in-patient treatment < 24 hrs

3. Severe injury = any injury with in-patient treatment > 24 hrs

4. Fatal injury = any fatal outcome that occurs within 30 days from the incident

Nevertheless, from the policy making and research perspective, this categorization is inadequate, since it does not discriminate between the main samples of interest. From the medical perspective, a severely injured patient shall carry a certain risk of deaths or else serious consequences. However, AIS 1- and 2-injuries can be frequently found in the federal crash statistics' category "severely injured" although they have an almost 0% risk of death. As a result, the analysis of the longitudinal

development of crash statistics (e.g. number of medically severely injured patients) is almost impossible and can't be use for an objective injury and outcome surveillance.

Therefore, the German Trauma Society and the AUC - Academy of Trauma Surgery are collaborating with the German Federal Highway Research Institute (bast) in order to support an evidence-based and applicable framework for a new definition of injury outcomes after road crashes. Detailed registry data of more than 50.000 cases were used. As a result, a new definition for Germany was proposed using an MAIS 3 plus need for Intensive Care as a threshold between "severe injury" and the new category "life threatening injury". The following table 2 presents the deciding differences in mortality rates.

Table 2: Mortality per need for Intensive Care and MAIS category

MORTALITY	*MAIS 1-2	*MAIS 3-6
Intensive Care YES	<1%	<2%
Intensive Care NO	<2%	**14%**

* Maximum Abbreviated Injury Score

In a similar context, the German Trauma Society has shared his knowledge and data with the European Commission and proposed a common European definition of severe road injury. In this context, an MAIS of $\geq$ 3 was proposed as the new threshold.

Clinical research and injury prevention

Data from the TraumaRegister DGU® has been extensively used for various research projects. Studies using registry data have been published in the most high-ranked medical journals, including The Lancet, Journal of Trauma, Critical Care Medicine, Injury, Journal of Neurotrauma, and many more Furthermore, it served for reports to the German Ministry of Transport and the associated Federal Highway Research Institute [7]. All publications are listed on the registries website: www.traumaregister.de > click button "publications". As an example, the figure 6 shows the distribution of injuries per AIS-body region in a sample of n=7.207 patients with an Injury Severity Score (ISS) > 9.

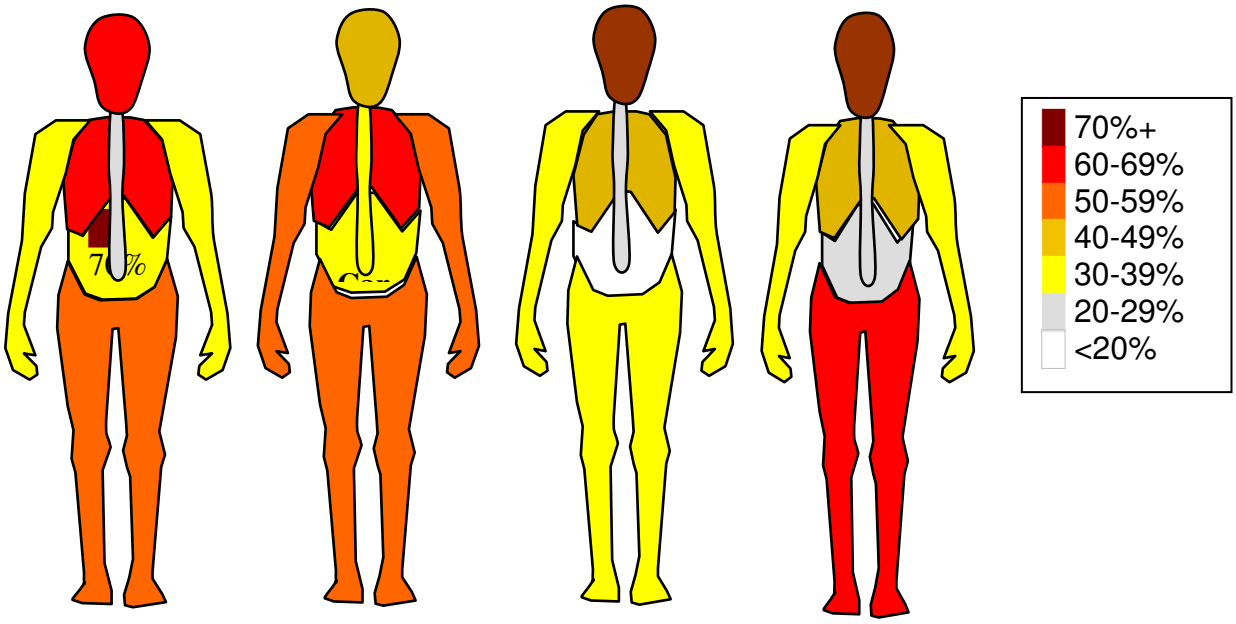

Figure 6. Frequency of AIS2+ injuries per AIS-body region (modified according to [7])

FUTURE PERSPECTIVES

Where do we want to be in the year 2015? The trauma registry is still about to increase its annual data input and is aiming at an annual input of 25.000 – 30.000 severely injured patients from Germany. These numbers are considered a case maximum for Germany. However, other countries, regions, and hospitals demonstrated a great interest in importing and integrating the trauma registry. Amongst these are isolated satellite centers all over the world, e.g. in China and the United Arab Emirates. Such satellite centers are quite valuable in serving as reference centers, promoting the registry philosophy in their respective regions, and assisting in the development of regionally adapted questionnaires and recruitment algorithms. Next to isolated satellite centers, the TraumaRegister DGU® is serving as a model for regional and nation-wide approaches in other European countries. Such would be a huge step towards an international benchmarking of trauma systems and hospitals.

Aside from the core registry with its core data set, the near future will show, how associated data subsets (e.g. for specific crash mechanisms, specific injuries, specific surgical procedures) can be integrated in the existing infrastructure of the data base. In the same context, the registry is working on the establishment of data links to the federal crash statistics data base and other medical data bases. Such would expand the use of the registry as a profound public health tool and an optimized tool for road injury surveillance and monitoring.

For more information about the trauma network or trauma registry please visit the websites www.traumaregister.de and www.dgu-traumanetzwerk.de in English language or contact the author Mr. U. Schmucker, M.D.: uli.schmucker@auc-online.de

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