Committee on Emergency Medicine, Intensive Care and Trauma Management of the German Trauma Society (DGU)

AUC - Academy for Trauma Surgery

Annual Report 2024

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TraumaRegister DGU®

General Annual Report

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Annual Report 2024 - TraumaRegister DGU®

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Content

Preface

Dear readers,

We are pleased to send you the TraumaRegister DGU® general **2024 annual report**.

This edition includes data for the seriously injured in 2023 (basic group), which were documented by the participating hospitals through the end of March 2024. In 2023, this basic group is comprised of 31,217 cases, according to the TraumaRegister DGU® definition of a seriously injured person.

Following last year's increase (6% more cases in 2022 than in 2021), the number of cases in the basic group has remained constant. Over the last ten years, the average age in the basic group has increased from 52.8 to 54.5 years, with the proportion of over 69-year-olds rising from 27.2 % to 30.1 %. Of the 25,208 patients who received primary care, the average injury severity according to ISS was 17.6 points; 70% were male. Of these patients, 7.4 % died in hospital. The mortality prognosis for these patients was 8.1% (RISC II). In 2023, a total of 37,590 patients were documented in the TraumaRegister DGU®. In primary diagnostics in the trauma room, the use of chest X-rays has fallen steadily in recent years. In 2019, a chest X-ray was documented in 24.5 per cent of cases in the trauma room. In 2022 and 2023, it was only 17% of cases. The prehospital use of pelvic belts for unstable pelvic fractures rose from 37% in 2019 to 47% in 2021. Since 2021, this proportion has been just under 50%.

At the end of 2023, a total of 699 hospitals were participating in the TraumaRegister DGU®. In addition to the 627 hospitals from Germany, hospitals from from eight other countries are also participating in the registry. This includes 16 hospitals from Austria, 33 from Belgium and 9 from Switzerland.

We sincerely hope that the annual report will again provide you with findings that contribute to the further improvement of care for severely injured patients, in regards to quality assurance and health services research. In 2023, 17 scientific papers were published using data from the TraumaRegister DGU®. We would like to thank the authors, reviewers and all contributing clinicians for their commitment.

Sincerely yours,

Sebastian Imach Heiko Trentzsch Rolf Lefering

Christine Höfer Stefan Huber

1 Number of cases

Inclusion criteria for documenting a patient in the TraumaRegister DGU® (TR-DGU) are admission via the emergency room and the need for intensive care. Patients who died before ICU admission should also be included. This pragmatic criterion was chosen to avoid complicated score calculations in the emergency room and to limit the documentation to patients with relevant, serious injuries.

However, the number of documented patients with only minor injuries has continuously increased over the years. This is not only unnecessary work for the hospitals, but more importantly it makes it difficult to draw comparisons both between hospitals and over time. Therefore, in 2015 a **basic group** was defined and nearly all analyses presented in this report refer to this patient group only (i.e. not to all documented patients).

The severity of each injury is described using the Abbreviated Injury Scale (**AIS**), which classifies severity from 1 (minor) to 6 (maximal). Using these severity grades, more sophisticated measures like the maximum AIS (**MAIS**), the Injury Severity Score (**ISS**) or the New ISS (**NISS**) can be derived.The **basic group** of the TR-DGU is defined as:

All patients with MAIS ≥ 3 AND all MAIS 2 patients who died or were treated in the intensive care unit.

The following flowchart gives an overview of the composition of the basic group.

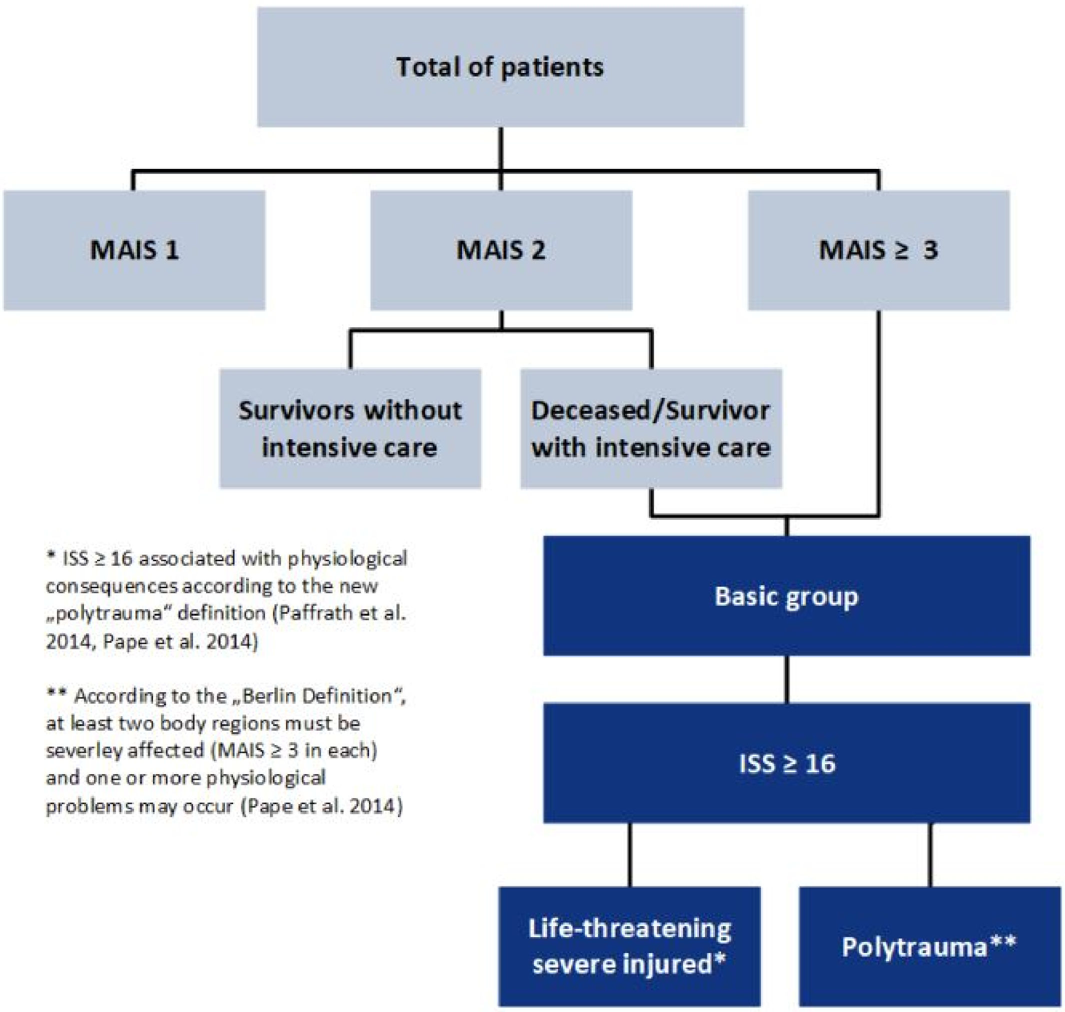


Figure 1: Flowchart describing the composition of the basic group

The following table shows the data of groups as defined in figure 1. The table is broken down by the MAIS criteria as well as the basic group and selected subgroups.

Table 1: Number of cases in 2023 from the TR-DGU

	TR-DGU 2023	Primary admitted	Transfer in	Early transfer out
Total number of documented patients.	**37,590**	32,677	2,611	2,302
MAIS 1 For these patients, the most severe injury was AIS grade 1 (MAIS = 1). Thus, they were not severely injured. Furthermore, the RISC II* prognostic score has not been validated for these cases and they were excluded from all further analyses (except chapter 5.3).	**3,403** (9 %)	3,263	24	116
MAIS 2 survivors without intensive care The most severe injury was of AIS grade 2. These patients survived and did not receive intensive care.	**2,787** (7 %)	4,239	193	175
MAIS 2 deceased or survivors needing intensive care The most severe injury was of AIS grade 2. The patients died or survived but required intensive care.	**4,742** (13 %)	24,050	2,254	814
MAIS ≥ 3 The most severe injury was of AIS grade 3 or more (MAIS 3+). This criteria is also used by the EU as an internationally agreed to definition of a „*serious injury*" in the context of road accidents.	**26,475** (71 %)	22,506	2,295	1,673
Non-basic group Patients with MAIS 1 as well as patients with MAIS 2 that survived without intensive care.**	**6,190** (16 %)	5,667	70	453
From this point onward all absolute numbers and percentages refer only to the basic group				
Basic group This definition includes all MAIS ≥ 3 patients and MAIS 2 patients who died or were treated on the intensive care unit. Patient age must also be documented.	**31,217**	**26,870**	**2,498**	**1,848**
Intensive care Patients admitted to the ICU.	**25,916** (83 %)	22,905	2,241	769
Deceased Patients who died in the acute care hospital.	**3,815** (12 %)	3,519	296	0
ISS 16+ The definition ISS ≥ 16 (or > 15) is commonly used to define a serious injury.	**17,283** (55 %)	14,387	1,729	1,166
Life-threatening severe injury Injury severity of ISS ≥ 16 in conjunction with physiological problems according to the „polytrauma" definition (Paffrath et al. 2014, Pape et al. 2014).	**10,004** (32 %)	8,645	794	565
Polytrauma According to the „Berlin Definition", two body regions are severly affected and one or more physiological problems are present (Pape et al. 2014).	**4,687** (15 %)	4,215	259	213

* RISC II: Revised Injury Severity Classification: Version 2; Lefering et al. 2014

**Exclusive cases that are documented as part of TR-DGU modules

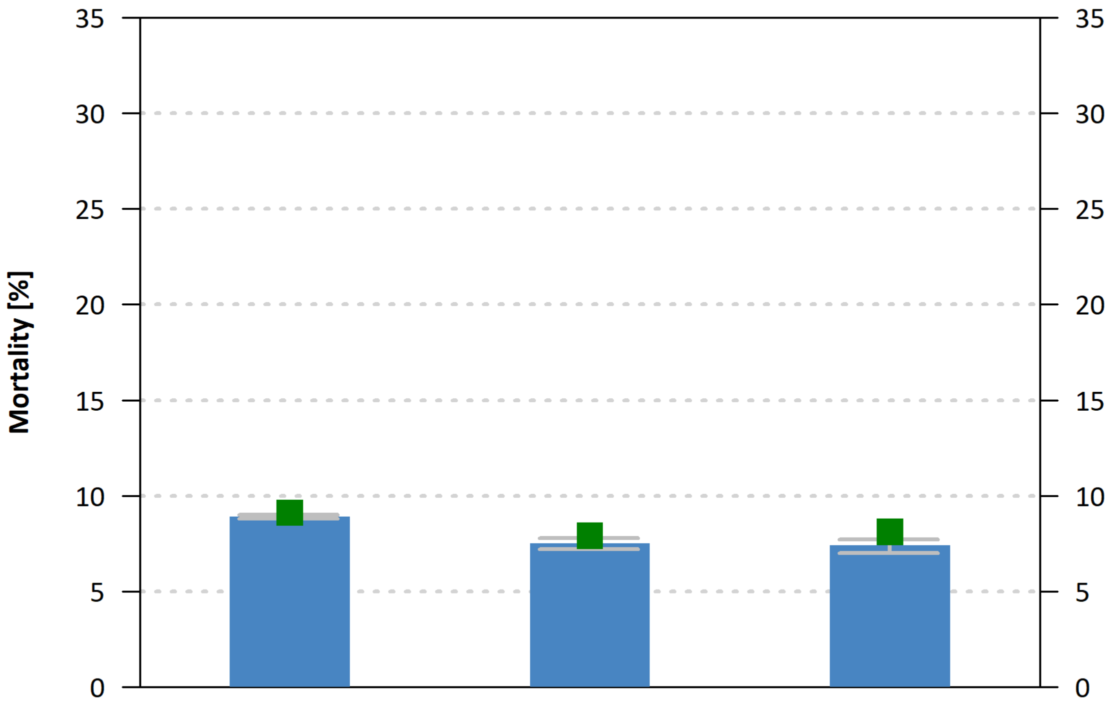
2 Observed mortality and prognosis

Comparing the observed **mortality** of severely injured trauma patients with their **prognosis** is a central element of quality assessment in the TraumaRegister DGU®. Here, the risk of death prognosis is derived using the **RISC II** prognostic score (Revised Injury Severity Classification; Lefering et al. 2014). This score can be calculated for all primarily admitted patients. The analysis in chapter 2 is confined to the **basic group** as defined on page 5.

No. of basic group patients documented in the TR-DGU in the last 10 years (2014-2023)	n = **320,909**
- of these, documented last year (2023)	n = **31,217**
- of these, only primary cases (no transfer in; no early transfer out; no patients deceased within the first week with a patient's volition)	n = **25,208**

Comparisons of mortality and risk of death prognosis will be performed for **primary admitted patients** only (Figure 2). For patients **transferred in** from another hospital (n = 2,498 in 2023), the initial status from primary admission is missing; for patients **transferred out early** (within 48 hours after admission; n = 1,848 in 2023), no final outcome is documented. Additionally, patients deceased within the first week with a patient's volition (n = 1,662 in 2023) are excluded from this analysis to ensure a correct presentation of the quality of treatment in a hospital.

The mean age of the remaining 25,208 patients was 53.4 years and 70 % were male. The mean ISS was 17.6 points. Of these patients 1,857 died in hospital, which is **7.4 %** (95 % CI: 7.0 - 7.7). The risk of death prognosis based on RISC II is **8.1 %**. You find these values for the TR-DGU in figure 2.



	TR-DGU 10 years	TR-DGU 2022	TR-DGU 2023
No. of pat. (n):	263,676	25,280	25,208
Mortality [%]:	8.9	7.5	7.4
RISC II [%]:	9.1	7.9	8.1

Figure 2: Observed mortality and risk of death prognosis (RISC II)

<u>Expanded information for Figure 2:</u>
The bars represent the observed mortality rate; percentages are given in the table at the bottom of each bar. The predicted mortality rate, RISC II, is given as a yellow **box**. This box turns to green or red in case that the observed mortality is significantly lower (= better) or higher (= worse) than expected, respectively. For the interpretation of the results, it must be considered that these findings depend on statistical uncertainty. Therefore, the 95 % confidence interval (CI) for the observed mortality rate is given as well (grey vertical error bars). The 95 %-CI describes a range of values which covers the „true" value with a high probability (95 %). The more patients a value is based on, the narrower the CI.

Data quality for the risk of death prognosis

The validity of a prognosis depends on the quality and the completeness of the variables required for its calculation. In the TR-DGU two different documentation types are used, the standard and the QM dataset. The standard dataset includes all parameters that are recorded by the registry. The QM dataset is a reduced version of the standard dataset. The risk of death prognosis **RISC II score**, developed for the TraumaRegister DGU®, is based on 13 different variables. Since the revision of the dataset in 2015, all 13 required variables are recorded by both datasets. Even though the only mandatory components are age and injury severity, every additional piece of information increases the accuracy of the outcome prediction.

Therefore, additional information on the data quality of the variables used for the prognosis is provided here. If all data required for calculation of the RISC II score were recorded, or if only one value was missing, then this patient was considered as a **„well documented"** case. The percentage of well documented patients (per hospital) is then used to quantify the data quality of outcome prediction. The following applies:

- (green) **more than 95 %** of cases were well documented,
- (yellow) **80 - 94 %** of cases were well documented,
- (red) **less than 80 %** of cases were well documented.

Table 2: Data quality for the calculation of the RISC II score

	TR-DGU 10 years	TR-DGU 2022	TR-DGU 2023
Total cases (n)	263,676	25,280	25,208
„Well documented" (n)	211,128	20,640	20,525
„Well documented" (%)	80	82	81
Data quality colour code	(yellow)	(yellow)	(yellow)
Average number of missing values per patient for the calculation of the RISC II	0.9	0.8	0.8

Mortality *vs.* risk of death prognosis

Figure 3 compares the **observed mortality** of each hospital with their respective **RISC II prognosis for all the hospitals participating in the TR-DGU in 2023**. The **deviation** of the observed mortality from the expected prognosis is plotted against the number of patients. Negative values correspond to mortality rates lower than expected. The grey lines represent the 95 % confidence interval. Hospitals with **fewer than 5 patients** are not included due to the large statistical uncertainty.

TR-DGU 2023:	Patients in the basic group:	**25,208**	primary admitted cases
	Deviation between mortality and prognosis:	**-0.7 %**	

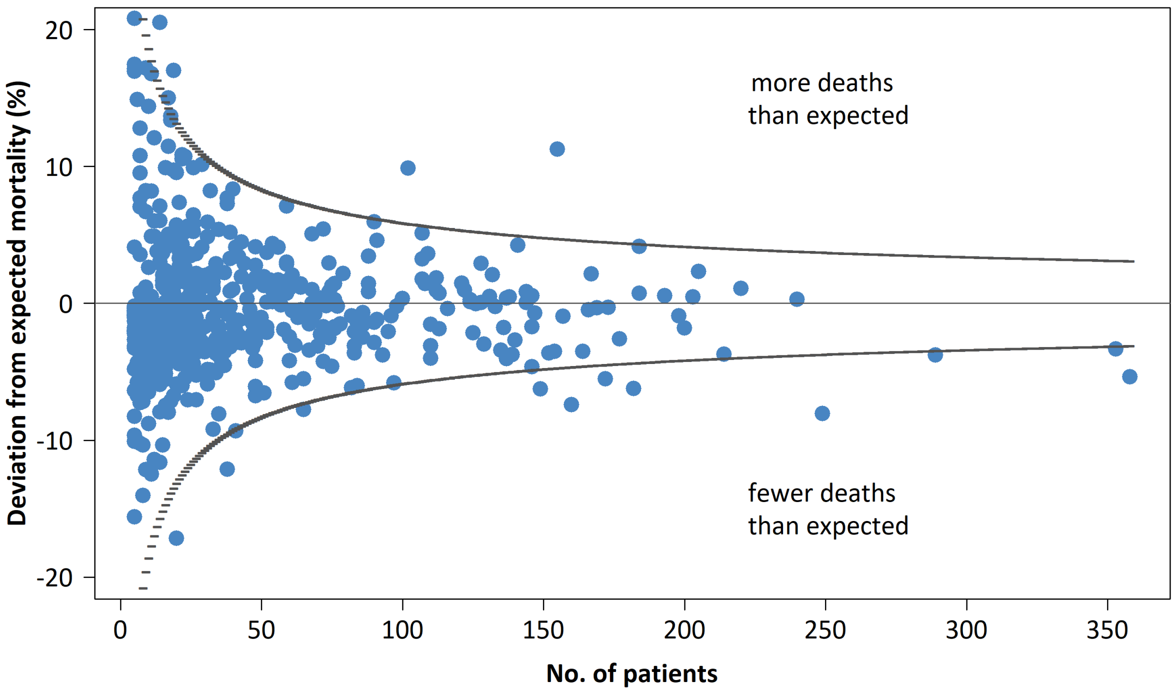


Figure 3: Deviation between the observed mortality and the risk of death prognosis (RISC II) of every hospital participating in the TR-DGU with more than 5 cases in the year 2023

3 Basic data from the last 3 years

The results in table 3 refer to the **basic group** only excluding patients with minor injuries and survivors without intensive care treatment. Attention: Results should be interpreted with caution when the number of patients is < 5!

Table 3: Overview of the data from the TR-DGU in the basic group from the last 3 years

		TR-DGU			
		10 years	2021	2022	**2023**
Total number of patients	(n)	320,909	29,327	31,342	**31,217**
Primary admitted and treated patients	(n)	272,399	25,106	26,890	**26,870**
Patients transferred out early	(n)	20,648	1,734	1,978	**1,848**
All primary admissions	(n)	293,047	26,840	28,868	**28,718**
Patients transferred in	(n)	27,861	2,487	2,474	**2,498**

Table 3 continuation:

		TR-DGU			
		10 years	2021	2022	**2023**
Demography (all patients in the basic group)					
Mean age	[years]	52.8	54.3	54.4	**54.5**
70 years or older	[%]	27.7	29.8	29.3	**30.1**
Proportion male	[%]	69.6	68.9	69.5	**69.6**
Trauma (all patients in the basic group)					
Blunt trauma	[%]	96.0	95.9	95.9	**95.6**
Mean ISS	[points]	18.3	18.1	18.4	**18.5**
ISS ≥ 16	[%]	54.3	53.6	54.6	**55.4**
TBI (AIS head ≥ 3)	[%]	36.7	36.2	36.9	**37.7**
Prehospital care (only primary admissions)					
Intubation by emergency physician	[%]	19.6	18.1	18.7	**18.0**
Unconscious (GCS ≤ 8)	[%]	16.0	14.7	15.4	**15.1**
Shock (RR ≤ 90 mmHg)	[%]	8.3	7.6	8.1	**8.2**
Average amount of volume	[ml]	615	587	582	**572**
Emergency room care (only primary admissions)					
Whole-body CT	[%]	76.2	73.5	74.8	**72.7**
X-ray of thorax	[%]	26.5	18.8	16.7	**17.2**
Patients with blood transfusion	[%]	7.4	7.7	7.8	**8.3**
Treatment in hospital (all patients in the basic group)					
Patients with surgery 1)	[%]	66.2	67.3	65.4	**65.2**
if yes, no. of pat. with surgery 2)	[n]	3.3	3.5	3.2	**3.0**
Patients treated in the ICU	[%]	85.8	83.3	83.8	**83.0**
Length of stay in the ICU 3)	[days]	6.2	5.9	6.1	**6.1**
Intubated/ventilated patients in the ICU 3)	[%]	36.2	34.3	34.0	**34.8**
Length of intubation 3)	[days]	7.2	6.8	6.9	**6.8**
Outcome (all patients in the basic group)					
Length of stay in hospital 4)	[days]	15.3	14.4	14.5	**14.5**
Hospital mortality 4)	[n]	35,618	3,426	3,831	**3,815**
	[%]	11.9	12.4	13.0	**13.0**
Multiple organ failure 2) 4)	[%]	17.8	15.4	15.6	**14.5**
Discharge to other hospital	[%]	17.4	16.8	16.7	**17.4**

1) years where less than 20 % patients underwent surgery are excluded

2) not available in the reduced QM dataset

3) only ICU patients

4) excludes patients transferred out early

4 Indicators of process quality

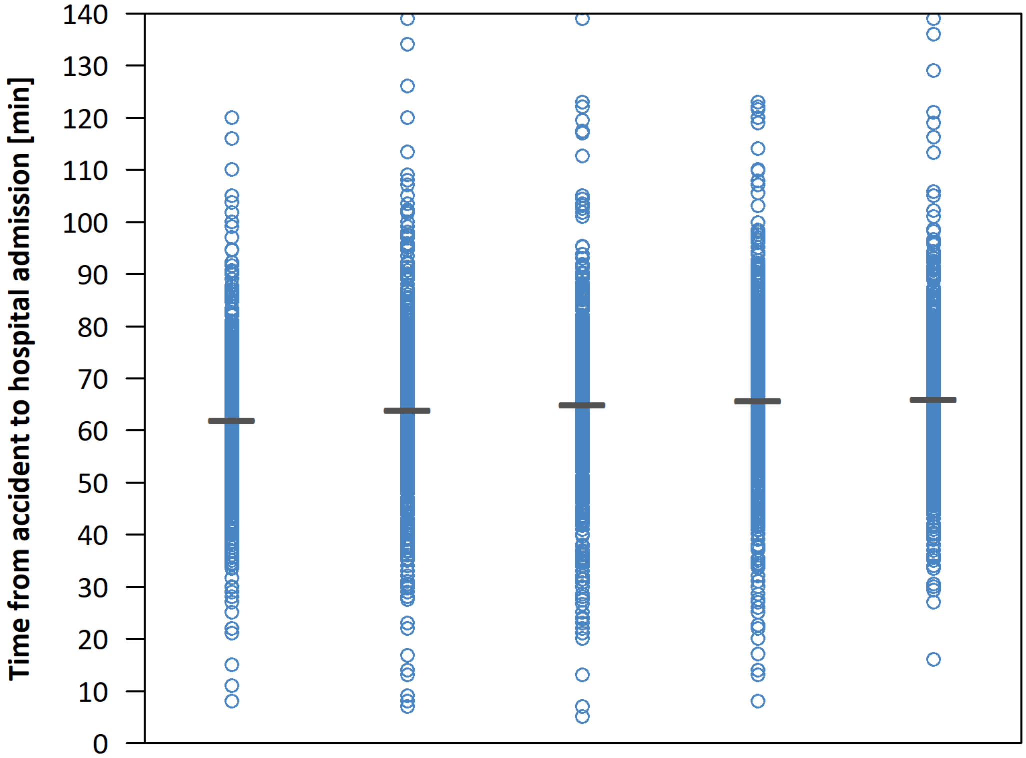
Quality indicators are measurements which are presumed to be associated with the quality of care and outcome. All results presented here are based on **primary admitted cases only from the basic group in 2023** with valid data or respective subgroups thereof. This includes early transfer out cases.

