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

AUC - Academy for Trauma Surgery

Annual Report 2021

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TraumaRegister DGU®

General Annual Report

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Annual Report 2021 - TraumaRegister DGU®

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Content

Preface

Dear readers,

We are pleased to send you the TraumaRegister DGU® general **2021 annual report**.

This edition includes data for the seriously injured in 2020 (basic group), which were documented by the participating hospitals through the end of March 2021. In 2020, this basic group is comprised of 28.947 cases, according to the TraumaRegister DGU® definition of a seriously injured person. This is a decrease of 1.3 % in basis group cases compared to last year.

Internal analyses of the 2018, 2019 and 2020 TraumaRegister DGU® datasets compared to the three-year period 2015-2017 showed that there have been no relevant shifts in the registry's patient collective due to the decrease in the total number of cases. It can therefore be assumed that the comparative values from the overall register shown here continue to represent the current care situation. However, the TraumaRegister DGU® data from 2020 do reflect the changed conditions in the hospitals due to the SARS-CoV19 pandemic as well as changes in accident types in 2020 as compared to long year trends.

In 2020 a total of 36.222 patients were documented in the TR-DGU®. 20 % or 7,275 of these cases were patients with less severe injuries (e.g. simple concussions) and therefore do not fit the criteria of the TR DGU®. Cases not belonging to the basis group are not included in most scientific analyses and are also excluded from most aspects of the annual report. The AUC is available to provide information, advice and support to participating hospitals in order to minimize this unneccessary documentation.

At the end of 2020, a total of 689 hospitals were participating in the TraumaRegister DGU®. In addition to the 629 hospitals from Germany, hospitals from from eight other countries are also participating in the registry. This includes 23 hospitals from Austria, 16 from Belgium and 11 from Switzerland.

What is new in the 2021 annual report?

A new data set version (V2020) was released in July 2020. The new variables introduced with this dataset are not yet presented in the annual report, as there is no complete data year and the numbers are therefore not representative for the entire year.

The only exception is the data on COVID-19 testing, which is presented in chapter 11.2.

We sincerely hope that the 2021 annual report will again provide you with findings that contribute to the further improvement of care for severely injured patients, in the sense of quality assurance as well as health services research. In 2020, 39 scientific papers were prepared using data from the TraumaRegister DGU®. We would like to thank the authors, active reviewers and all contributing clinicians for their commitment.

Sincerely yours,

Dan Bieler   Christine Höfer   Stefan Huber-Wagner

Rolf Lefering   Katie Rascher   Christian Waydhas

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 documentatrf patients to those 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.

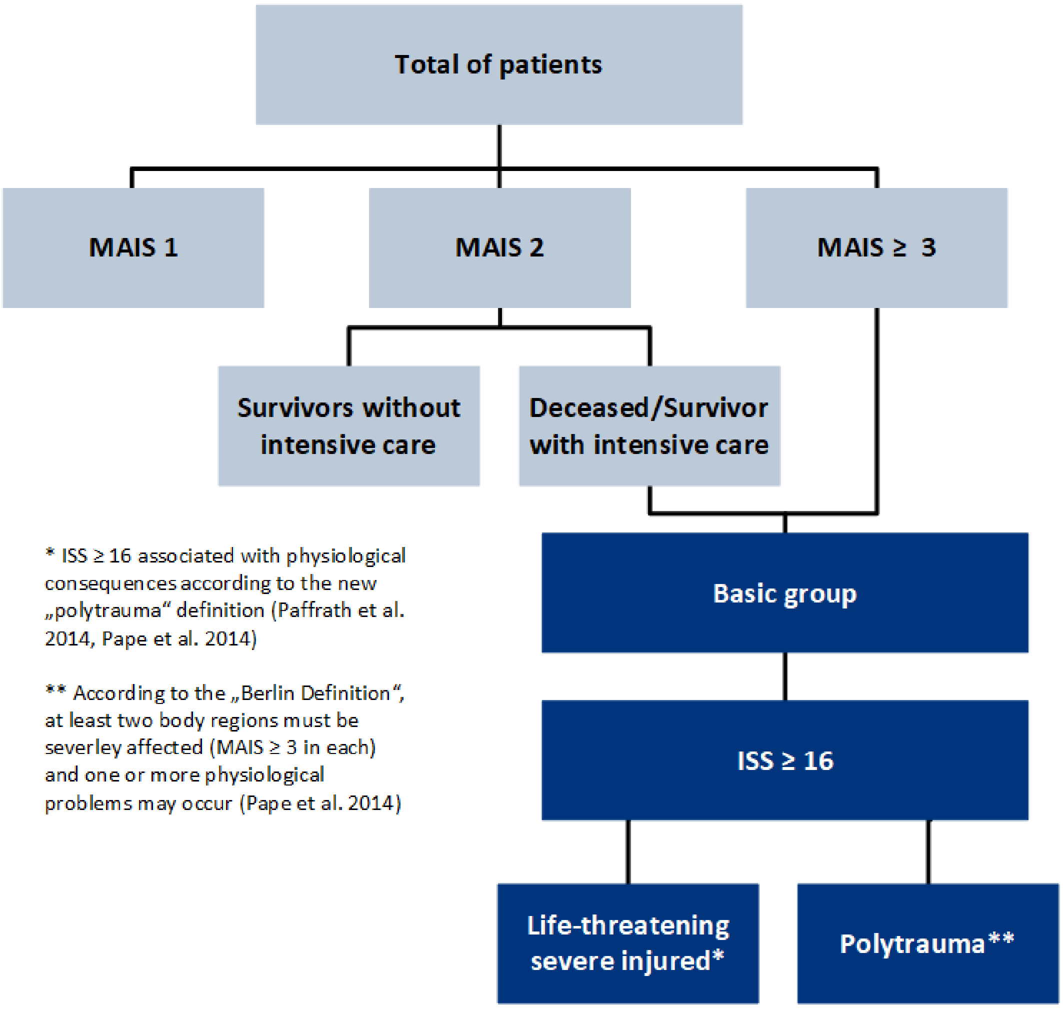


Figure 1: Flowchart describing the composition of the basic group

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 2020 from the TR-DGU

	TR-DGU 2020	Primary admitted	Transfer in	Early transfer out
Total number of documented patients.	**36.222**	31.715	2.336	2.171
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).	**4.517** (12 %)	4.362	33	122
MAIS 2 survivors without intensive care The most severe injury was of AIS grade 2. These patients survived and did not receive intensive care.	**2.712** (7 %)	4.624	193	165
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.	**5.102** (14 %)	23.970	2.137	777
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.	**23.845** (66 %)	20.217	2.065	1.563
Non-basic group Patients with MAIS 1 as well as patients with MAIS 2 that survived without intensive care.	**7.275** (20 %)	6.758	74	443
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.	**28.947**	**24.957**	**2.262**	**1.728**
Intensive care Patients admitted to the ICU.	**24.863** (86 %)	22.025	2.110	728
Deceased Patients who died in the acute care hospital.	**3.452** (12 %)	3.194	258	0
ISS 16+ The definition ISS ≥ 16 (or > 15) is commonly used to define a serious injury.	**15.743** (54 %)	13.046	1.634	1.063
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).	**9.098** (31 %)	7.744	806	548
Polytrauma According to the „Berlin Definition", two body regions are severly affected and one or more physiological problems are present (Pape et al. 2014).	**4.332** (15 %)	3.762	334	236