For each indicator, the distribution of the values of all participating hospitals is presented graphically over time. The light blue circles present the individual hospital values. The grey horizontal line is the mean across all hospitals for that year.

4.1 Prehospital indicators

4.1.1 Prehospital time

The sooner a patient reaches a trauma centre, the earlier life-saving interventions can be performed. Only patients with ISS ≥ 16 are included here. The time period from accident until hospital admission is presented as an average value in minutes. Implausible time values < 5 minutes and > 4 hours are excluded.

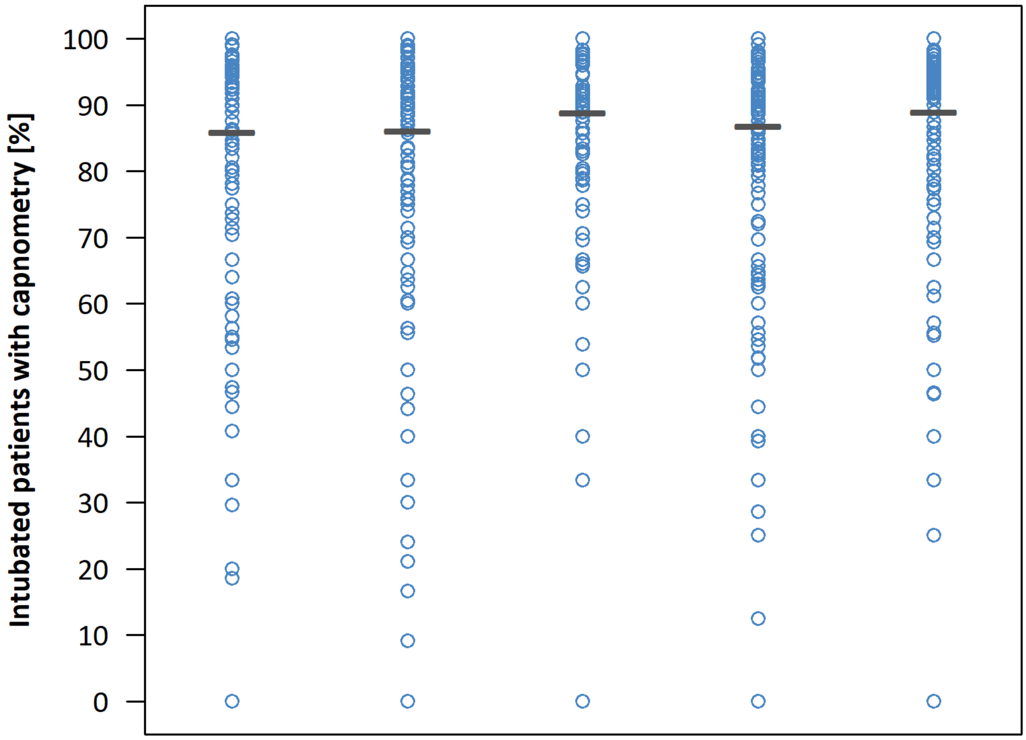


Year:	2019	2020	2021	2022	2023
TR-DGU:	62 [min]	64 [min]	65 [min]	66 [min]	66 [min]
n:	10,944	11,135	10,518	11,284	11,400
Min-Max:	5-240 [min]	5-240 [min]	5-240 [min]	5-240 [min]	5-240 [min]

Figure 4: Distribution of the mean duration from accident until hospital admission of patients with mit ISS ≥ 16 over all hospitals, 2019-2023, — TR-DGU, o single hospital value

4.1.2 Capnometry in intubated patients

Capnometry helps to assess the effectiveness of intubation in intubated patients. Only patients with a prehospital endotracheal intubation with valid data for capnometry are considered here. Intubated patients without information regarding capnometry cannot be analysed (n = 1,399).

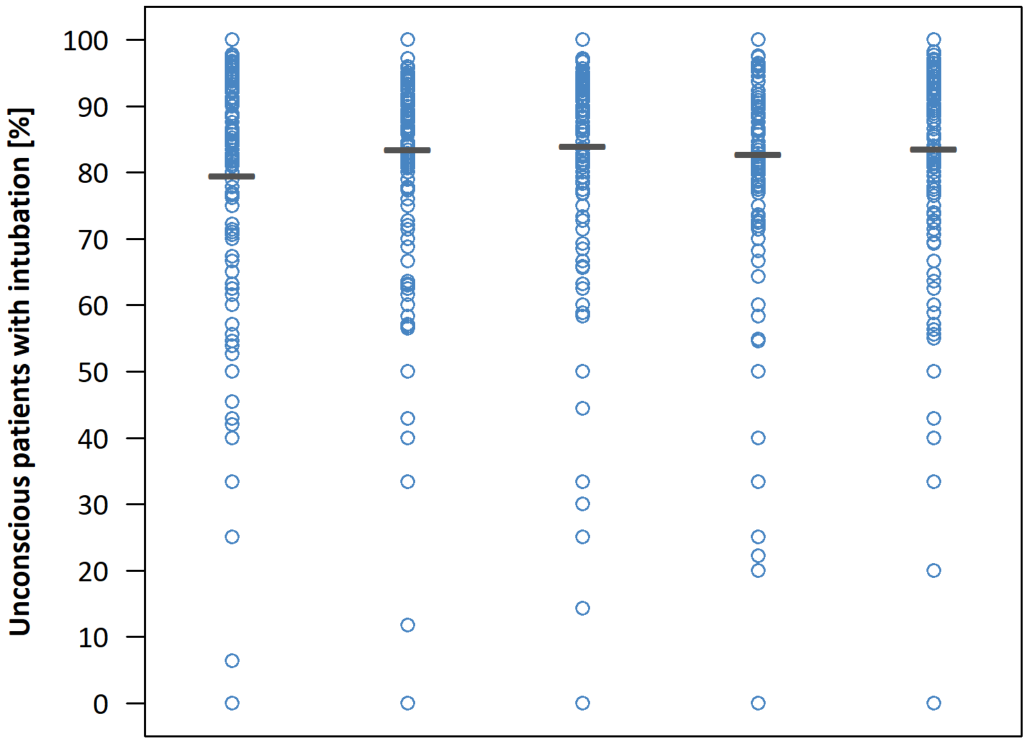


Year:	2019	2020	2021	2022	2023
TR-DGU:	86 %	86 %	89 %	87 %	89 %
Capnometry (n):	3,199	3,038	3,062	3,352	3,365
Intubated (N):	3,723	3,526	3,448	3,862	3,782

Figure 5: Distribution of the capnometry rate in prehospital intubated patients over all hospitals, 2019-2023, — TR-DGU, o single hospital value

4.1.3 Intubation of unconscious patients

The prehospital intubation of unconscious patients guarantees an oxygen supply until the hospital is reached. Only patients with a prehospital documented GCS ≤ 8 are considered here, regardless of the injury severity. When information on intubation is missing it is considered as „no intubation", while an alternative airway is counted here as „intubation".

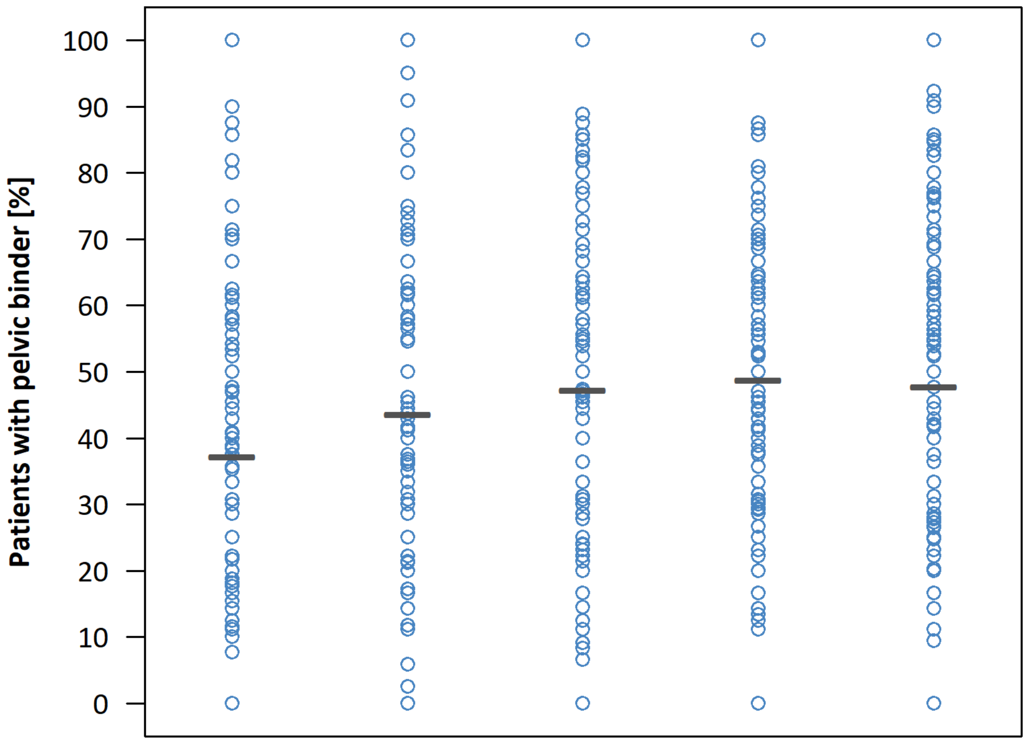


Year:	2019	2020	2021	2022	2023
TR-DGU:	80 %	83 %	84 %	83 %	84 %
Intubated (n):	3,324	3,247	2,980	3,281	3,238
Unconscious (N):	4,179	3,889	3,550	3,966	3,876

Figure 6: Distribution of the intubation rate in unconscious patients over all hospitals, 2019-2023, — TR-DGU, o single hospital value

4.1.4 Pelvic binder in pelvic fracture

The stabilisation of an instable pelvic fracture can help to improve the hemodynamic status of the patient. Only cases with a pelvic fracture (AIS severity 3 to 5) are considered here. The pelvic binder is documented in the standard dataset only.



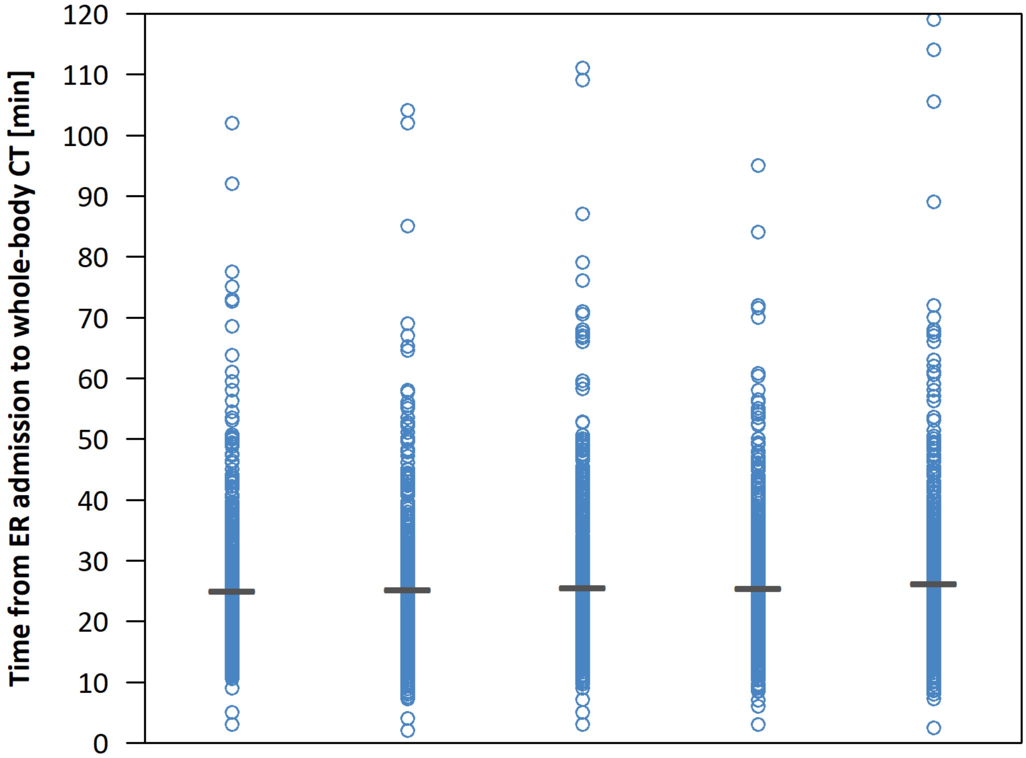
Year:	2019	2020	2021	2022	2023
TR-DGU:	37 %	44 %	47 %	49 %	48 %
Pelvic binder (n):	506	625	798	876	907
Pelvic fracture (N):	1,361	1,432	1,690	1,794	1,898

Figure 7: Distribution of the pelvic binder rate in patients with an instable pelvic fracture over all hospitals, 2019-2023, — TR-DGU, o single hospital value

4.2 Process times in the emergency room

4.2.1 Time until whole-body CT

If a whole-body CT is indicated, it should be performed immediately after admission to the ER in order to initiate subsequent interventions in a timely manner. Time periods > 120 minutes are excluded from the following analysis. All patients who received a whole-body CT are considered here.

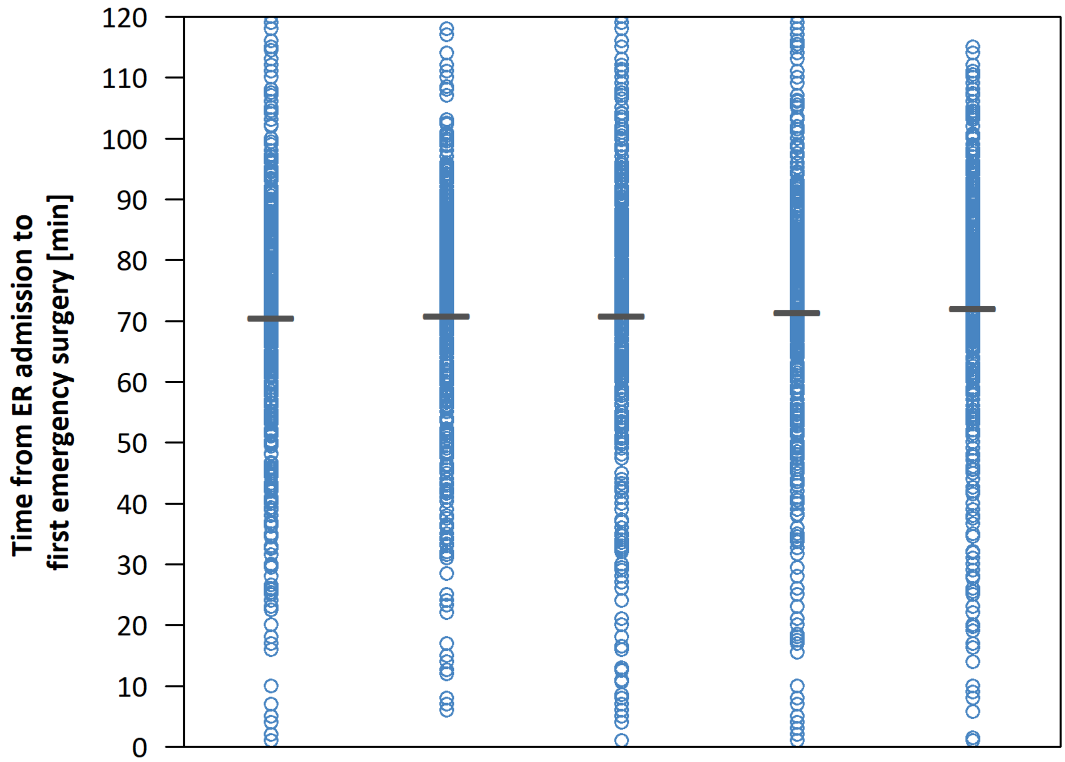


Year:	2019	2020	2021	2022	2023
TR-DGU:	25 [min]	25 [min]	26 [min]	25 [min]	26 [min]
n:	21,031	20,323	19,493	21,312	20,551
Min-Max:	1-120 [min]	1-120 [min]	1-120 [min]	1-120 [min]	1-119 [min]

Figure 8: Distribution of the mean duration from admission to the ER until whole-body CT over all hospitals, 2019-2023, — TR-DGU, o single hospital value

4.2.2 Time until first emergency surgery

Eight different emergency interventions are documented in TR-DGU (surgical liquid drain or brain decompression, laminectomy, thoracotomy, laparotomy, revascularisation, embolisation, and stabilisation of pelvis or extremities). All patients with at least one of these interventions are considered here. Time periods between admission to the ER and emergency surgery > 120 minutes are excluded.

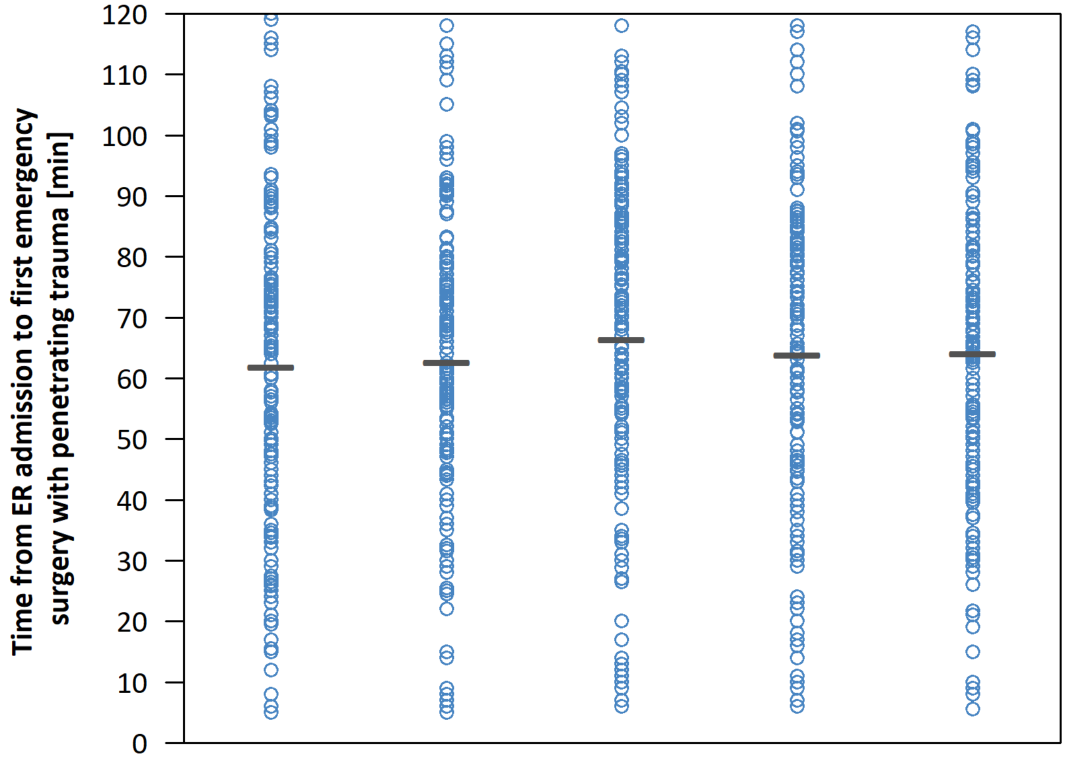


Year:	2019	2020	2021	2022	2023
TR-DGU:	70 [min]	71 [min]	71 [min]	71 [min]	72 [min]
n:	4,065	3,943	3,698	3,811	3,747
Min-Max:	1-120 [min]	1-120 [min]	1-120 [min]	1-120 [min]	1-120 [min]

Figure 9: Distribution of the mean duration from admission to the ER until the first emergency surgery over all hospitals, 2019-2023, — TR-DGU, o single hospital value

4.2.3 Time from admission to the ER until surgery in penetrating trauma

Time period between admission to the ER and the first surgical intervention (list of procedures see 4.2.2) in patients with penetrating injuries (stabbing, gunshot, etc.). Time periods longer than 120 minutes are excluded from this analysis.

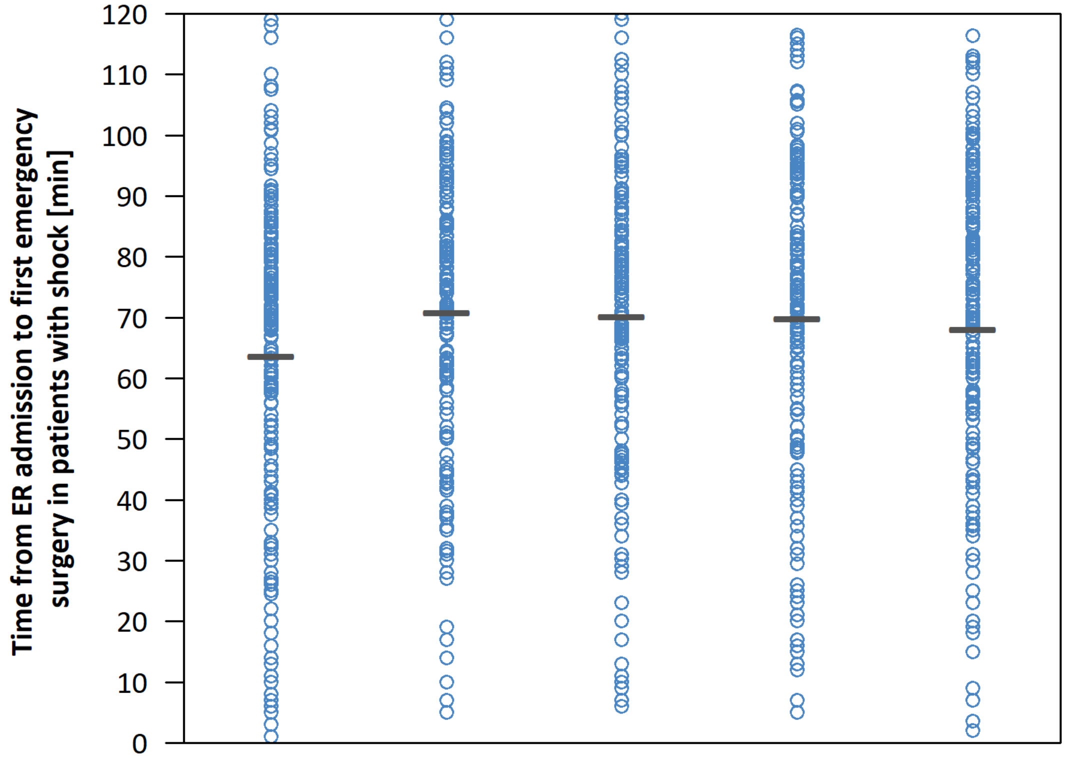


Year:	2019	2020	2021	2022	2023
TR-DGU:	62 [min]	63 [min]	66 [min]	64 [min]	64 [min]
n:	401	333	375	359	400
Min-Max:	1-120 [min]	1-120 [min]	6-120 [min]	2-120 [min]	2-120 [min]

Figure 10: Distribution of the mean duration from admission to the ER until surgery in patients with penetrating trauma over all hospitals, 2019-2023, — TR-DGU, o single hospital value

4.2.4 Time until surgery in patients in shock

Time period from admission to the ER until the first surgical intervention (list of procedures see 4.2.2) in patients in shock (systolic blood pressure ≤ 90 mmHg). Time periods longer than 120 minutes are excluded from this analysis.

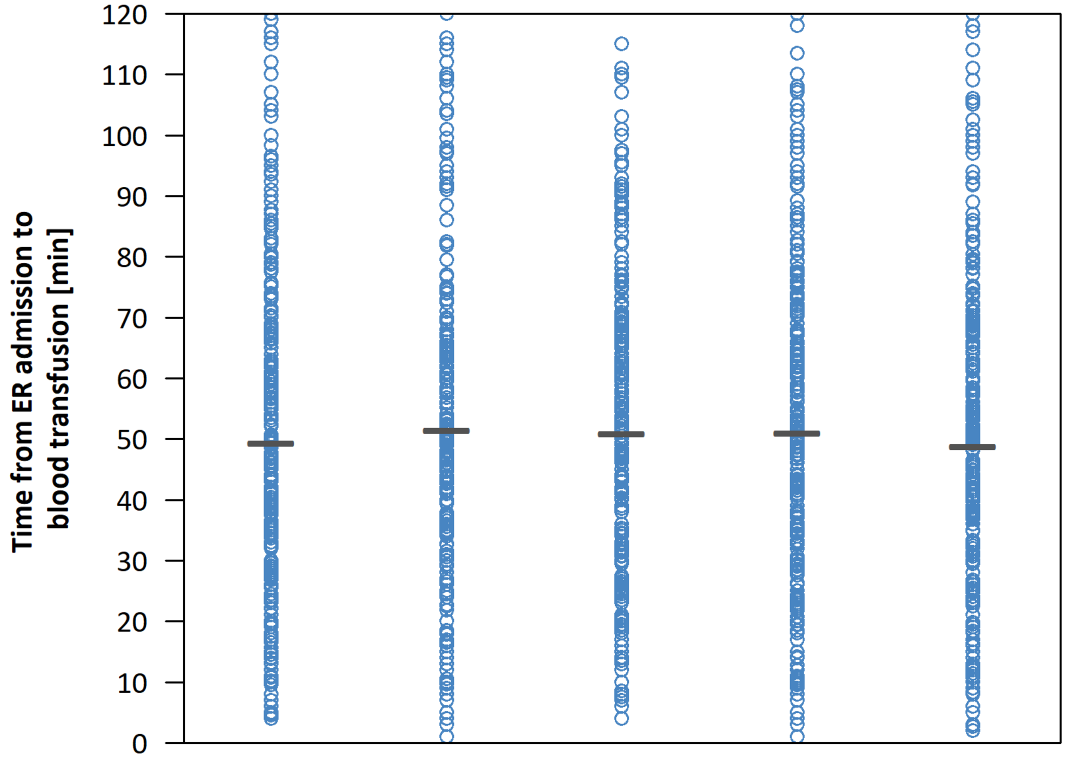


Year:	2019	2020	2021	2022	2023
TR-DGU:	64 [min]	71 [min]	70 [min]	70 [min]	68 [min]
n:	596	547	519	548	555
Min-Max:	1-120 [min]	1-120 [min]	2-120 [min]	2-120 [min]	1-120 [min]

Figure 11: Distribution of the mean duration from admission to the ER until surgery in patients with shock over all hospitals, 2019-2023, — TR-DGU, o single hospital value

4.2.5 Time until start of blood transfusion

If blood substitution is required, this should be done as quickly as possible. All patients with a valid time to blood transfusion (pRBC) are considered here. Time periods between admission to the ER and time of blood transfusion over 120 minutes are excluded from this analysis.

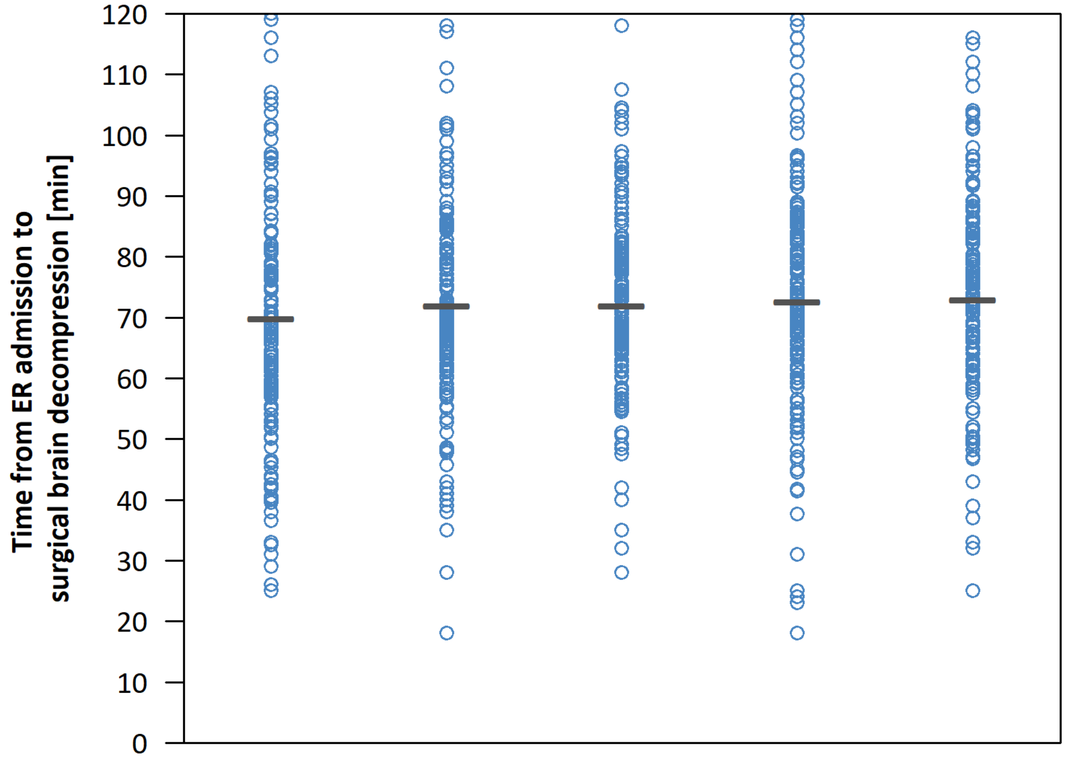


Year:	2019	2020	2021	2022	2023
TR-DGU:	49 [min]	51 [min]	51 [min]	51 [min]	49 [min]
n:	1,244	1,159	1,198	1,372	1,393
Min-Max:	1-120 [min]	1-120 [min]	1-120 [min]	1-120 [min]	1-120 [min]

Figure 12: Distribution of the mean duration from admission to the ER until start of the transfusion over all hospitals, 2019-2023, — TR-DGU, o single hospital value

4.2.6 Surgical brain decompression

In patients with intracranial bleeding after severe traumatic brain injury (TBI, AIS severity = 5) a surgical brain decompression is indicated. Only surgery patients with a valid time to surgery (max. 120 minutes) and AIS severity degree of 5 are considered in this analysis.



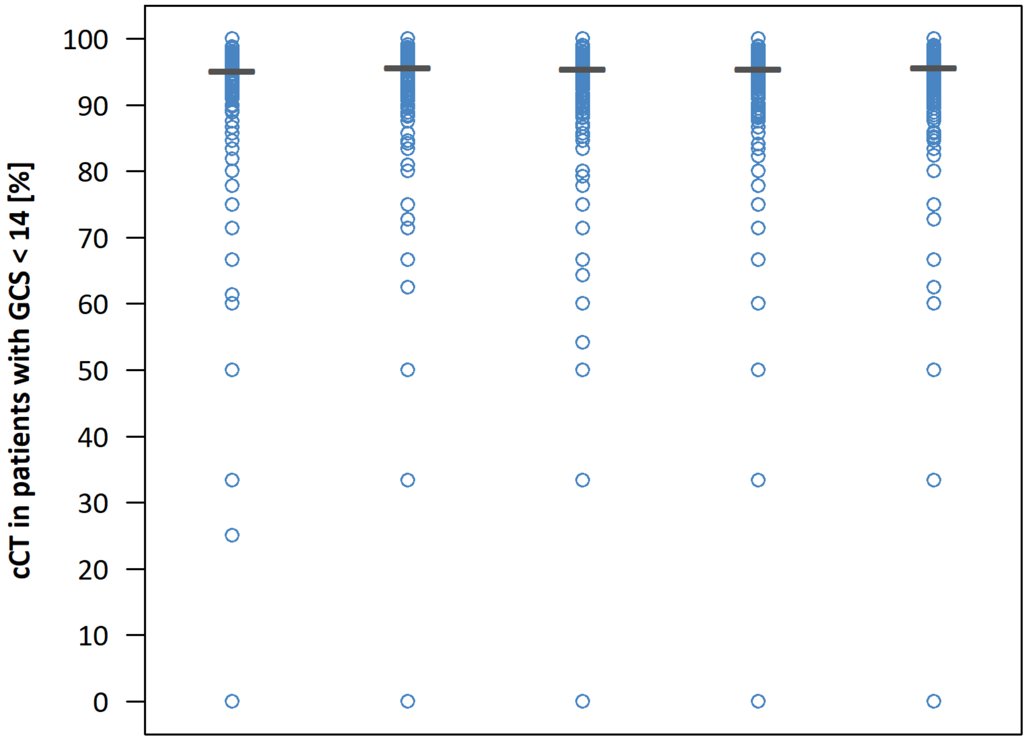
Year:	2019	2020	2021	2022	2023
TR-DGU:	70 [min]	72 [min]	72 [min]	73 [min]	73 [min]
n:	632	675	603	690	615
Min-Max:	1-120 [min]	14-120 [min]	16-120 [min]	3-120 [min]	5-120 [min]

Figure 13: Distribution of the mean duration from admission to the ER until surgical brain decompression over all hospitals, 2019-2023, — TR-DGU, o single hospital value

4.3 Diagnostics and interventions

4.3.1 Cranial CT (cCT) with GCS < 14

A reduced consciousness could be indicative of a TBI and should be investigated with a cranial CT (cCT) or whole-body CT. All patients with a GCS < 14 are included, either prehospital or on admission (if not intubated). Patients who died within the first 30 minutes after admission are excluded, because a cCT / whole-body CT is no longer possible. A missing value regarding cCT / whole-body CT is considered as „not performed".

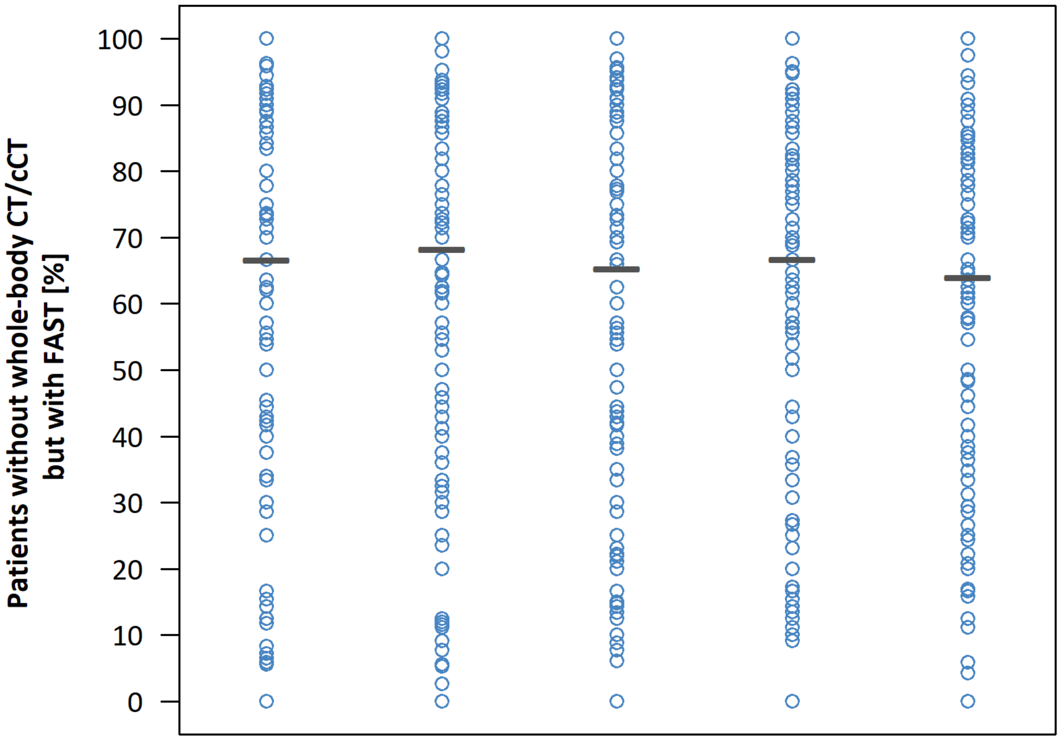


Year:	2019	2020	2021	2022	2023
TR-DGU:	95 %	96 %	95 %	95 %	96 %
cCT (n):	7,722	7,529	7,266	7,935	7,964
GCS < 14 (N):	8,114	7,867	7,614	8,316	8,329

Figure 14: Distribution of the cCT rate in patients with GCS < 14 over all hospitals, 2019-2023, — TR-DGU, o single hospital value

4.3.2 Sonography in patients without CT

If no whole-body CT / cCT has been performed, abdominal sonography (FAST = Focused Assessment with Sonography for Trauma) should be part of the diagnostic work-up. All patients without a documented whole-body CT / cCT are included in this analysis. A missing value regarding the FAST is considered as „not performed".

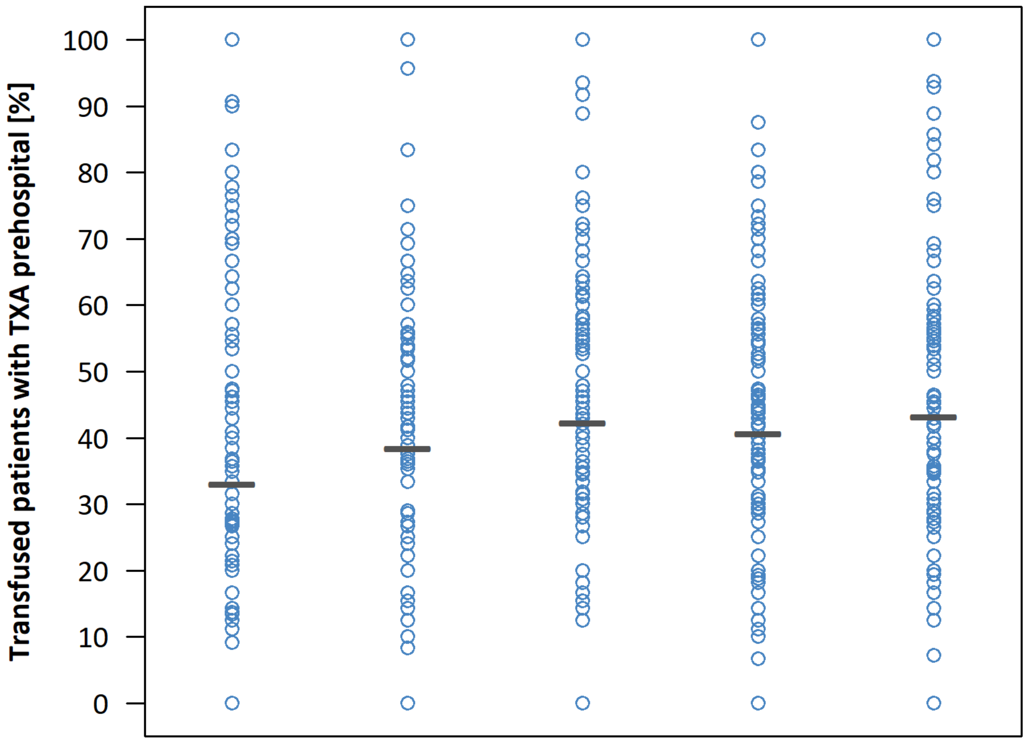


Year:	2019	2020	2021	2022	2023
TR-DGU:	67 %	68 %	65 %	67 %	64 %
FAST (n):	1,767	2,098	2,086	2,123	2,181
No WBCT/cCT (N):	2,653	3,074	3,192	3,181	3,410

Figure 15: Distribution of the sonography rate in patients without whole-body CT / ccT over all hospitals, 2019-2023, — TR-DGU, o single hospital value

4.3.3 Prehospital tranexamic acid in patients with blood transfusion

Based on a randomized trial, patients receiving tranexamic acid (TXA) need a reduced transfusion volume or even no transfusion at all. Therefore, patients who require a blood transfusion should have been previously given TXA. All patients with documented blood transfusion (received pRBCs in the ER up to ICU admission) are included here. A missing value regarding prehospital TXA administration is considered as „no TXA given".

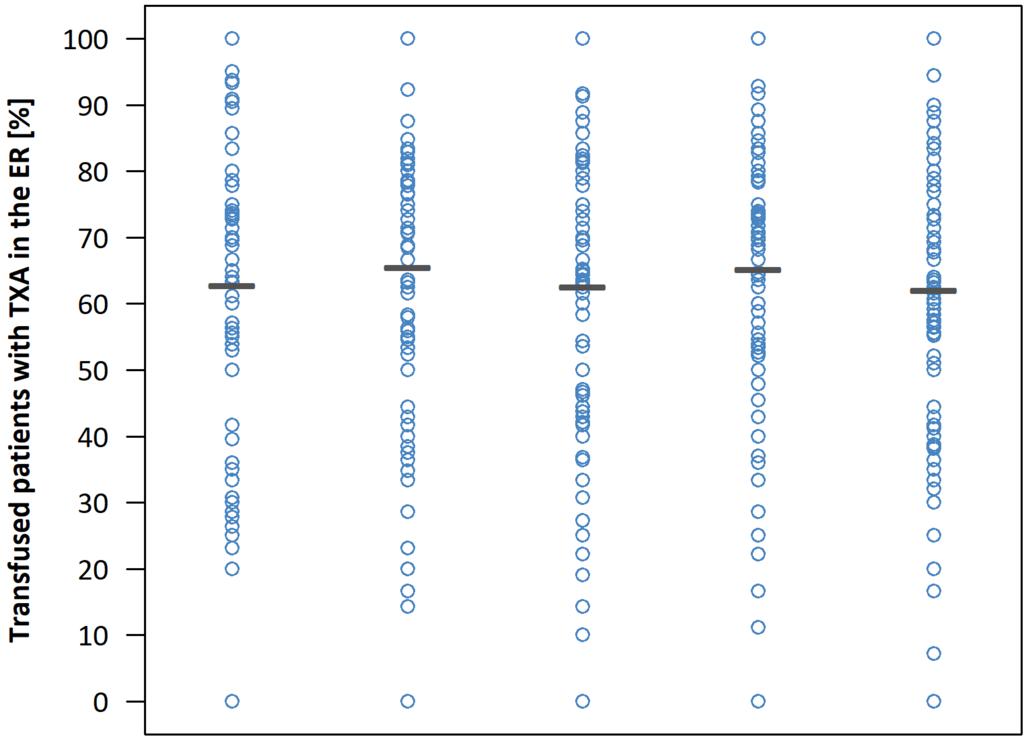


Year:	**2019**	**2020**	**2021**	**2022**	**2023**
TR-DGU:	33 %	38 %	42 %	41 %	43 %
TXA prehosp. (n):	635	762	877	910	1,033
Transfused (N):	1,923	1,982	2,075	2,238	2,389

Figure 16: Distribution of the prehospital tranexamic acid rate in the ER or surgery phase transfused patients over all hospitals, 2019-2023, — TR-DGU, o single hospital value

4.3.4 Tranexamic acid in the ER in patients with blood transfusion

Currently, tranexamic acid given in the ER is only documented in the standard dataset. All patients with documented blood transfusion (received pRBCs in the ER up to ICU admission) are included here. A missing value regarding TXA administration in the ER is considered as „no TXA given".



Year:	2019	2020	2021	2022	2023
TR-DGU:	63 %	66 %	63 %	65 %	62 %
TXA in ER (n):	824	872	1,003	1,167	1,169
Transfused (N):	1,312	1,331	1,604	1,789	1,884

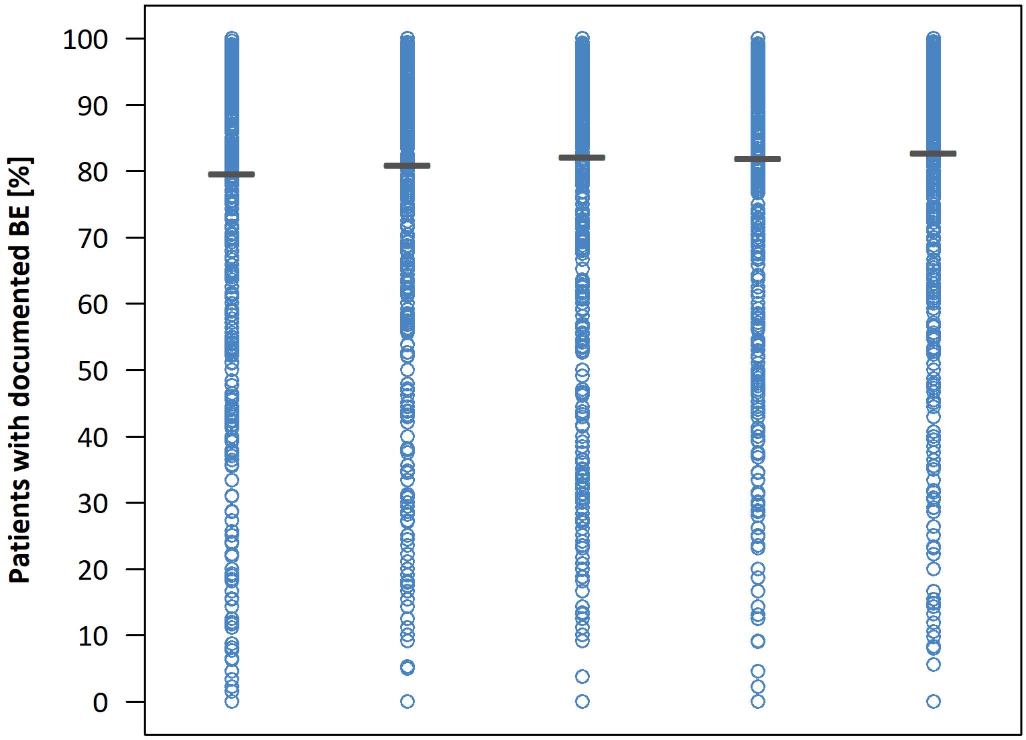
Figure 17: Distribution of the TXA admission rate in the ER in patients transfused between ER and intensive therapy over all hospitals, 2019-2023, — TR-DGU, o single hospital value

4.4 Data quality

4.4.1 Blood gas analysis performed / Base excess documented

A blood gas analysis (BGA) provides important and timely information about the condition of a trauma patient. But often these measurements are not documented in the TR-DGU. Specifically the base excess (BE) is an important outcome predictor that is used in the RISC II prognostic score. Detailed results regarding the completeness of data are presented in chapter 10. As an example, the completeness of BE data is presented here in the same way as the process indicators above.

All primary admitted patients are considered in this analysis and the proportion of patients with valid BE values is calculated. BE values less than -50 mmol/l or greater than 20 mmol/l are excluded.



Year:	2019	2020	2021	2022	2023
TR-DGU:	80 %	81 %	82 %	82 %	83 %
Document. BE (n):	21,958	22,109	22,062	23,651	23,782
Patients (N):	27,592	27,297	26,840	28,868	28,718

Figure 18: Distribution of the patient rate with documented base excess (BE) over all hospitals, 2019-2023, — TR-DGU, o single hospital value

5 Comparisons of the hospitals in the TraumaNetzwerk DGU®

In chapter 5, the hospitals in the TraumaNetzwerk DGU® are displayed corresponding to their trauma level. The classification into local, regional, supra-regional TraumaZentrum DGU® results from the certification requirements of the Whitebook Medical Care of the Severly Injured from the German Trauma Society. Hospitals that are not certified are not considered in the data.

5.1 Documented TraumaNetzwerk DGU® patients in the last 10 years

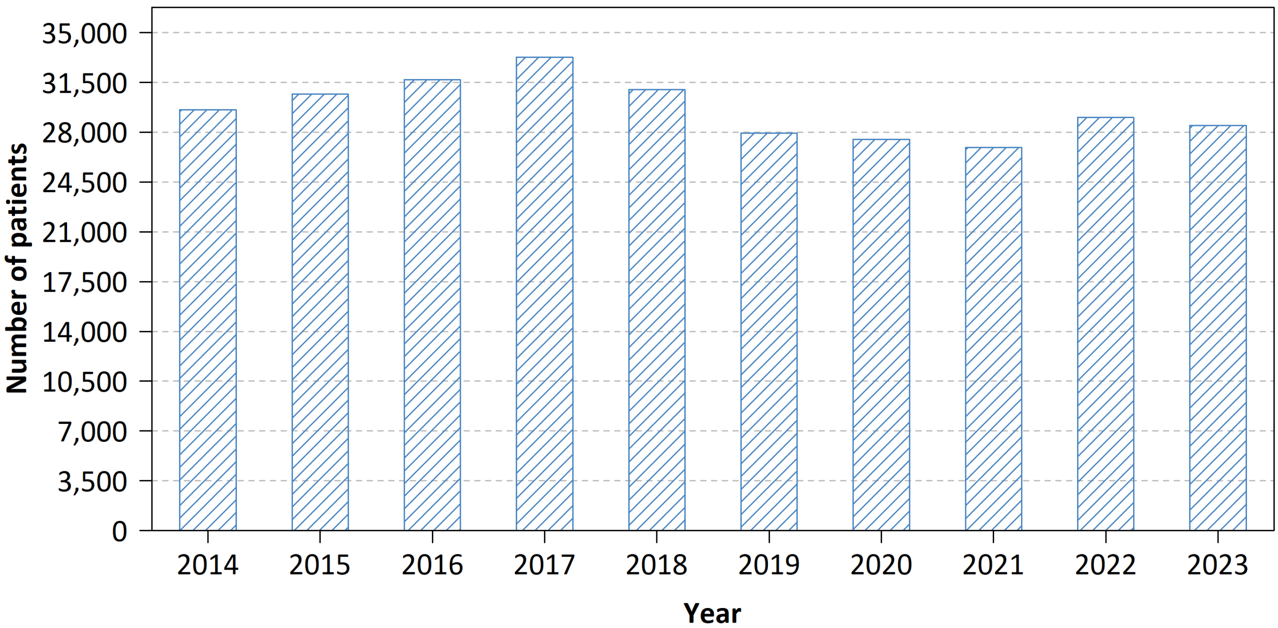


Figure 19: Documented number of patients in the TraumaNetzwerk DGU® basic group from 2014-2023 (bars)

5.2 Number of patients in each trauma level

In the latest year, the TraumaNetzwerk DGU® documented **28.463 patients** in the basic group. The values in figure 20 represent the median (vertical line), the interquartile range (grey box) and the minimum/maximum (horizontal line). Hospitals without a TraumaNetzwerk DGU® certification are excluded here.

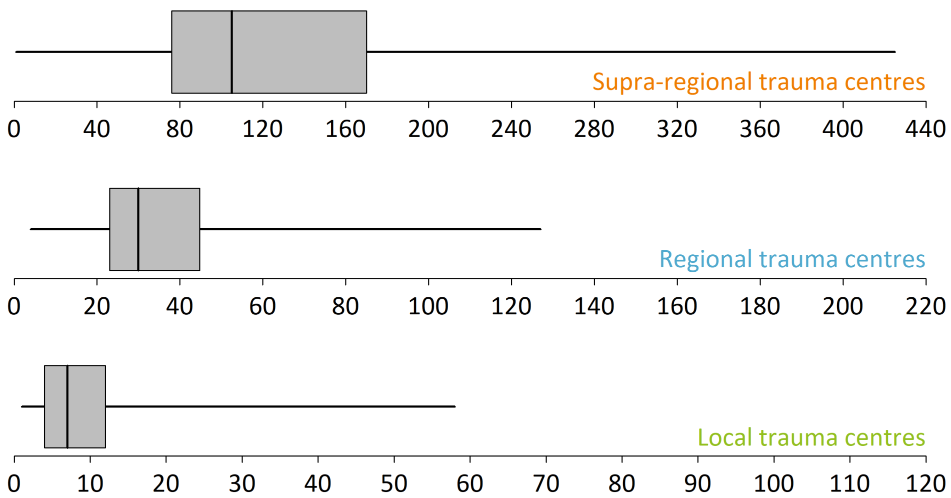


Figure 20: Median number of cases of the in the TraumaNetzwerk DGU® participating trauma centres separated by the trauma level in 2023

5.3 Comparisons between the trauma levels

Table 4 allows a comparison of the hospitals in the TraumaNetzwerk DGU® with the same trauma level. The total values of all certified trauma centres from the TR-DGU are presented as well.

Again, only cases from the **basic group** are considered here. In order to reduce the statistical uncertainty, all patients from the **last three years** are pooled and analysed together.

Table 4: Basic data from the total data from the TR-DGU trauma centres over the past three years

		Trauma centre DGU			
Characteristics		**local**	**regional**	**supra-regional**	**TR-DGU**
Number of hospitals		280	238	133	651
Portion of patients in the TR-DGU		9 %	30 %	60 %	100 %
Patients per year and hospital (mean)	n	**9** / year	**36** / year	**127** / year	**43** / year
Patients (3 years, cumulated)	n	7,686	25,389	50,639	83,714
Primary admitted and treated	n (%)	6,151 (80 %)	21,814 (86 %)	44,207 (87 %)	72,172 (86 %)
Primary admitted and transferred out early (< 48 h)	n (%)	1,436 (19 %)	2,883 (11 %)	745 (2 %)	5,064 (6 %)
Transferred in from another hospital	n (%)	99 (1 %)	692 (3 %)	5,686 (11 %)	6,477 (8 %)

Table 4 continuation:

		Trauma centre			
Characteristics		**local**	**regional**	**supra-regional**	**TR-DGU**
Patients					
Average age [years]	M	56.9	57.1	53.2	54.8
Patients aged 70 years and older	%	32 %	34 %	28 %	30 %
Males	%	67 %	67 %	70 %	69 %
ASA 3-4	%	22 %	26 %	23 %	24 %
Injuries					
Injury Severity Score (ISS) [points]	M	13.4	16.1	19.9	18.2
Proportion with ISS ≥ 16	%	33 %	46 %	60 %	54 %
Proportion polytrauma *	%	6 %	11 %	18 %	14 %
Proportion with life-threatening severe injury **	%	17 %	26 %	36 %	31 %
Patients with TBI, AIS ≥ 3	%	18 %	28 %	43 %	36 %
Patients with thoracic injury, AIS ≥ 3	%	36 %	39 %	39 %	38 %
Patients with abdominal injury, AIS ≥ 3	%	7 %	9 %	11 %	10 %
Prehospital care (primary admissions only)					
Rescue time (accident to hospital) [min]	M	62.1	64.0	72.3	68.3
Prehospital volume administration [ml]	M	428	497	676	589
Prehospital intubation	%	2 %	8 %	27 %	18 %
Proportion unconscious (GCS ≤ 8)	%	3 %	7 %	18 %	13 %
Emergency room (primary admissions only)					
Blood transfusion	%	3 %	4 %	11 %	8 %
Whole-body CT	%	64 %	68 %	79 %	74 %
Cardio-pulmonary resuscitation	%	1 %	2 %	4 %	3 %
Shock / hypotension	%	4 %	5 %	8 %	7 %
Coagulopathy	%	8 %	9 %	11 %	10 %
Length of stay (without early transfers out)					
Length of intubation on the intensiv care unit [days]	M	4.3	5.4	6.7	6.4
Length of stay on the intensiv care unit [days]	M	2.2	3.6	6.4	5.3
Length of stay in the hospital [days]	M	9.6	11.9	16.2	14.4
Outcome and prognosis (without transfers in and early transfers out and patients deceased within the first week with a patient's volition)					
Patients	n	6,151	21,814	44,207	72,172
Non-survivors	n	214	1,250	3,455	4,919
Hospital mortality	%	3.6 %	6.0 %	8.4 %	7.3 %
RISC II prognosis	%	4.4 %	6.3 %	9.2 %	7.9 %

GCS = Glasgow Coma Scale; AIS = Abbreviated Injury Scale; M = Mean

* Polytrauma: see „Berlin-Definition" (Pape et al. 2014)

** Life-threatening severe injury: ISS ≥ 16 in conjunction with phys. effects (Paffrath et al. 2014)

5.4 State of transfer within the trauma levels

The transfer status of all patients in the TraumaNetzwerk DGU® is displayed in the following figure, classified according to the trauma level for the year 2023. As expected, the proportion of patients that are transferred out of a local trauma centre as well as the proportion of patients that are transferred into a supra-regional trauma centre are the highest.

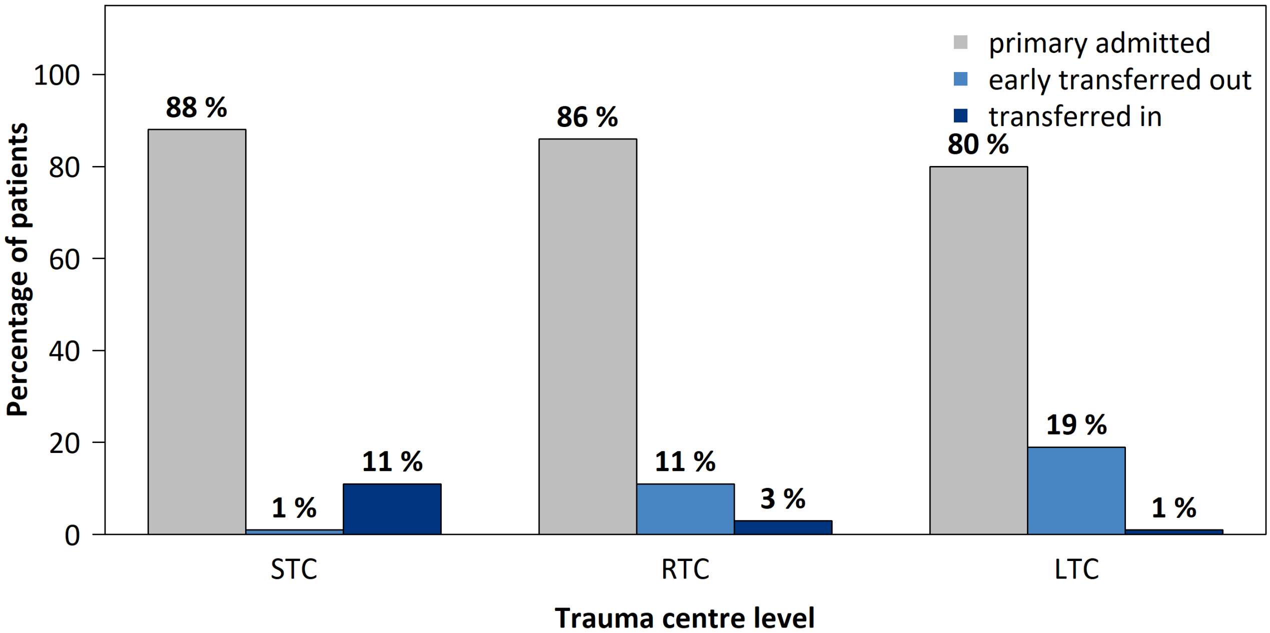


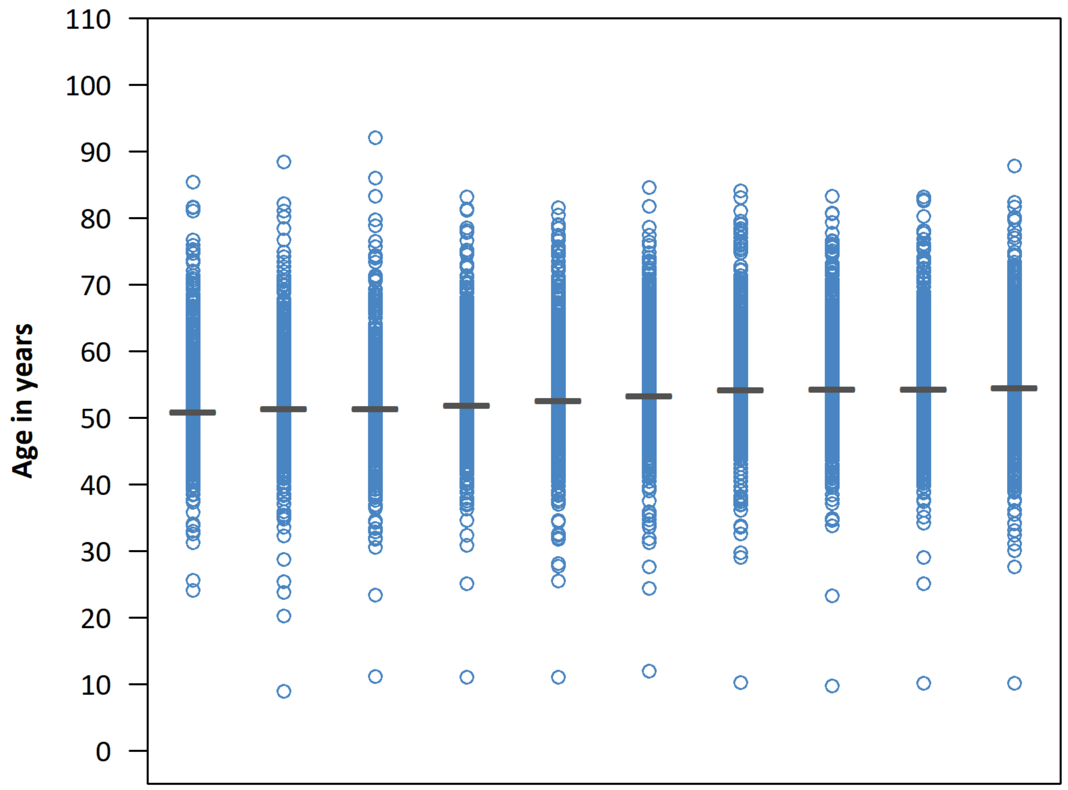
Figure 21: Transfer status classified according to the trauma level in 2023

6 Graphical comparisons with other hospitals

Below, selected information about the patients from the years **2014-2023** from the hospitals in the TraumaRegister DGU® are displayed. Only cases from the **basic group** are considered (see page 5). Different from the values in chapter 3, only hospitals are analysed, where **at least 3 patients** were available. The hospitals from the TR-DGU are indicated as light blue circles. The horizontal grey line is the mean value over all hospitals per year.

6.1 Distribution of age in the past 10 years

The figure below shows the distribution of mean age of the patients from the TR-DGU **with at least 3 patients** over the past ten years.

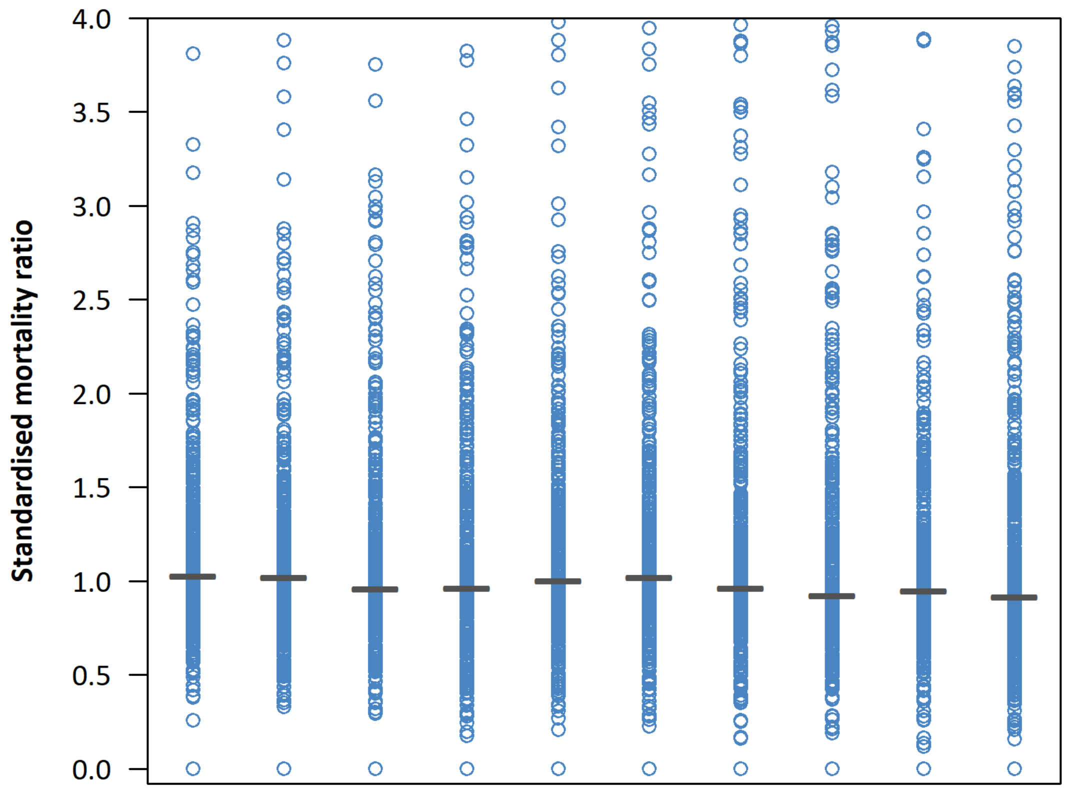


Year:	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
TR-DGU:	50.9	51.4	51.4	51.9	52.6	53.3	54.2	54.3	54.4	54.5

Figure 22: Mean patient's age in the — TR-DGU compared to the o single hospital values in the TR-DGU for the years 2014-2023

6.2 Distribution of the standardised mortality ratio (SMR) over the past ten years

Only primary admitted patients are displayed here (from hospitals with at least 3 cases). Early transfers out (< 48 h) are excluded. Patients deceased within one week after admission **with a patient's volition** are excluded from this analysis to ensure a correct presentation of the quality of treatment in a hospital, as in chapter 2. The standardised mortality ratio is shown for each hospital as well as for the TR-DGU over the past ten years. The standardised mortality ratio is defined as the quotient of the observed mortality and the risk of death prognosis (RISC II) for each hospital. A SMR value > 1 means, that the observed mortality is higher than expected. A SMR value < 1 indicates that the observed mortality is lower than expected. Figure 23 shows an SMR slightly under 1 for 2021.



Year:	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
TR-DGU:	1.03	1.02	0.96	0.96	1.00	1.02	0.96	0.92	0.95	0.92

Figure 23: Standardised mortality ratio of the — TR-DGU compared to the o single hospital values in the TR-DGU for the years 2014-2023

6.3 Length of stay and injury severity

The length of stay of patients is highly variable and depends on diverse factors. Figure 24 describes the relationship between the average length of stay (LOS) in hospital and injury severity (ISS). The mean value is calculated for survivors from the basic group. Patients transferred to another hospital (n= 4,764) are excluded here. Hospitals with **fewer than 3 patients** are **not** displayed in the figure due to their statistical uncertainty.

TR-DGU 2023:

The value is based on:
22,635 patients

Mean length of stay:
15.5 days

Mean ISS:
16.3 points

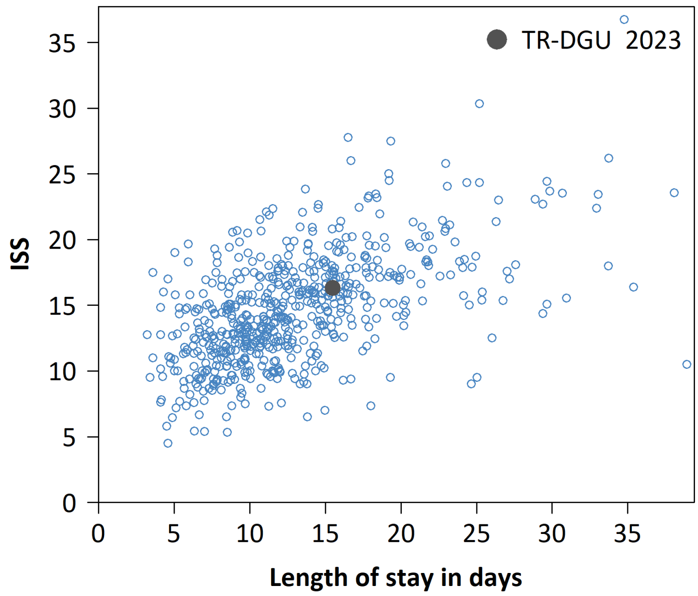


Figure 24: Relationship between length of stay and injury severity over all hospitals in 2023

6.4 Length of stay of the deceased patients

The following figure shows the distribution of length of stay of the deceased patients (N = 3,814) within the first 30 days (n = 3,667) in the TR-DGU in the last year.

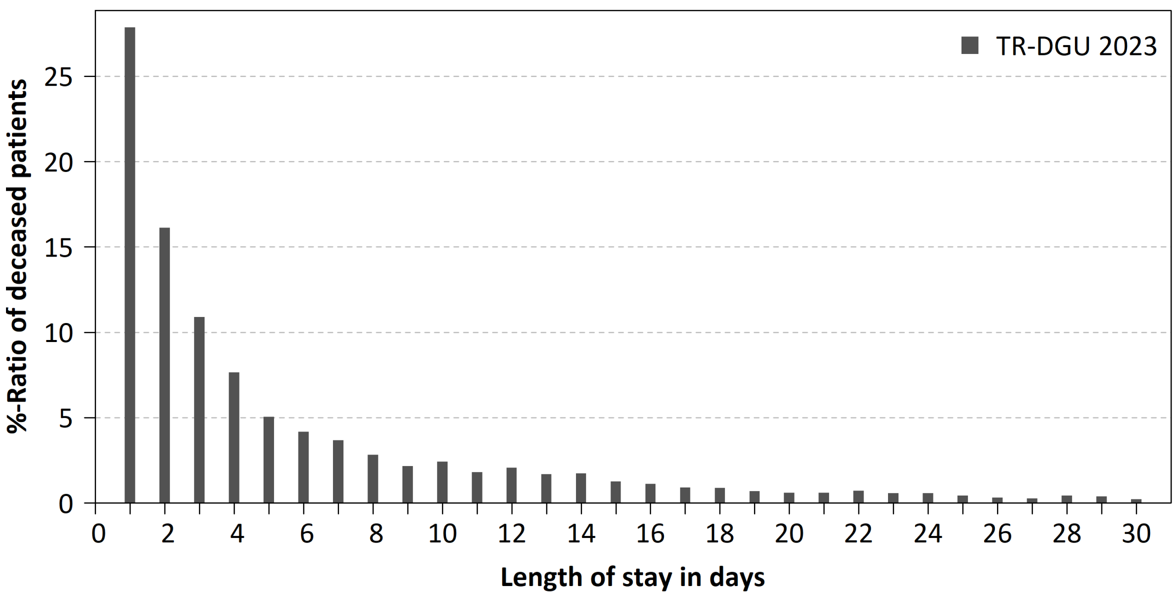


Figure 25: Time point of death of the patients from the TR-DGU [length of stay in days] in 2023

7 Basic data of trauma care

The following pages present basic data from the trauma care of the actual year 2023. The data refer to patients from the **basic group** (see page 5). Shown is data from the TraumaRegister DGU® basic group in the current year, (**TR-DGU 2023**), and the registry data sumarized from the last 10 years, 2014-2023 (**TR-DGU 10 years**).

Table 5: Data from the TR-DGU regarding the patients and accident type

(S) Patient and accident	TR-DGU 2023		TR-DGU 10 years	
Patients in the **basic group** (n)	31,217		320,909	
Primary admissions / transfers	%	n	%	n
Primary admitted	**92.0 %**	28,718	**91.3 %**	293,047
... and transferred out within 48 h	**5.9 %**	1,848	**6.4 %**	20,648
Transferred in within 24 h after accident	**7.2 %**	2,245	**7.8 %**	25,140
Transferred in after 24 h	**0.8 %**	253	**0.8 %**	2,721
Patient characteristics	**M** ± SD*/%	n	**M** ± SD*/%	n
Age [years]	**54.5** ± 22.9	31,217	**52.8** ± 22.7	320,909
Children under 16 years	**3.8 %**	1,171	**3.9 %**	12,536
Elderly over 70 years	**30.1 %**	9,401	**27.7 %**	89,015
Males	**69.6 %**	21,729	**69.6 %**	223,502
ASA 3-4 prior to trauma (since 2009)	**23.8 %**	6,994	**19.7 %**	57,844
Mechanism of injury	%	n	%	n
Blunt	**95.6 %**	28,073	**96.0 %**	292,151
Penetrating	**4.4 %**	1,278	**4.0 %**	12,102
Type and cause of accident	%	n	%	n
Traffic: Car	**16.1 %**	4,964	**18.7 %**	59,195
... thereof as car passenger (since 2020)	**15.4 %**	4,746	**5.6 %**	17,607
... thereof as lorry passenger (since 2020)	**0.6 %**	181	**0.2 %**	715
... thereof as bus passenger (since 2020)	**0.1 %**	37	**0.0 %**	149
Traffic: Motor bike	**10.9 %**	3,354	**11.8 %**	37,421
Traffic: Bicycle	**11.8 %**	3,661	**10.6 %**	33,511
... thereof as supported bike (since 2020)	**1.7 %**	534	**0.6 %**	1,741
Traffic: Pedestrian	**4.9 %**	1,518	**5.3 %**	16,808
Traffic: E-scooter (since 2020)	**0.8 %**	235	**0.2 %**	707
High fall (> 3m)	**14.4 %**	4,451	**15.1 %**	47,878
Low fall (≤ 3m)	**29.0 %**	8,970	**26.9 %**	85,149
... thereof as ground level fall (since 2020)	**10.6 %**	3,284	**3.4 %**	10,877
Suicide (suspected)	**4.5 %**	1,383	**4.4 %**	13,859
Assault (suspected)	**3.0 %**	918	**2.6 %**	8,093

* M = Mean; SD = Standard deviation

Table 6: Data from the TR-DGU regarding findings at the accident scene. Information for primary admitted patients

Time point A: Findings at the accident scene	TR-DGU 2023		TR-DGU 10 years	
Primary admitted patients (n) (%-ratio of the basic group)	28,718 (92 %)		293,047 (91 %)	
Vital signs	**M** ± SD*	n	**M** ± SD*	n
Systolic blood pressure [mmHg]	**134.0** ± 32.8	23,677	**133.9** ± 32.9	250,028
Respiratory rate [1/min]	**16.1** ± 5.5	19,411	**15.8** ± 5.7	188,717
Glasgow Coma Scale (GCS) [points]	**12.8** ± 3.8	25,607	**12.7** ± 3.9	267,965
Findings	%	n	%	n
Shock (systolic blood pressure ≤ 90 mmHg)	**8.2 %**	1,952	**8.3 %**	20,855
Unconsciousness (GCS ≤ 8)	**15.1 %**	3,876	**16.0 %**	42,995
Therapy	%	n	%	n
Cardio-pulmonary resuscitation	**3.0 %**	871	**2.9 %**	8,483
Pre-hospital thoracotomy (since 2020)	**0.2 %**	64	**0.1 %**	181
Endotracheal intubation	**18.0 %**	5,181	**19.6 %**	57,544
Alternative airway	**0.8 %**	237	**1.1 %**	3,124
Surgical airway (since 2020)	**0.1 %**	19	**0.0 %**	63
Cervical spine immobilization (since 2020)	**58.3 %**	14,258	**61.7 %**	56,476
Analgo-sedation **	**49.0 %**	14,086	**35.8 %**	104,952
Chest drain (with and without needle decompression) **	**3.0 %**	867	**1.9 %**	5,687
... thereof only with needle decompression (since 2020)	**0.7 %**	199	**0.2 %**	622
Catecholamines **	**8.3 %**	2,384	**5.3 %**	15,649
Pelvic binder **	**16.0 %**	4,581	**8.0 %**	23,326
Tourniquet (since 2020)	**1.6 %**	461	**0.5 %**	1,476
Intraosseous access (since 2020)	**1.5 %**	440	**0.5 %**	1,611
Tranexamic acid	**16.3 %**	4,691	**8.9 %**	25,962
Volume administration	**M** ± SD*/%	n	**M** ± SD*/%	n
Patients without volume administration	**22.3 %**	5,749	**19.6 %**	53,367
with volume administration	**77.7 %**	20,047	**80.4 %**	219,095
with colloids	**1.9 %**	465	**2.9 %**	7,549
Average amount in patients with volume administration [ml]	**572** ± 509	25,796	**615** ± 530	272,462
Average amount in patients with and without volume administration [ml]	Median **500**		Median **500**	

* M = Mean; SD = Standard deviation

** Not available in the reduced QM dataset

Table 7: Data from the TR-DGU on emergency room and surgery. Information for primary admitted patients

Time point B: Emergency room / surgery	TR-DGU 2023		TR-DGU 10 years	
Primary admitted patients (n) (%-ratio of the basic group)	28,718 (92 %)		293,047 (91 %)	
Transportation to the hospital	%	n	%	n
With helicopter	**18.4 %**	5,293	**18.8 %**	54,971
Glasgow Coma Scale (GCS)	**M** ± SD*	n	**M** ± SD*	n
Prehospital intubated patients	**3.4** ± 1.8	3,158	**3.3** ± 1.6	34,451
Patients not prehospital intubated	**13.9** ± 2.3	14,326	**13.9** ± 2.4	115,650
Initial diagnostics	%	n	%	n
Sonography of the abdomen	**77.1 %**	22,152	**80.4 %**	235,750
X-ray of the thorax	**17.2 %**	4,946	**26.5 %**	77,775
cCT (isolated or whole-body)	**88.1 %**	25,308	**89.5 %**	262,147
Whole-body CT	**72.7 %**	20,872	**76.2 %**	223,176
Selective CT: Cervical spine (since 2020)	**9.9 %**	2,851	**9.4 %**	10,460
Selective CT: Chest/thoraric spine (since 2020)	**4.8 %**	1,387	**4.6 %**	5,153
Selective CT: Abdomen/lumbar spine/pelvis (since 2020)	**72.0 %**	20,672	**69.2 %**	77,323
Time period in the emergency room	**M** ± SD*/%	n	**M** ± SD*/%	n
Transfer to the operating theatre	**22.7 %**	6,138	**23.6 %**	54,148
If so: Duration from admission to the ER* until surgery [min]	**86.3** ± 69.2	5,446	**79.4** ± 63.4	48,758
Transfer to intensive care unit	**62.0 %**	16,762	**63.1 %**	144,967
If so: Duration from admission to the ER* until ICU* [min]	**113.1** ± 91.5	14,749	**94.6** ± 80.8	126,091
Bleeding and transfusion	**M** ± SD*/%	n	**M** ± SD*/%	n
Pre-existing coagulopathy	**22.8 %**	5,770	**20.7 %**	41,412
Systolic blood pressure ≤ 90 mmHg	**7.0 %**	1,855	**7.3 %**	19,963
Hemostasis therapy**	**24.3 %**	4,207	**20.8 %**	29,566
Administration of tranexamic acid**	**15.8 %**	3,875	**15.2 %**	23,047
ROTEM / thrombelastography**	**11.0 %**	1,725	**10.5 %**	13,247
Patients with blood transfusion	**8.3 %**	2,389	**7.4 %**	21,806
Number of pRBC, if transfused	**4.7** ± 5.3	2,389	**4.9** ± 5.9	21,806
Number of FFP, if transfused	**2.8** ± 4.8	2,389	**3.0** ± 5.4	21,806
Treatment in the ER*	%	n	%	n
Cardio-pulmonary resuscitation **	**2.3 %**	597	**2.0 %**	4,298
Chest drain**	**9.7 %**	2,556	**8.4 %**	18,071
Endotracheal intubation**	**8.4 %**	2,159	**11.5 %**	21,047
Initial laboratory values	**M** * ± SD	n	**M** * ± SD	n
Base excess [mmol/l]	**-1.6** ± 5.0	23,818	**-1.6** ± 4.7	232,235
Haemoglobin [g/dl]	**13.0** ± 2.2	27,753	**13.2** ± 2.2	282,437
INR	**1.1** ± 0.4	26,433	**1.2** ± 0.5	272,005
Quick's value [%]	**88.0** ± 20.7	25,791	**88.2** ± 21.3	264,998
Temperature [C°]**	**36.3** ± 1.0	18,015	**36.2** ± 1.1	118,122

* ICU = Intensiv care unit; ER = Emergency room; M = Mean; SD = Standard deviation
** Not available in the reduced QM dataset

Table 8: Data from the TR-DGU on intensive care unit

Time point C: Intensive care unit	TR-DGU 2023		TR-DGU 10 years	
Patients with **intensive care therapy** (n) (%-ratio of the basic group)	25,916 (83 %)		275,459 (86 %)	
Treatment	%	n	%	n
Hemostasis therapy **	**13.0 %**	2,174	**14.1 %**	20,791
Dialysis / hemofiltration **	**1.7 %**	297	**2.1 %**	3,089
Blood transfusion ** (within the first 48 h after admission to ICU)	**24.3 %**	3,244	**24.6 %**	29,484
Mechanical ventilation / intubated	**34.8 %**	9,025	**36.2 %**	99,850
Complications on ICU	%	n	%	n
Organ failure **	**28.4 %**	4,883	**31.6 %**	47,472
Multiple organ failure (MOF) **	**14.5 %**	2,529	**17.8 %**	26,657
Sepsis **	**5.5 %**	946	**5.4 %**	8,072
Length of stay and ventilation	**M** ± SD*	n	**M** ± SD*	n
Length of intubation [days]	**6.8** ± 10.5 Median **3**	8,867	**7.2** ± 10.1 Median **3**	98,696
Length of stay on ICU* [days]	**6.1** ± 9.6 Median **2**	25,915	**6.2** ± 9.8 Median **2**	275,458

* ICU = Intensiv care unit; ER = Emergency room; M = Mean; SD = Standard deviation
** Not available in the reduced QM dataset

Table 9: Data from the TR-DGU on discharge and outcome

Time point D: Discharge / outcome	TR-DGU 2023		TR-DGU 10 years	
Patients from the basic group	31,217		320,909	
Diagnoses	**M** ± SD*/%	n	**M** ± SD*/%	n
Number of injuries / diagnoses per patient	**4.6** ± 3.1		**4.5** ± 3.0	
Patients with only **one** injury	**10.3 %**	3,224	**10.3 %**	33,028
Surgeries	**M** ± SD*/ %	n	**M** ± SD*/ %	n
Patients requiring surgery	**65.2 %**	14,434	**66.2 %**	121,145
Number of surgeries per patient, if undergone surgery**	**3.0** ± 3.4		**3.3** ± 7.0	
Thrombo-embolic events (MI; pulmonary embolism; DVT; stroke; etc.)	%	n	%	n
Patients with at least one event **	**3.0 %**	554	**2.8 %**	4,564
Outcome (without early transfers out)	%	n	%	n
Survivors	**87.0 %**	25,553	**88.1 %**	264,642
Hospital mortality	**13.0 %**	3,815	**11.9 %**	35,618
Died within 30 days	**12.5 %**	3,667	**11.4 %**	34,185
Died within 24 hours	**4.7 %**	1,385	**4.4 %**	13,273
Died in the ER (without ICU)	**1.6 %**	480	**1.5 %**	4,585
Died with end-of-life-decision (since 2015)	**72.0 %**	2,623	**57.5 %**	14,547
... palliative reason (since 2020)	**50.4 %**	1,327	**48.1 %**	4,425
... presumed will of the patient (since 2020)	**34.5 %**	908	**35.4 %**	3,258
... written willingness of the patient (since 2020)	**15.1 %**	396	**16.5 %**	1,519

* M = Mean; SD = Standard deviation
** Not available in the reduced QM dataset

Table 9 continuation:

Time point D: Discharge / outcome	TR-DGU 2023		TR-DGU 10 years	
Patients from the basic group	31,217		320,909	
Transfer / discharge (all survivors)	%	n	%	n
Survivors who were discharged and …	**100.0 %**	27,402	**100.0 %**	285,291
transferred into another hospital	**17.4 %**	4,764	**17.4 %**	49,525
... among them early discharges (< 48 h)	**6.7 %**	1,848	**7.2 %**	20,648
transferred into a rehabilitation center	**13.8 %**	3,786	**15.7 %**	44,791
other destination	**4.3 %**	1,176	**3.7 %**	10,432
sent home	**64.5 %**	17,676	**63.3 %**	180,543
Condition at the time of discharge (according to the parameter „outcome"; without early transfers out)	%	n	%	n
Patients with a valid value		29,064		294,379
of these surviving patients		25,249		258,761
- good recovery	**57.8 %**	14,599	**63.1 %**	163,334
- moderate disability	**30.6 %**	7,725	**26.5 %**	68,568
- severe disability	**10.4 %**	2,634	**9.1 %**	23,476
- persistant vegetative state	**1.2 %**	291	**1.3 %**	3,383
Length of stay in hospital [days] (all patients from the basic group)	**M** ± SD*	n	**M** ± SD*	n
All patients	**13.7** ± 16.4	31,213	**14.4** ± 16.8	320,873
Median	**9**		**10**	
Only survivors	**14.6** ± 16.8	27,399	**15.3** ± 17.1	285,260
Median survivors	**10**		**11**	
Only non-survivors	**7.3** ± 11.2	3,814	**7.5** ± 12.6	35,613
Median non-survivors	**3**		**3**	
LOS when transferred to a rehabilitation centre	**27.5** ± 24.1	3,786	**28.2** ± 22.2	44,786
when transferred to another hospital	**10.5** ± 14.1	4,764	**10.2** ± 14.6	49,524
when sent home	**12.5** ± 13.0	17,674	**13.1** ± 13.9	180,521
Costs of treatment *** (without early transfers out)	€	n	€	n
Average costs in € per patient				
... all patients	**22,542**	9,483	**22,342**	111,697
... only non-survivors	**12,993**	2,461	**12,880**	25,492
... only survivors	**25,888**	7,022	**25,141**	86,205
... only patients with ISS ≥ 16	**24,520**	7,405	**25,001**	84,291
Sum of all costs	213,763,536 €		2,495,583,009 €	
Sum of all days in hospital	196,011 days		2,310,302 days	
Average costs per day per patient	1090.6 €		1080.2 €	

* M = Mean; SD = Standard deviation; LOS = Length of stay
** Not available in the reduced QM dataset
***** Treatment costs:** The estimated treatment costs are based on data from 1,002 German TR-DGU patients treated in 2007/08. For these patients a detailed cost analysis is available (Lefering et al., Unfallchirurg, 2019). Assuming a cost increase of 2 % per year the costs today would be 35 % higher.

8 Subgroup analyses

Specific subgroups are presented on these pages. Besides descriptive data on the patients and the process of care, also the outcome (hospital mortality) and prognosis are presented here for each subgroup. In order to reduce the statistical uncertainty occurring in subgroup analyses, patients from the last three years (2021-2023) are pooled together. Again, only patients from the **basic group** are considered here.

8.1 Subgroups within the TR-DGU

All results in table 10 refer to **primary admitted cases** from the basic group. Patients transferred in as well as those transferred out early (within 48 h) are not considered here. There are a total of **78,868 patients** from the TR-DGU in the last three years.

Table 10: Basic data from the TR-DGU on selected subgroups. The percentage frequency refers to the number of patients from the respective subgroup in the basic group

		Primary patients 2021-2023	**Subgroups**					
			No TBI	**Combined trauma**	**Isolated TBI**	**Shock**	**Severe injuries**	**Elderly**
Definition of the subgroups		All	AIS head ≤ 1	AIS head and body each ≥ 2	AIS head ≥ 3 and AIS elsewhere ≤ 1	sBP ≤ 90 mmHg on admission	ISS ≥ 16 and at least 1 phys. problem*	Age 70 years or more
Number of basic group patients	n	78,868	39,510	28,887	10,471	5,062	24,698	23,392
	%	100 %	50.1 %	36.6 %	13.3 %	6.4 %	31.3 %	29.7 %
Patients								
Age [years]	M	54.5	51.1	56.0	63.0	54.0	63.5	80.8
Males	%	69.1 %	70.4 %	68.9 %	64.6 %	69.9 %	66.3 %	55.7 %
ASA 3-4	%	22.6 %	17.4 %	24.6 %	37.2 %	27.6 %	36.9 %	52.3 %
Injuries								
ISS [points]	M	18.1	14.6	23.0	18.0	29.4	27.9	18.6
Head injury (AIS ≥ 3)	%	35.2 %		60.0 %	100.0 %	46.4 %	64.8 %	46.8 %
Thoracic injury (AIS ≥ 3)	%	39.4 %	46.8 %	43.6 %		56.8 %	50.7 %	35.9 %
Abdominal injury (AIS ≥ 3)	%	9.6 %	13.8 %	7.4 %		23.3 %	13.4 %	4.8 %
Prehospital care								
Duration from accident to hospital [min]	M	69	68	69	71	74	74	71
Intubation	%	19.0 %	9.1 %	28.9 %	28.9 %	56.8 %	43.0 %	17.4 %
Volume [ml]	M	587.3	585.8	632.2	467.4	927.4	714.5	496.4
Emergency room								
Blood transfusion	%	8.2 %	8.2 %	9.9 %	3.3 %	39.1 %	18.8 %	6.7 %
Whole-body CT	%	74.1 %	74.8 %	80.6 %	53.5 %	76.9 %	76.6 %	66.5 %
Cardio-pulmonary resuscitation	%	2.2 %	1.9 %	2.8 %	1.8 %	14.3 %	6.2 %	2.2 %
Physiological problems *								
Age ≥ 70 years	%	29.7 %	22.6 %	32.5 %	48.6 %	30.0 %	54.4 %	100.0 %
Shock (sBP ≤ 90 mmHg)	%	11.3 %	10.1 %	13.9 %	8.4 %	100.0 %	28.0 %	11.0 %
Acidosis (BE < -6)	%	12.1 %	9.7 %	15.3 %	11.3 %	44.4 %	28.6 %	11.9 %
Coagulopathy	%	11.3 %	8.8 %	13.9 %	13.9 %	34.6 %	26.0 %	19.0 %
Unconsciousness (GCS ≤ 8)	%	15.5 %	4.0 %	25.0 %	32.3 %	44.3 %	41.4 %	17.3 %

* According to the definition of patients with severe life-threatening injuries from Paffrath et al. (2014); physiological problems are defined according to Pape et al. (2014).

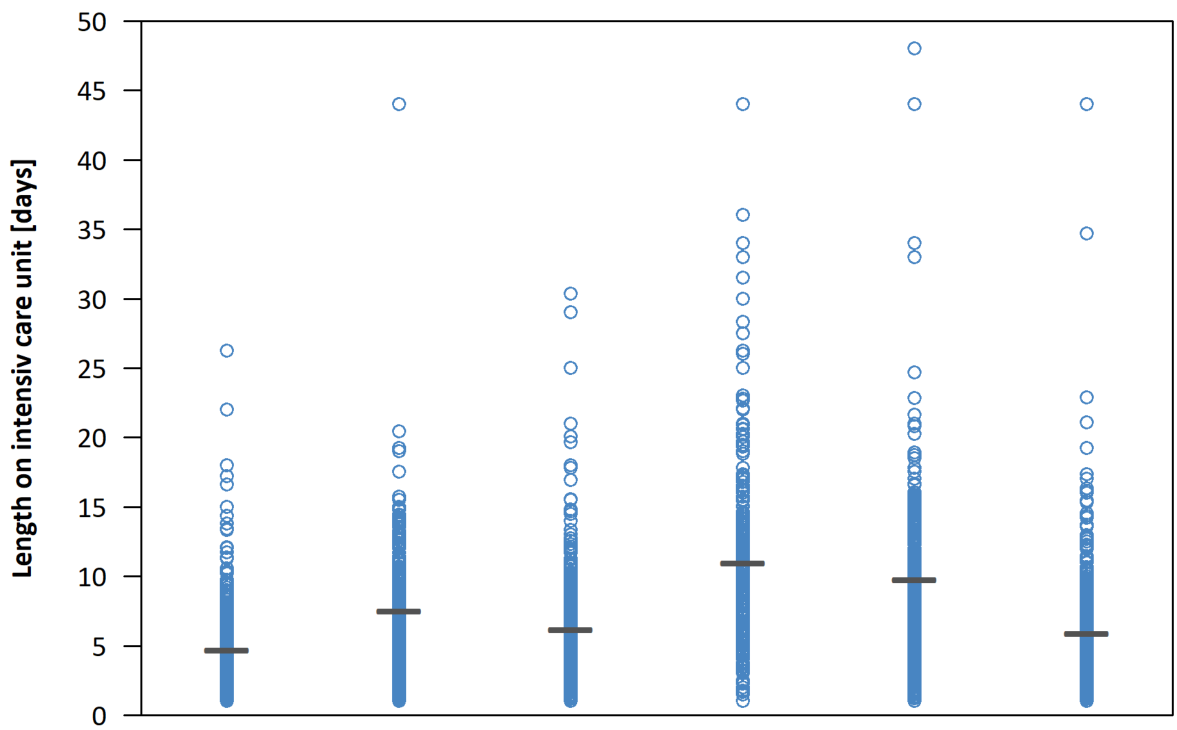
Table 10 continuation:

		Primary patients 2021-2023	Subgroups					
			No TBI	Combined trauma	Isolated TBI	Shock	Severe injuries	Elderly
Length of stay								
Patients with intensive care therapy	n	67,731	32,039	26,447	9,245	4,300	21,912	19,641
- Intubation on intensive care unit [days]	M	6.9	5.4	8.0	6.3	7.7	7.9	6.2
- Intensive care unit [days]	M	6.0	4.7	7.5	6.2	11.0	9.8	5.9
Days in hospital, all patients	M	14.3	14.2	15.3	11.8	19.1	17.8	13.9
Mortality and prognosis (without patients deceased within the first week with a patient's volition)								
Non-survivors	n	5,498	1,468	2,669	1,361	1,209	4,433	2,859
Mortality	%	7.4 %	3.8 %	10.0 %	15.8 %	28.3 %	21.4 %	14.3 %
Risk of death prognosis (RISC II)	%	8.0 %	4.0 %	11.2 %	16.0 %	32.1 %	23.1 %	15.2 %

8.2 Graphical comparison of the length of stay between subgroups

To graphically illustrate the deviations between the different subgroups regarding their length of stay, the following figures are given. As in chapter 6, the hospitals from the TR-DGU are indicated as light blue circles. The horizontal grey line is the mean value over all hospitals per group.

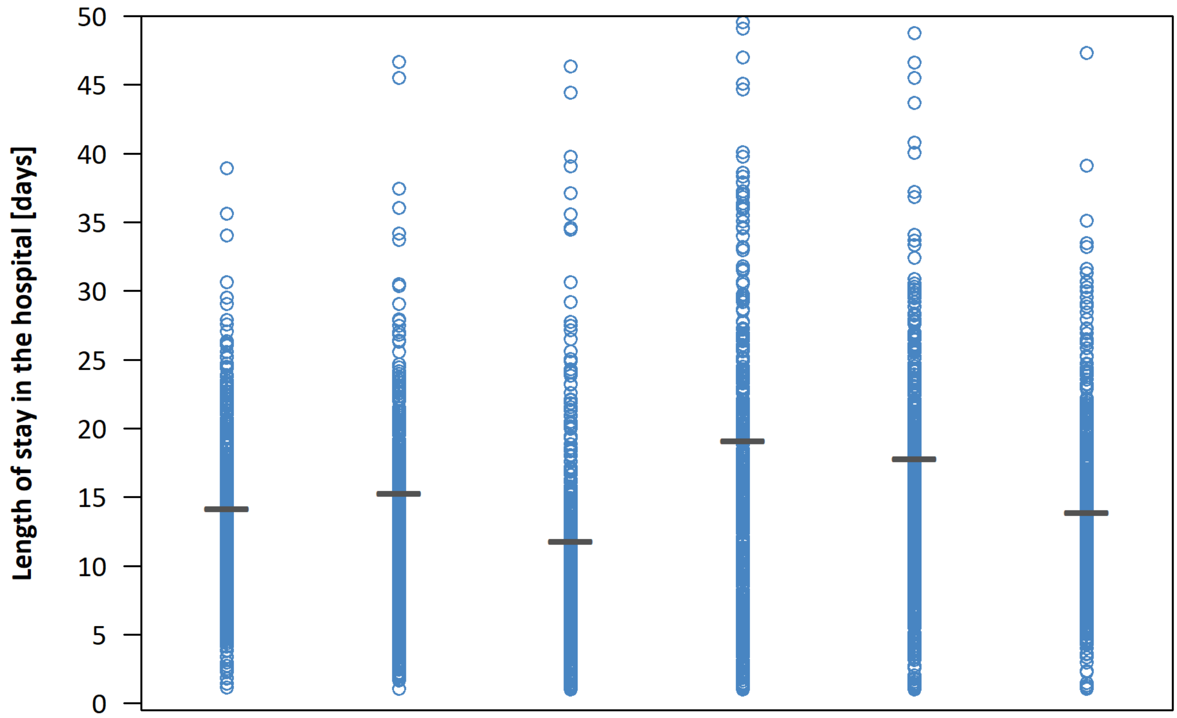
Figure 26 shows the **length of stay in the intensive care unit** in days for 2021-2023 between the subgroups defined in table 10 for all primary admitted and treated patients of the TR-DGU in the basic group.



	No TBI	Combined trauma	Isolated TBI	Shock	Severe injuries	Elderly
TR-DGU:	4.7	7.5	6.2	11.0	9.8	5.9
n:	32,038	26,447	9,245	4,300	21,912	19,641

Figure 26: Length of stay in the intensive care unit [days] and number of patients divided into subgroups, for definition see tab. 10, patients 2021-2023, — TR-DGU, o single hospital value

Figure 27 compares the **length of stay in hospital** in days for 2021-2023 between the subgroups defined in table 10 for all primary admitted and treated patients of the TR-DGU in the basic group.



	No TBI	Combined trauma	Isolated TBI	Shock	Severe injuries	Elderly
TR-DGU:	14.2	15.3	11.8	19.1	17.8	13.9
n:	39,510	28,887	10,471	5,062	24,698	23,392

Figure 27: Length of stay in hospital [days] and number of patients divided into subgroups, for definition see tab. 10, patients 2021-2023, — TR-DGU, o single hospital value

9 Data quality and completeness

9.1 Completeness of selected variables

Registries and audit reports can only be as good as the data they are based on. If a lot of patients have missing data in important variables, then the results might be biased or even wrong. Table 12 describes the **completeness rates („ % ")** of several important variables, together with **the number of patients with missing data („ {} ")**. The list of variables only contains the prognostic variables needed for the RISC II.

As on the previous pages, only cases from the **basic group** are considered here. The completeness rates of the **TR-DGU in 2023** are compared with the data from the previous years (**since 2014**). Cases with implausible data are classified as missing.

Table 11: Evaluation criteria for data quality in the TR-DGU

Coding	Evaluation	Data completeness in general	Data completeness based on the surgery rate
(green)	Good	> 95 %	≥ 70 %
(yellow)	Moderate	90 %-95 %	50 %-69 %
(red)	Insufficient	< 90 %	< 50 %

Table 12: Completeness rates [%], number of missing values {} for selected parameters as well as time to case documentation in the TR-DGU [months]

Variable	Explanation	TR-DGU 2023		TR-DGU 2014-2022	
Pre-hospital data (A)		%	{}	%	{}
Only primary admitted patients, who have not admitted themselves / were not admitted privately		n = 28,007		n = 258,916	
GCS	RISC II requires the motor component; quality indicators use the GCS for the definition of cases	**91 %**	2,547	**93 %**	18,309
Blood pressure	Initial blood pressure is important for validating the volume therapy and for the definition of shock	**84 %**	4,388	**87 %**	33,272
Pupils *	Pupil size and reactivity are relevant for prognosis (RISC II)	**93 %**	2,036	**81 %**	49,654
CPR	Cardio-pulmonary resuscitation is seldom but highly predictive for outcome; required for RISC II	**86 %**	3,859	**90 %**	26,674
Emergency room (B)					
Only primary admitted patients		n = 28,718		n = 264,329	
Time of admission	Required to calculate the diagnostic time periods (quality indicators)	**100 %**	1	**99 %**	1,525
Blood pressure	Blood pressure on admission is used by RISC II as a prognostic variable and to define shock	**93 %**	2,069	**93 %**	17,714
Base excess	The initial base excess is part of the RISC II and an important prognostic factor	**83 %**	4,936	**79 %**	56,099
Coagulation	The INR (or Quick's value) is needed for the RISC II as coagulation marker	**92 %**	2,285	**93 %**	18,757
Haemoglobin	Prognostic factor; is part of the RISC II prognosis	**97 %**	965	**96 %**	9,645
Patients and outcome					
All patients from the basic group		n = 31,217		n = 289,692	
ASA	Prior diseases are relevant for outcome prediction (RISC II)	**94 %**	1,839	**91 %**	25,015
Surgical treatment *	A low rate of surgical patients could be based on incomplete documentation	**61 %**	12,302	**54 %**	132,384
Outcome	The levels according to the parameter „outcome" describe the patient's condition at discharge or transfer	**99 %**	462	**97 %**	9,059
Process data - Period of time until documentation					
All patients from the basic group		n = 31,217		n = 289,692	
Time from accident to case creation in the TR-DGU**	A **prompt documentation** of patients increases the data quality of a case in the TR-DGU. Therefore, the time period from accident to the start of documentation is given here	**3.6 months**		**4.2 months**	
Time from discharge to case completion in the TR-DGU**	Time from discharge of a patient to **completion** of documentation in the registry	**4.9 months**		**5.5 months**	

* Since the dataset revision in 2015 the parameter is also part of the QM dataset

** Not to be interpreted for imported data, because only the import date is recorded and not the date of creation and completion of the case documentation

9.2 Comparison of data quality among hospitals

Detailed completeness rates for different variables are presented in chapter 9.1. In order to compare data quality among hospitals, a combined **quality score** is generated here.

The calculation of this quality score is based on the following ten variables:
Prehospital phase: GCS, blood pressure, cardio-pulmonary resuscitation
Emergency room phase: Time of admission, blood pressure, base excess, coagulation (Quick's value or INR), haemoglobin
Patient information: Previous health status (pre-injury ASA), outcome (according to the parameter „outcome").
All these variables are part of both the standard and the reduced QM dataset.

The number of missing data from all **primary admitted patients in the basic group** is summarised. This leads to the calculation of an average completeness rate.

Table 13: Data completeness for the TR-DGU in 2023 and comparison over the time

Data quality: Completeness	TR-DGU 2023	TR-DGU 2014-2022
Primary admitted patients from the basic group	n = 28,718	n = 264,329
Expected number of documented values	n = 287,180	n = 2,643,290
Number of missing values	{} 24,833	{} 224,437
Average completeness rate (%) based on the 10 specified parameters	**91.4 %**	**91.5 %**

9.2.1 Graphical comparison with other hospitals

Figure 28 summarises the average completeness value from all 693 hospitals with documented basic group cases **in the last year**. It follows the idea of a box plot in which the light blue box ranging from 87.1 % to 96.0 % covers half of all hospital values. The black vertical line within the box is the median average completeness value 92.3 %.

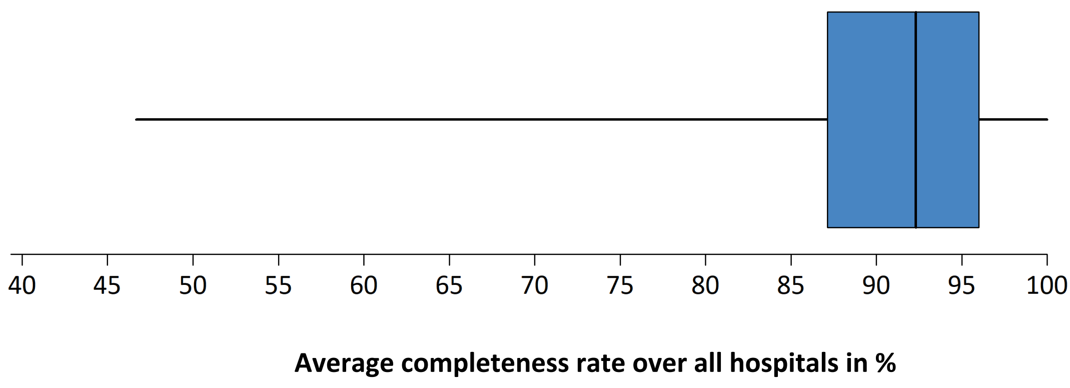


Figure 28: Distribution of the data completeness rate in 2023 over all hospitals

9.2.2 Development over time

Figure 29 shows the development of data completeness over the last ten years since 2014. For each documentation form (standard/QM dataset) a separate line is given. It can be seen that the data completeness rate of the QM dataset is slightly increased since 2014. The data completeness of the standard dataset has been approaching that of the QM dataset for years. In 2023 the completeness of both datasets are over 90 %.

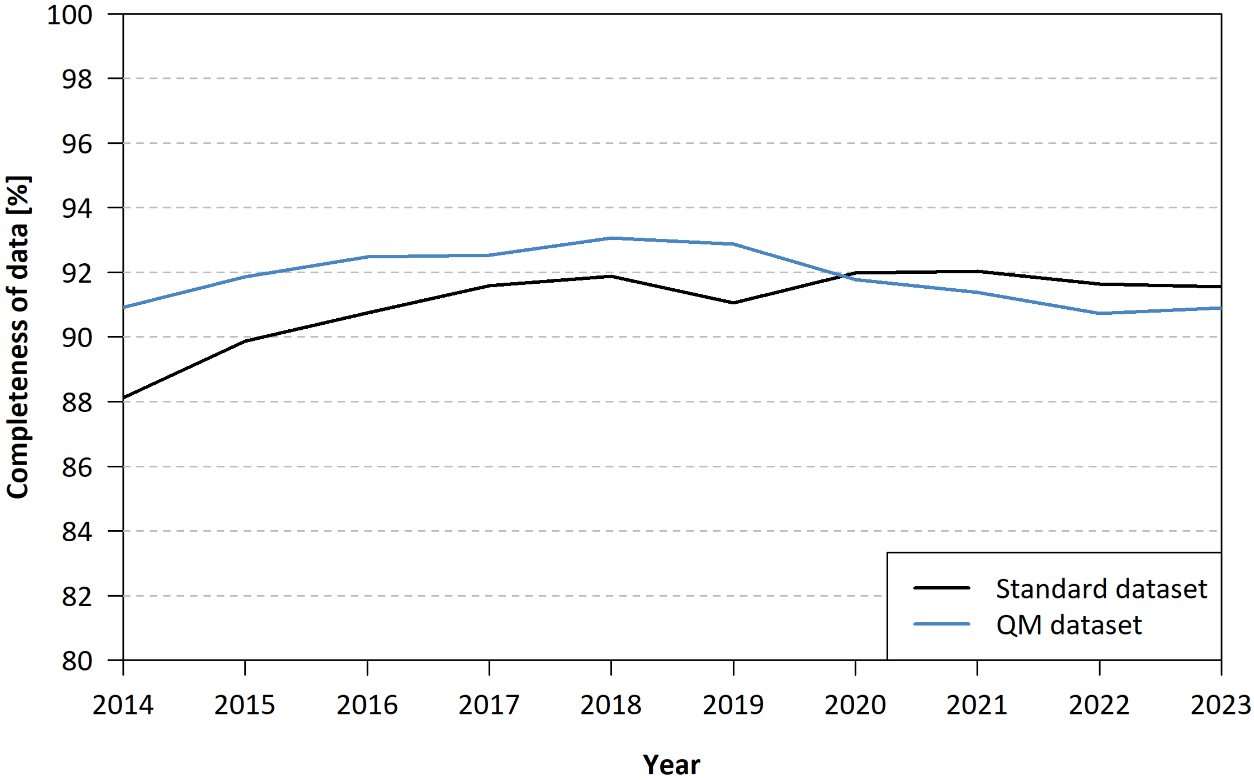


Figure 29: Development over time of the documentation quality: completeness rate in the TR-DGU 2014-2023

10 Injury pattern

In table 14, the average injury pattern of the TraumaRegister DGU® patients is presented. Only cases from the **basic group** are considered. In order to increase precision, all patients from the **last three years (2021-2023)** are pooled. Data are presented for each of the nine body regions according to the **Abbreviated Injury Scale (AIS)**. The percents refer to injuries with an injury **severity of at least two points** (including radius fractures, spine fractures, lung contusions, etc.).

Figure 30 shows in colour the injury pattern over the the body regions that were documented in the TR-DGU in 2021-2023.

Table 14: Distribution of the injuries from all recorded patients (basic group) for the years 2021-2023

	TR-DGU 2021-2023
Patients in the basic group	**100 %** (N = 91,889)
Head	**45.9 %** (n = 42,147)
Face	**10.8 %** (n = 9,892)
Neck	**1.9 %** (n = 1,725)
Thorax	**45.7 %** (n = 41,996)
Abdomen	**14.4 %** (n = 13,192)
Spine	**29.9 %** (n = 27,508)
Arms	**28.8 %** (n = 26,465)
Pelvis	**15.6 %** (n = 14,328)
Legs	**22.7 %** (n = 20,827)

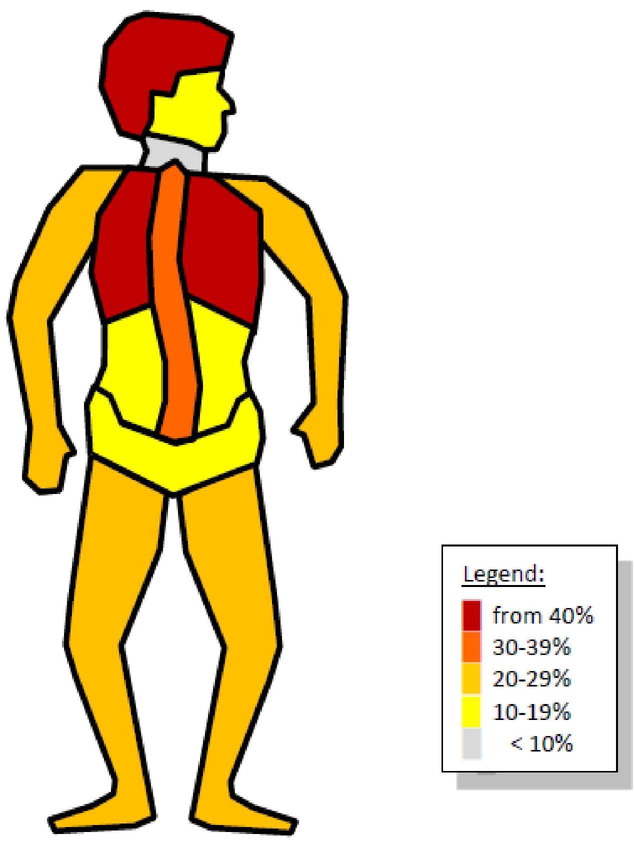


Figure 30: Injury pattern in the TR-DGU for the basic group from 2021-2023

Serious injuries (AIS 3+)

Injuries with a severity of 3 points or more (AIS) are considered „serious". The prevalence of serious injuries in the four most important body regions (head, thorax, abdomen, extremities) is given in table 15. The body regions considered here refer to the respective regions of the **Injury Severity Score** (ISS). Spinal injuries are assigned to the respective regions head, thorax or abdomen.

Different from table 14 only patients with at least one relevant serious injury (MAIS 3+, see chapter 1) are considered here.

Table 15: Ratio of serious injured patients (AIS ≥ 3) per body region for the years 2021-2023 (basic group)

	TR-DGU 2021-2023
Serious injury (AIS ≥ 3)	**83.8 %** (N = 76,983)
... of the **head**	**44.1 %** (n = 33,944)
... of the **thorax**	**46.0 %** (n = 35,380)
... of the **abdomen**	**11.9 %** (n = 9,140)
... of the **extremities**	**27.8 %** (n = 21,419)
Patients with **more than one** seriously injured body region	**28.9 %** (n = 22,226)

11 General results

11.1 Number of cases

Some results of the actual data analysis from the TraumaRegister DGU® are of general interest. They are presented here without reference to individual hospitals' results.

Hospitals

In the latest year, 37,591 patients were registered from 699 hospitals that documented cases in the TraumaRegister DGU®. The **basic group** that this report is based on comprises **31,217 patients** from 693 hospitals (details on the definition see chapter 1).

There were 17,283 patients with ISS ≥ 16 from 642 hospitals in the basic group. The distribution of the number of ISS ≥ 16 patients per hospital is shown in figure 31.

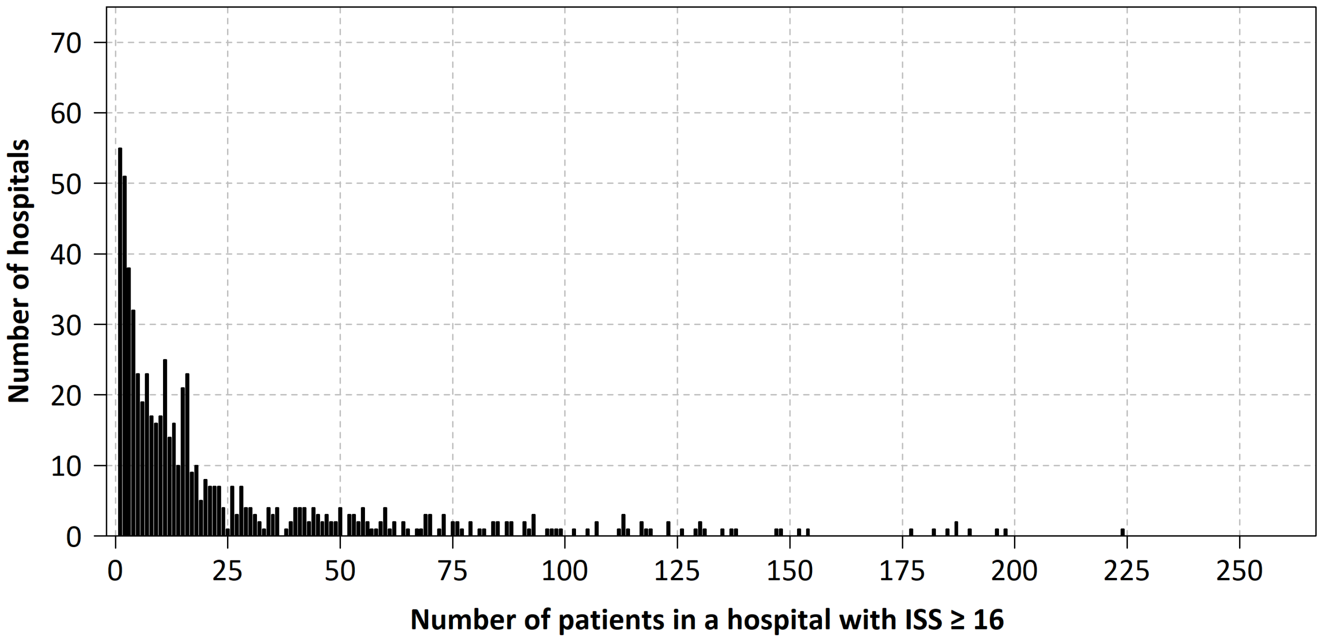


Figure 31: Frequency distribution of ISS ≥ 16 patients numbers per hospital in the TR-DGU 2023

Patients

Figure 32 demonstrates the continuous increase of registered patients over time since 2002. In the latest year, 6,374 documented patients did not fulfill the criteria to be included in the basic group and were not seriously injured per TR-DGU definition. There were 66.0 % German patients in the basic group that were documented by the standard dataset (S) in 2021.

In the latest year, there were **693 hospitals** that documented patients in the basic group, 72 hospitals were from foreign countries (10.4 %), namely Belgium, Finland, Luxembourg, The Netherlands, Austria, Switzerland, Slovenia and the United Arab Emirates and 621 hospitals from Germany.

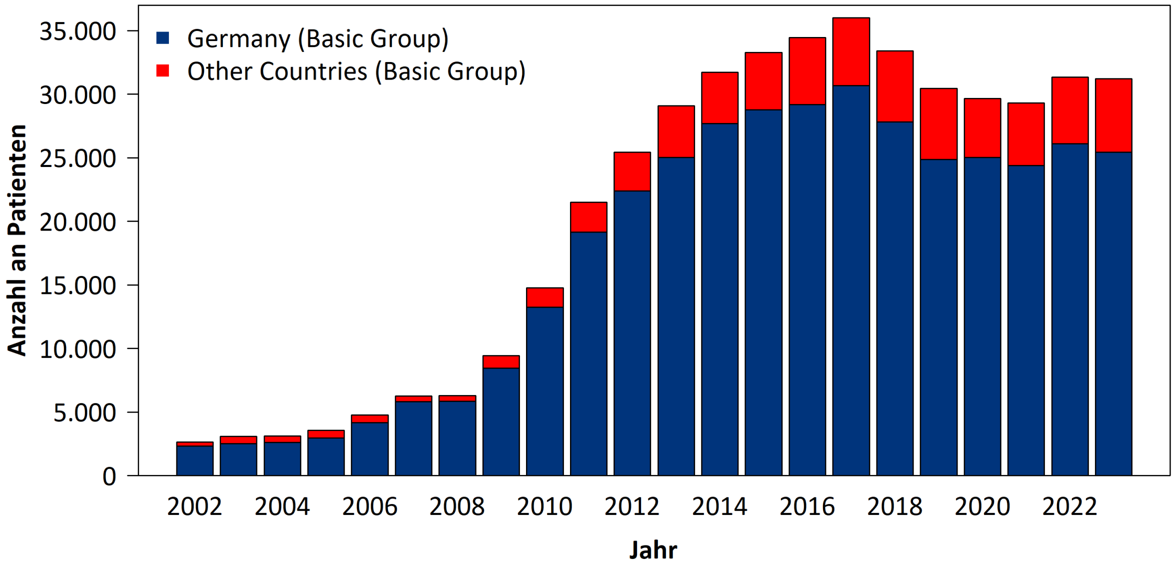


Figure 32: Number of cases in the TR-DGU 2002-2023

11.2 Patients with a documented patient's volition

With the revision of the data set in 2015, the new parameter "Patient's volition" was added in order to more accurately assess treatment quality. This parameter allows for the identification of patients who were against life-sustaining treatments. In this report all analyses comparing the actual mortality rates with the risk of death prognoses, excluded patients who denied care of their own volition and subsequently died within the first week of treatment. This was done in order to better assess the quality of treatment in each hospital.

The following analysis will provide a deeper insight into this special cohort. Table 17 shows the deceased of the basic group, separated according to patient's volition available or not available.

Table 16: Number of deceased patients with a documented patient's volition for the years 2019-2023

Year	2019	2020	2021	2022	2023
Number of deceased	3,391	3,516	3,426	3,831	3,815
Number of deceased **without** a patient's volition	1,049	1,058	943	1,069	1,020
Number of deceased **with** a patient's volition	1,148	2,002	2,257	2,539	2,623
...among them deceased within the first 7 days	737	1,323	1,491	1,737	1,793
Proportion of deceased **with a patient's volition**	52 %	65 %	71 %	70 %	72 %

The analysis of the age of the deceased shows (Table 17) that their mean age in the past 5 years was over 68,5. Furthermore, deceased patients with a patient's volition were on average approximately 16,3 years older compared to the deceased without a patient's volition.

Table 17: Mean age of the deceased separated by availability of a patient's volition in the years 2019-2023

Year	2019	2020	2021	2022	2023
Mean age of the deceased [years]	67.3	68.1	69.5	68.9	68.6
Mean age of the deceased **with** a patient's volition [years]	76.5	74.2	74	74.3	73.9
Mean age of the deceased **without** a patient's volition [years]	59.7	58.1	59.7	57.3	56

12 Publications from the TraumaRegister DGU®

An extended list of publications from the TraumaRegister DGU® since 1997 is available on **www.traumaregister-dgu.de**.

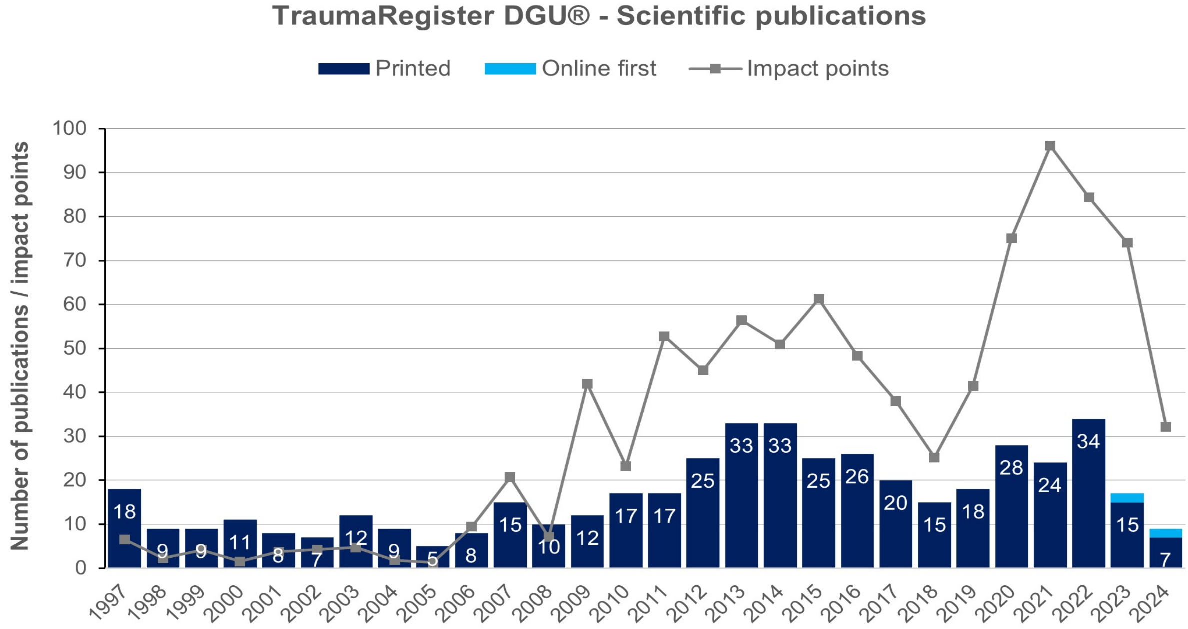


Figure 33: Number of publications from the TraumaRegister DGU® and their impact points since 1997 (status: 06/2024)

12.1 Facts from the Reviewboard in 2023

The Reviewboard meets every 4-6 weeks to discuss incoming applications and manuscripts from the TraumaRegister DGU® and to initiate the review process. The Reviewboard consists of four members of the NIS, that meet in a quarterly rotation system with Prof. Lefering, Dr. Höfer, Mr. Huber and Ms. Bartha. The administrative management is performed by Ms. Isserstedt. Table 19 gives an overview over the work of the TraumaRegister DGU® Reviewboard in the year 2023.

Table 18: Facts from the Reviewboard 2023

	2023
Number of new research proposals	37
Number of research proposals discussed in the Reviewboard (incl. Revisions)	57
Number of research proposals reviewed (incl. resubmissions)	25
Number of manuscripts reviewed	13
Number of manuscripts approved for publication	15
Number of participating reviewers	54

12.2 Publications from the TR-DGU 2023 - 06/2024

2024

Bath MF, Schloer J, Strobel J, Rea W, Lefering R, Maegele M, De'Ath H, Perkins ZB. Trends in pre-hospital volume resuscitation of blunt trauma patients: a 15-year analysis of the British (TARN) and German (TraumaRegister DGU®) National Registries. Crit Care. 2024; 28: 81.*

Beltzer, C., Imach, S., Wafaisade, A. et al. Use of angioembolization, treatment modalities and mortality in association with blunt liver trauma in Germany — a data analysis of the TraumaRegister DGU®. Langenbecks Arch Surg 2024; 409, 6.

Deluca A, Deininger C, Wichlas F, Traweger A, Lefering R, Mueller EJ. Präklinisches Management bei Traumapatienten und die zunehmende Zahl von Helikopter-Rettungstransporten: Eine epidemiologische Studie des TraumaRegister DGU® [Prehospital management in trauma patients and the increasing number of helicopter EMS transportations: An epidemiological study of the TraumaRegister DGU®]. Unfallchirurgie (Heidelb). 2023. [Epub ahead of print].

Fitschen-Oestern S, Franke GM, Kirsten N, Lefering R, Lippross S, Schröder O, Klüter T, Müller M, Seekamp A; TraumaRegister DGU. RDoes tranexamic acid have a positive effect on the outcome of older multiple trauma patients on antithrombotic drugs? An analysis using the TraumaRegister DGU®. Front Med (Lausanne). 2024 Feb 20;11:1324073. doi: 10.3389/fmed.2024.

*Lefering R, Bieler D.*Woran stirbt der schwerverletzte Patient: eine Analyse aus 30 Jahren TraumaRegister DGU [Cause of Death after Severe Trauma: 30 Years Experience from TraumaRegister DGU]. Zentralbl Chir. 2024 May 27. German. doi: 10.1055/a-2324-1627. Epub ahead of print.

*Maek T, Fochtmann U, Jungbluth P, Pass B, Lefering R, Schoeneberg C, Lendemans S, Hussmann B.*Reality of treatment for severely injured patients: are there age-specific differences? BMC Emerg Med. 2024; 24: 14.*

Pflüger P, Lefering R, Dommasch M, Biberthaler P, Kanz KG. Auswirkung der COVID-19-Pandemie auf die Versorgung von Schwerverletzten: Analyse aus dem TraumaRegister DGU®. Unfallchirurgie (Heidelb). 2023 [Epub ahead of print].*

Trentzsch H, Lefering R, Schweigkofler U; TraumaRegister DGU. Imposter or knight in shining armor? Pelvic circumferential compression devices (PCCD) for severe pelvic injuries in patients with multiple trauma: a trauma-registry analysis. Scand J Trauma Resusc Emerg Med. 2024 Jan 16;32(1):2.

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2023

Bakir S, Lefering R, Auerbach L, Ekkernkamp A and the TraumaRegister DGU. The quality of care of persons with severe trauma in Germany during the COVID-19 pandemic as assessed with data from the 2020 DGU Trauma Registry [Versorgungsqualität Schwerverletzter in Deutschland während der COVID-19-Pandemie anhand von Daten aus dem TraumaRegister DGU 2020]. Dtsch Arztebl Int 2023; 120: 400-401.

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Biber R, Kopschina C, Willauschus M, Bail HJ, Lefering R; TraumaRegister DGU. CT scan and conventional x-ray in multiple injured patient care: diagnostic strategies and outcomes analysed from the TraumaRegister DGU®. Eur J Trauma Emerg Surg. 2023 Aug;49(4):1927-1932.

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Fuchs K, Backhaus R, Jordan MC, Lefering R, Meffert RH, Gilbert F; das TraumaRegister DGU. Der schwer verletzte ältere Fahrradfahrer – Auswertung des TraumaRegister DGU® : Retrospektive, multizentrische Querschnittstudie anhand des TraumaRegister DGU® [The severely injured older cyclist-Evaluation of the TraumaRegister DGU® : Retrospective, multicenter cross-sectional study based on the TraumaRegister DGU®]. Unfallchirurgie 2023; 126:952–959.

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*Helsloot D, Fitzgerald M, Lefering R, Verelst S, Missant C; TraumaRegister DGU.*Trauma-induced disturbances in ionized calcium levels correlate parabolically with coagulopathy, transfusion, and mortality: a multicentre cohort analysis from the TraumaRegister DGU®. Crit Care. 2023; 27(1):267.

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Mair O, Müller M, Rittstieg P, Zehnder P, Lefering R, Biberthaler P, Wenk MJ, Hanschen M, The TraumaRegister Dgu. Predicting Genitourinary Injuries in Polytraumatized Patients-Development of the GUIPP Scoring System. J Clin Med. 2023; 12: 7341.

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Spering C, Bieler D, Ruchholtz S, Bouillon B, Hartensuer R, Lehmann W, Lefering R, Düsing H; for Committee on Emergency Medicine, Intensive Care and Trauma Management (Sektion NIS) of the German Trauma Society (DGU). Evaluation of the interhospital patient transfer after implementation of a regionalized trauma care system (TraumaNetzwerk DGU®) in Germany. Front Med (Lausanne). 2023;10:1298562.

Spering C, Lehmann W, Möller S, Bieler D, Schweigkofler U, Hackenberg L, Sehmisch S, Lefering R; TraumaRegister DGU. The pelvic vascular injury score (P-VIS): a prehospital instrument to detect significant vascular injury in pelvic fractures. Eur J Trauma Emerg Surg. 2023 Oct 23. Epub ahead of print.

von Lübken F, Prause S, Lang P, Friemert BD, Lefering R, Achatz G. Early total care or damage control orthopaedics for major fractures ? Results of propensity score matching for early definitive versus early temporary fixation based on data from the trauma registry of the German Trauma Society (TraumaRegister DGU®). Eur J Trauma Emerg Surg. 2023 Aug;49(4):1933-1946.

Wilharm A, Pflug A, Loos F, Sommerfeld O, Hofmann GO, Sauer S. Causes of Death in the Seriously Injured -Why do Severely Injured Patients Die Today? Z Orthop Unfall. 2023;161(3):297-303.

12.3 Abstracts 07/2023 - 05/2024

Crit Care. 2024 Mar 15;28(1):81. doi: 10.1186/s13054-024-04854-x.

Trends in pre-hospital volume resuscitation of blunt trauma patients: a 15-year analysis of the British (TARN) and German (TraumaRegister DGU®) National Registries.

Bath MF, Schloer J, Strobel J, Rea W, Lefering R, Maegele M, De'Ath H, Perkins ZB.

INTRODUCTION: Fluid resuscitation has long been a cornerstone of pre-hospital trauma care, yet its optimal approach remains undetermined. Although a liberal approach to fluid resuscitation has been linked with increased complications, the potential survival benefits of a restrictive approach in blunt trauma patients have not been definitively established. Consequently, equipoise persists regarding the optimal fluid resuscitation strategy in this population.

METHODS: We analysed data from the two largest European trauma registries, the UK Trauma Audit and Research Network (TARN) and the German TraumaRegister DGU® (TR-DGU), between 2004 and 2018. All adult blunt trauma patients with an Injury Severity Score > 15 were included. We examined annual trends in pre-hospital fluid resuscitation, admission coagulation function, and mortality rates.

RESULTS: Over the 15-year study period, data from 68,510 patients in the TARN cohort and 82,551 patients in the TR-DGU cohort were analysed. In the TARN cohort, 3.4% patients received pre-hospital crystalloid fluids, with a median volume of 25 ml (20-36 ml) administered. Conversely, in the TR-DGU cohort, 91.1% patients received pre-hospital crystalloid fluids, with a median volume of 756 ml (750-912 ml) administered. Notably, both cohorts demonstrated a consistent year-on-year decrease in the volume of pre-hospital fluid administered, accompanied by improvements in admission coagulation function and reduced mortality rates.

CONCLUSION: Considerable variability exists in pre-hospital fluid resuscitation strategies for blunt trauma patients. Our data suggest a trend towards reduced pre-hospital fluid administration over time. This trend appears to be associated with improved coagulation function and decreased mortality rates. However, we acknowledge that these outcomes are influenced by multiple factors, including other improvements in pre-hospital care over time. Future research should aim to identify which trauma populations may benefit, be harmed, or remain unaffected by different pre-hospital fluid resuscitation strategies.

Langenbecks Arch Surg. 2023 Dec 13;409(1):6. doi: 10.1007/s00423-023-03196-6.

Use of angioembolization, treatment modalities and mortality in association with blunt liver trauma in Germany - a data analysis of the TraumaRegister DGU®.

Beltzer C, Imach S, Wafaisade A, Lefering R, Kölbel B; TraumaRegister DGU.

PURPOSE: Angioembolization (ANGIO) is highly valued in national and international guideline recommendations as a treatment adjunct with blunt liver trauma (BLT). The literature on BLT shows that treatment, regardless of the severity of liver injury, can be accomplished with a high success rate using nonoperative management (NOM). An indication for surgical therapy (SURG) is only seen in hemodynamically instable patients. For Germany, it is unclear how frequently NOM ± ANGIO is actually used, and what mortality is associated with BLT.

METHODS: A retrospective systematic data analysis of patients with BLT from the TraumaRegister DGU® was performed. All patients with liver injury AIS ≥ 2 between 2015 and 2020 were included. The focus was to evaluate the use ANGIO as well as treatment selection (NOM vs. SURG) and mortality in relation to liver injury severity. Furthermore, independent risk factors influencing mortality were identified, using multivariate logistic regression.

RESULTS: A total of 2353 patients with BLT were included in the analysis. ANGIO was used in 18 cases (0.8%). NOM was performed in 70.9% of all cases, but mainly in less severe liver trauma (AIS ≤ 2, abbreviated injury scale). Liver injuries AIS ≥ 3 were predominantly treated surgically (64.6%). Overall mortality associated with BLT was 16%. Severity of liver injury ≥ AIS 3, age > 60 years, hemodynamic instability (INSTBL), and mass transfusion (≥ 10 packed red blood cells/pRBC) were identified as independent risk factors contributing to mortality in BLT.

CONCLUSION: ANGIO is rarely used in BLT, contrary to national and international guideline recommendations. In Germany, liver injuries AIS ≥ 3 are still predominantly treated surgically. BLT is associated with considerable mortality, depending on the presence of specific contributing risk factors.

Sci Rep. 2023 Jul 27;13(1):12152. doi: 10.1038/s41598-023-39335-8.

Adherence to the transfer recommendations of the German Trauma Society in severely injured children: a retrospective study from the TraumaRegister DGU.

Bläsius FM, Laubach M, Lefering R, Hildebrand F, Andruszkow H.

Particularly for pediatric trauma patients, it is of utmost importance that the right patient be treated in the right place at the right time. While unnecessary interhospital transfers must be avoided, the decision against transfer should not lead to higher complication rates in trauma centers without added pediatric qualifications.

We therefore identified independent predictive factors for an early transfer of severely injured patients and compared these factors with the current transfer recommendations of the German Trauma Society. Additionally, the quality of the self-assessment based on the mortality of children who were not transferred was evaluated. A national dataset from the TraumaRegister DGU® was used to retrospectively identify factors for an early interhospital transfer (< 48 h) to a superordinate trauma center. Severely injured pediatric patients (age < 16 years) admitted between 2010 and 2019 were included in this analysis. Adjusted odds ratios (OR) with 95% confidence intervals (CI) for early transfer were calculated from a multivariable model. Prognostic factors for hospital mortality in non-transferred patients were also analyzed.

In total, 6069 severely injured children were included. Of these, 65.2% were admitted to a Level I trauma center, whereas 27.7% and 7.1% were admitted to Level II and III centers, respectively. After the initial evaluation in the emergency department, 25.5% and 50.1% of children primarily admitted to a Level II or III trauma center, respectively, were transferred early. Statistically significant predictors of an early transfer were: Serious traumatic brain injury (OR 1.76, 95% CI 1.28-2.43), Injury severity score (ISS) ≥ 16 points (ISS 16-24: OR 2.06, 95% CI 1.59-2.66; ISS 25-33: OR 3.0, 95% CI 2.08-4.31; ISS 34-75: OR 5.42, 95% CI 3.0-9.81, reference category: ISS 9-15), age < 10 years (age 0-1: OR 1.91, 95% CI 1.34-2.71; age 2-5: 2.04, 95% CI 1.50-2.78; age 6-9: 1.62, 95% CI 1.23-2.14; reference category: age 10-15). The most important independent factor for mortality in non-transferred patients was age < 10 years (age 0-1: 5.35, 95% CI 3.25-8.81; age 2-5: 2.46, 95% CI 1.50-4.04; age 6-9: OR 1.7, 95% CI 1.05-2.75; reference category: age 10-15).

Knowing the independent predictors for an early transfer, such as a young patient's age, a high injury severity, serious traumatic brain injury (TBI), may improve the choice of the appropriate trauma center. This may guide the rapid decision for an early interhospital transfer. There is still a lack of outcome data on children with early interhospital transfers in Germany, who are the most vulnerable group.

Front Med (Lausanne). 2024 Feb 20;11:1324073. doi: 10.3389/fmed.2024.1324073. eCollection 2024.

Does tranexamic acid have a positive effect on the outcome of older multiple trauma patients on antithrombotic drugs? An analysis using the TraumaRegister DGU(®).

Fitschen-Oestern S, Franke GM, Kirsten N, Lefering R, Lippross S, Schröder O, Klüter T, Müller M, Seekamp A; TraumaRegister DGU.

BACKGROUND: Acute hemorrhage is one of the most common causes of death in multiple trauma patients. Due to physiological changes, pre-existing conditions, and medication, older trauma patients are more prone to poor prognosis. Tranexamic acid (TXA) has been shown to be beneficial in multiple trauma patients with acute hemorrhage in general. The relation of tranexamic acid administration on survival in elderly trauma patients with pre-existing anticoagulation is the objective of this study. Therefore, we used the database of the TraumaRegister DGU® (TR-DGU), which documents data on severely injured trauma patients.

METHODS: In this retrospective analysis, we evaluated the TR-DGU data from 16,713 primary admitted patients with multiple trauma and age > =50 years from 2015 to 2019. Patients with pre-existing anticoagulation and TXA administration (996 patients, 6%), pre-existing anticoagulation without TXA administration (4,807 patients, 28.8%), without anticoagulation as premedication but TXA administration (1,957 patients, 11.7%), and without anticoagulation and TXA administration (8,953 patients, 53.6%) were identified. A regression analysis was performed to investigate the influence of pre-existing antithrombotic drugs and TXA on mortality. A propensity score was created in patients with pre-existing anticoagulation, and matching was performed for better comparability of patients with and without TXA administration.

RESULTS: Retrospective trauma patients who underwent tranexamic acid administration were older and had a higher ISS than patients without tranexamic acid donation. Predicted mortality (according to the RISC II Score) and observed mortality were higher in the group with tranexamic acid administration. The regression analysis showed that TXA administration was associated with lower mortality rates within the first 24 h in older patients with anticoagulation as premedication. The propensity score analysis referred to higher fluid requirement, higher requirement of blood transfusion, and longer hospital stay in the group with tranexamic acid administration. There was no increase in complications. Despite higher transfusion volumes, the tranexamic acid group had a comparable all-cause mortality rate.

CONCLUSION: TXA administration in older trauma patients is associated with a reduced 24-h mortality rate after trauma, without increased risk of thromboembolic events. There is no relationship between tranexamic acid and overall mortality in patients with anticoagulation as premedication. Considering pre-existing anticoagulation, tranexamic acid may be recommended in elderly trauma patients with acute bleeding.

Global Spine J. 2023 Nov 14:21925682231216082. doi: 10.1177/21925682231216082. Online ahead of print.

Timing of Spinal Surgery in Polytrauma: The Relevance of Injury Severity, Injury Level and Associated Injuries.

Hax J, Teuben M, Halvachizadeh S, Berk T, Scherer J, Jensen KO, Lefering R, Pape HC, Sprengel K; TraumaRegister DGU.

OBJECTIVE: Polytraumatized patients with spinal injuries require tailor-made treatment plans. Severity of both spinal and concomitant injuries determine timing of spinal surgery. Aim of this study was to evaluate the role of spinal injury localization, severity and concurrent injury patterns on timing of surgery and subsequent outcome.

METHODS: The TraumaRegister DGU® was utilized and patients, aged ≥16 years, with an Injury Severity Score (ISS) ≥16 and diagnosed with relevant spinal injuries (abbreviated injury scale, AIS ≥ 3) were selected. Concurrent spinal and non-spinal injuries were analysed and the relation between injury severity, concurrent injury patterns and timing of spinal surgery was determined.

RESULTS: 12.596 patients with a mean age of 50.8 years were included. 7.2% of patients had relevant multisegmental spinal injuries. Furthermore, 50% of patients with spine injuries AIS ≥3 had a more severe non-spinal injury to another body part. ICU and hospital stay were superior in patients treated within 48 hrs for lumbar and thoracic spinal injuries. In cervical injuries early intervention (<48 hrs) was associated with increased mortality rates (9.7 vs 6.3%).

CONCLUSIONS: The current multicentre study demonstrates that polytrauma patients frequently sustain multiple spinal injuries, and those with an index spine injury may therefore benefit from standardized whole-spine imaging. Moreover, timing of surgical spinal surgery and outcome appear to depend on the severity of concomitant injuries and spinal injury localization. Future prospective studies are needed to identify trauma characteristics that are associated with improved outcome upon early or late spinal surgery.

Zentralbl Chir. 2024 May 27. doi: 10.1055/a-2324-1627. Online ahead of print.

Cause of Death after Severe Trauma: 30 Years Experience from TraumaRegister DGU.

Lefering R, Bieler D.

Every year, thousands of people in Germany succumb to severe injuries. But what causes the death of these patients? In addition to the trauma, pre-traumatic health status, age, and other influencing factors play a role in the outcome after trauma. This study aims to answer the question of what causes the death of a severely injured patient. For this publication, in addition to previously published results, we examined current data from patients in German hospitals from the years 2015-2022 (8 years) documented in the TraumaRegister DGU®. The feature "Presumed Cause of Death", introduced in 2015, was considered. Patients transferred out early (< 48 h) as well as patients with minor injuries were excluded from this analysis. The number of fatalities decreases over time and does not correspond to a traditionally postulated tri-modal mortality distribution. Instead, over time, the distribution of causes of death shows significant variation. In over half of the cases (54%), traumatic brain injury (TBI) was the presumed cause of death, followed by organ failure (24%) and haemorrhage (9%). TBI dominates, especially in the first week, haemorrhage in the first 24 h, and organ failure as a cause steadily increases over time.In summary, it can be observed that the risk of death due to trauma-related consequences is highest in the first minutes, hours, and days, decreasing steadily over time. Particularly, the extent of injuries, head injuries, and significant blood loss are early risk factors.

BMC Emerg Med. 2024 Jan 24;24(1):14. doi: 10.1186/s12873-024-00935-w.

Reality of treatment for severely injured patients: are there age-specific differences?

Maek T, Fochtmann U, Jungbluth P, Pass B, Lefering R(3), Schoeneberg C, Lendemans S, Hussmann B.

BACKGROUND: Major trauma and its consequences are one of the leading causes of death worldwide across all age groups. Few studies have conducted comparative age-specific investigations. It is well known that children respond differently to major trauma than elderly patients due to physiological differences. The aim of this study was to analyze the actual reality of treatment and outcomes by using a matched triplet analysis of severely injured patients of different age groups.

METHODS: Data from the TraumaRegister DGU® were analyzed. A total of 56,115 patients met the following inclusion criteria: individuals with Maximum Abbreviated Injury Scale > 2 and < 6, primary admission, from German-speaking countries, and treated from 2011-2020. Furthermore, three age groups were defined (child: 3-15 years; adult: 20-50 years; and elderly: 70-90 years). The matched triplets were defined based on the following criteria: 1. exact injury severity of the body regions according to the Abbreviated Injury Scale (head, thorax, abdomen, extremities [including pelvis], and spine) and 2. level of the receiving hospital.

RESULTS: A total of 2,590 matched triplets could be defined. Traffic accidents were the main cause of severe injury in younger patients (child: 59.2%; adult: 57.9%). In contrast, low falls (from < 3 m) were the most frequent cause of accidents in the elderly group (47.2%). Elderly patients were least likely to be resuscitated at the scene. Both children and elderly patients received fewer therapeutic interventions on average than adults. More elderly patients died during the clinical course, and their outcome was worse overall, whereas the children had the lowest mortality rate.

CONCLUSIONS: For the first time, a large patient population was used to demonstrate that both elderly patients and children may have received less invasive treatment compared with adults who were injured with exactly the same severity (with the outcomes of these two groups being opposite to each other). Future studies and recommendations should urgently consider the different age groups.

J Clin Med. 2023 Nov 27;12(23):7341. doi: 10.3390/jcm12237341.

Predicting Genitourinary Injuries in Polytraumatized Patients-Development of the GUIPP Scoring System.

Mair O, Müller M, Rittstieg P, Zehnder P, Lefering R, Biberthaler P, Wenk MJ, Hanschen M, The TraumaRegister Dgu.

BACKGROUND: The genitourinary system is not as commonly affected as many other organ systems in severely injured patients. Although a delayed and missed diagnosis of genitourinary injuries (GUIs) can severely compromise long-term outcomes, these injuries are frequently overlooked. Therefore, we present a scoring system designed to assist emergency physicians in diagnosing GUIs in severely injured patients.

METHODS: The data were obtained from the TraumaRegister DGU® from the years 2015-2021. All severely injured patients (ISS ≥ 16) ≥16 years of age and treated in Germany, Austria, or Switzerland were included in this study. We excluded patients who were transferred out early (48 h), and all patients with isolated traumatic brain injury. After the univariate analysis of the relevant predictive factors, we developed a scoring system using a binary logistic regression model.

RESULTS: A total of 70,467 patients were included in this study, of which 4760 (6.8%) sustained a GUI. Male patients (OR: 1.31, 95% CI [1.22, 1.41]) injured in motorcycle accidents (OR: 1.70, 95% CI [1.55, 1.87]), who were under 60 years of age (OR: 1.59, 95% CI [1.49, 1.71]) and had sustained injuries in multiple body regions (OR: 6.63, 95% CI [5.88, 7.47]), and suffered severe pelvic girdle injuries (OR: 2.58, 95% CI [2.29, 2.91]) had the highest odds of sustaining a GUI. With these predictive factors combined, a novel scoring system, the GUIPP score, was developed. It showed good validity, with an AUC of 0.722 (95% CI [0.71; 0.73]).

CONCLUSION: Predicting GUI in severely injured patients remains a challenge for treating physicians, but is extremely important to prevent poor outcomes for affected patients. The GUIPP score can be utilized to initiate appropriate diagnostic steps early on in order to reduce the delayed and missed diagnosis of GUI, with scores ≥ 9 points making GUIs very likely.

Front Med (Lausanne). 2023 Nov 15;10:1298562. doi: 10.3389/fmed.2023.1298562. eCollection 2023.

Evaluation of the interhospital patient transfer after implementation of a regionalized trauma care system (TraumaNetzwerk DGU(®)) in Germany.

Spering C, Bieler D, Ruchholtz S, Bouillon B, Hartensuer R, Lehmann W, Lefering R, Düsing H; for Committee on Emergency Medicine, Intensive Care and Trauma Management (Sektion NIS) of the German Trauma Society (DGU).

PURPOSE: The aim of the study was to evaluate how many patients are being transferred between trauma centers and and their characteristics in the 2006 initiated TraumaNetzwerk DGU® (TNW). We further investigated the time point of transfer and differences in outcome, compared to patients not being transferred. We wanted to know how trauma centers judged the performance of the TNW in transfer.

METHOD: (1) We analyzed the data of the TraumaRegister DGU® (TR-DGU) from 2014-2018. Included were patients that were treated in German trauma centers, maximum AIS (MAIS) >2 and MAIS 2 only in case of admission on ICU or death of the patient. Patients being transferred were compared to patients who were not. Characteristics were compared, and a logistic regression analysis performed to identify predictive factors. (2) We performed a survey in the TNW focussing on frequency, timing and communication between hospitals and improvement through TNW.

RESULTS: Study I analyzed 143,195 patients from the TR-DGU. Their mean ISS was 17.8 points (SD 11.5). 56.4% were admitted primarily to a Level-I, 32.2% to a Level-II and 11.4% to a Level-III Trauma Center. 10,450 patients (7.9%) were transferred. 3,667 patients (22.7%) of the admitted patients of Level-III Center and 5,610 (12.6%) of Level-II Center were transferred, these patients showed a higher ISS (Level-III: 18.1 vs. 12.9; Level-II: 20.1 vs. 15.8) with more often a severe brain injury (AIS 3+) (Level-III: 43.6% vs. 13.1%; Level-II: 53.2% vs. 23.8%). Regression analysis showed ISS 25+ and severe brain injury AIS 3+ are predictive factors for patients needing a rapid transfer. Study II: 215 complete questionnaires (34%) of the 632 trauma centers. Transfers were executed within 2 h after the accident (Level-III: 55.3%; Level-II: 25.0%) and between 2-6 h (Level-III: 39.5%; Level-II: 51.3%). Most trauma centers judged that implementation of TNW improved trauma care significantly (Level III: 65.0%; Level-II: 61.4%, Level-I: 56.7%).

CONCLUSION: The implementation of TNW has improved the communication and quality of comprehensive trauma care of severely injured patients within Germany. Transfer is mostly organized efficient. Predictors such as higher level of head injury reveal that preclinical algorithm present a potential of further improvement.

Eur J Trauma Emerg Surg. 2023 Oct 23. doi: 10.1007/s00068-023-02374-x. Online ahead of print.

The pelvic vascular injury score (P-VIS): a prehospital instrument to detect significant vascular injury in pelvic fractures.

Spering C, Lehmann W(2), Möller S, Bieler D, Schweigkofler U, Hackenberg L, Sehmisch S, Lefering R; TraumaRegister DGU.

PURPOSE: The purpose of this study was to identify predictive factors for peri-pelvic vascular injury in patients with pelvic fractures and to incorporate these factors into a pelvic vascular injury score (P-VIS) to detect severe bleeding during the prehospital trauma management.

METHODS: To identify potential predictive factors, data were taken (1) of a Level I Trauma Centre with 467 patients (ISS ≥ 16 and AISPelvis ≥ 3). Analysis including patient's charts and digital recordings, radiographical diagnostics, mechanism and pattern of injury as well as the vascular bleeding source was performed. Statistical analysis was performed descriptively and through inference statistical calculation. To further analyse the predictive factors and finally develop the score, a 10-year time period (2012-2021) of (2) the TraumaRegister DGU® (TR-DGU) was used in a second step. Relevant peri-pelvic bleeding in patients with AISPelvis ≥ 3 (N = 9227) was defined as a combination of the following entities (target group PVITR-DGU N = 2090; 22.7%): pelvic fracture with significant bleeding (> 20% of blood volume), Injury of the iliac or femoral artery or blood transfusion of ≥ 6 units (pRBC) prior to ICU admission. The multivariate analysis revealed nine items that constitute the pelvic vascular injury score (P-VIS).

RESULTS: In study (1), 467 blunt pelvic trauma patients were included of which 24 (PVI) were presented with significant vascular injury (PVI, N = 24; control (C, N = 443). Patients with pelvic fractures and vascular injury showed a higher ISS, lower haemoglobin at admission and lower blood pressure. Their mortality rate was higher (PVI: 17.4%, C: 10.3%). In the defining and validating process of the score within the TR-DGU, 9227 patients met the inclusion criteria. 2090 patients showed significant peripelvic vascular injury (PVITR-DGU), the remaining 7137 formed the control group (CTR-DGU). Nine predictive parameters for peripelvic vascular injury constituted the peripelvic vascular injury score (P-VIS): age ≥ 70 years, high-energy-trauma, penetrating trauma/open pelvic injury, shock index ≥ 1, cardio-pulmonary-resuscitation (CPR), substitution of > 1 l fluid, intubation, necessity of catecholamine substitution, remaining shock (≤ 90 mmHg) under therapy. The multi-dimensional scoring system leads to an ordinal scaled rating according to the probability of the presence of a vascular injury. A score of ≥ 3 points described the peripelvic vascular injury as probable, a result of ≥ 6 points identified a most likely vascular injury and a score of 9 points identified an apparent peripelvic vascular injury. Reapplying this score to the study population a median score of 5 points (range 3-8) (PVI) and a median score of 2 points (range 0-3) (C) (p < 0.001). The OR for peripelvic vascular injury was 24.3 for the patients who scored > 3 points vs. ≤ 2 points. The TR-DGU data set verified these findings (median of 2 points in CTR-DGU vs. median of 3 points with in PVITR-DGU).

CONCLUSION: The pelvic vascular injury score (P-VIS) allows an initial risk assessment for the presence of a vascular injury in patients with unstable pelvic injury. Thus, the management of these patients can be positively influenced at a very early stage, prehospital resuscitation performed safely targeted and further resources can be activated in the final treating Trauma Centre.

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Imposter or knight in shining armor? Pelvic circumferential compression devices (PCCD) for severe pelvic injuries in patients with multiple trauma: a trauma-registry analysis.

Trentzsch H, Lefering R, Schweigkofler U; TraumaRegister DGU.

BACKGROUND: Pelvic Circumferential Compression Devices (PCCD) are standard in hemorrhage-control of unstable pelvic ring fractures (UPF). Controversial data on their usefulness exists. Aim of the study was to investigate whether prehospital application of PCCD can reduce mortality and transfusion requirements in UPF.

METHODS: Retrospective cohort study. From 2016 until 2021, 63,371 adult severely injured patients were included into TraumaRegister DGU® of the German Trauma Society (TR-DGU). We analyzed PCCD use over time and compared patients with multiple trauma patients and UPF, who received prehospital PCCD to those who did not (noPCCD). Groups were adjusted for risk of prehospital PCCD application by propensity score matching. Primary endpoints were hospital mortality, standardized mortality rate (SMR) and transfusion requirements.

RESULTS: Overall UPF incidence was 9% (N = 5880) and PCCD use increased over time (7.5% to 20.4%). Of all cases with UPF, 40.2% received PCCD and of all cases with PCCD application, 61% had no pelvic injury at all. PCCD patients were more severely injured and had higher rates of shock or transfusion. 24-h.-mortality and hospital mortality were higher with PCCD (10.9% vs. 9.3%; p = 0.033; 17.9% vs. 16.1%, p = 0.070). Hospital mortality with PCCD was 1% lower than predicted. SMR was in favor of PCCD but failed statistical significance (0.95 vs. 1.04, p = 0.101). 1,860 propensity score matched pairs were analyzed: NoPCCD-patients received more often catecholamines (19.6% vs. 18.5%, p = 0.043) but required less surgical pelvic stabilization in the emergency room (28.6% vs. 36.8%, p < 0.001). There was no difference in mortality or transfusion requirements.

CONCLUSION: We observed PCCD overuse in general and underuse in UPF. Prehospital PCCD appears to be more a marker of injury severity and less triggered by presence of UPF. We found no salutary effect on survival or transfusion requirements. Inappropriate indication and technical flaw may have biased our results. TR-DGU does not contain data on these aspects. Further studies are necessary. Modular add-on questioners to the registry could offer one possible solution to overcome this limitation. We are concerned that PCCD use may be unfairly discredited by misinterpretation of the available evidence and strongly vote for a prospective trial.

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In-hospital mortality after prehospital endotracheal intubation versus alternative methods of airway management in trauma patients. A cohort study from the TraumaRegister DGU®.

Weigeldt M, Schulz-Drost S, Stengel D, Lefering R, Treskatsch S, Berger C; TraumaRegister DGU.

PURPOSE: Prehospital airway management in trauma is a key component of care and is associated with particular risks. Endotracheal intubation (ETI) is the gold standard, while extraglottic airway devices (EGAs) are recommended alternatives. There is limited evidence comparing their effectiveness. In this retrospective analysis from the TraumaRegister DGU®, we compared ETI with EGA in prehospital airway management regarding in-hospital mortality in patients with trauma.

METHODS: We included cases only from German hospitals with a minimum Abbreviated Injury Scale score ≥ 2 and age ≥ 16 years. All patients without prehospital airway protection were excluded. We performed a multivariate logistic regression to adjust with the outcome measure of hospital mortality.

RESULTS: We included n = 10,408 cases of whom 92.5% received ETI and 7.5% EGA. The mean injury severity score was higher in the ETI group (28.8 ± 14.2) than in the EGA group (26.3 ± 14.2), and in-hospital mortality was comparable: ETI 33.0%; EGA 30.7% (27.5 to 33.9). After conducting logistic regression, the odds ratio for mortality in the ETI group was 1.091 (0.87 to 1.37). The standardized mortality ratio was 1.04 (1.01 to 1.07) in the ETI group and 1.1 (1.02 to 1.26) in the EGA group.

CONCLUSIONS: There was no significant difference in mortality rates between the use of ETI or EGA, or the ratio of expected versus observed mortality when using ETI.

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16 List of abbreviations

AIS	Abbreviated Injury Scale
ASA	American Society of Anaesthesiologists (classification)
AUC	AUC – Academy for Trauma Surgery (Akademie der Unfallchirurgie GmbH)
BE	Base excess
BGA	Blood gas analysis
CI	Confidence interval
CT	Computer tomography
cCT	Cranial computer tomography
CPR	Cardio-pulmonary resuscitation
DGU	German Trauma Society (Deutsche Gesellschaft für Unfallchirurgie e.V.)
DVT	Deep vein thrombosis
EMS	Emergency medical services
ER	Emergency room
FAST	Focused assessment with sonography for trauma
FFP	Fresh frozen plasma
GCS	Glasgow coma scale
h	Hours
ICU	Intensiv care unit
IFOM	Institute for Research in Operative Medicine (Institut für Forschung in der Operativen Medizin)
INR	International normalised ratio
ISS	Injury severity score
LOS	Length of stay
LTC	Local trauma centre
M	Mean
m	Metre
MAIS	Maximum AIS severity score
Max	Maximum
MCI	Mass casualty incident
MI	Myocardial infarction
[min]	Minute
Min	Minimum
ml	Millilitre
mmHg	Millimetre of mercury
mmol	Millimol
MOF	Multiple organ failure
NIS	Committee on Emergency Medicine, Intensive Care and Trauma Management of the German Trauma Society DGU (Sektion Notfall-, Intensivmedizin und Schwerverletztenversorgung (Sektion NIS) der DGU)
NISS	New injury severity score
No.	Number

OP	Operation
Pat.	Patients
phys.	physiological
pRBC	packed red blood cells
QM	Quality management
REBOA	Resuscitative endovascular balloon occlusion of the aorta
RTC	Regional trauma centre
RISC	Revised injury severity score (prognostic score)
RR	Systolic blood pressure (according to Riva-Rocci in mmHg)
S	Standard dataset
sBP	Systolic blood pressure
SD	Standard deviation
SMR	Standardised mortality ratio
STC	Supra-regional trauma centre
tab.	table
TBI	Traumatic brain injury
TR-DGU	TraumaRegister DGU®
TXA	Tranexamic acid
vs.	versus
WBCT	Whole-body computer tomography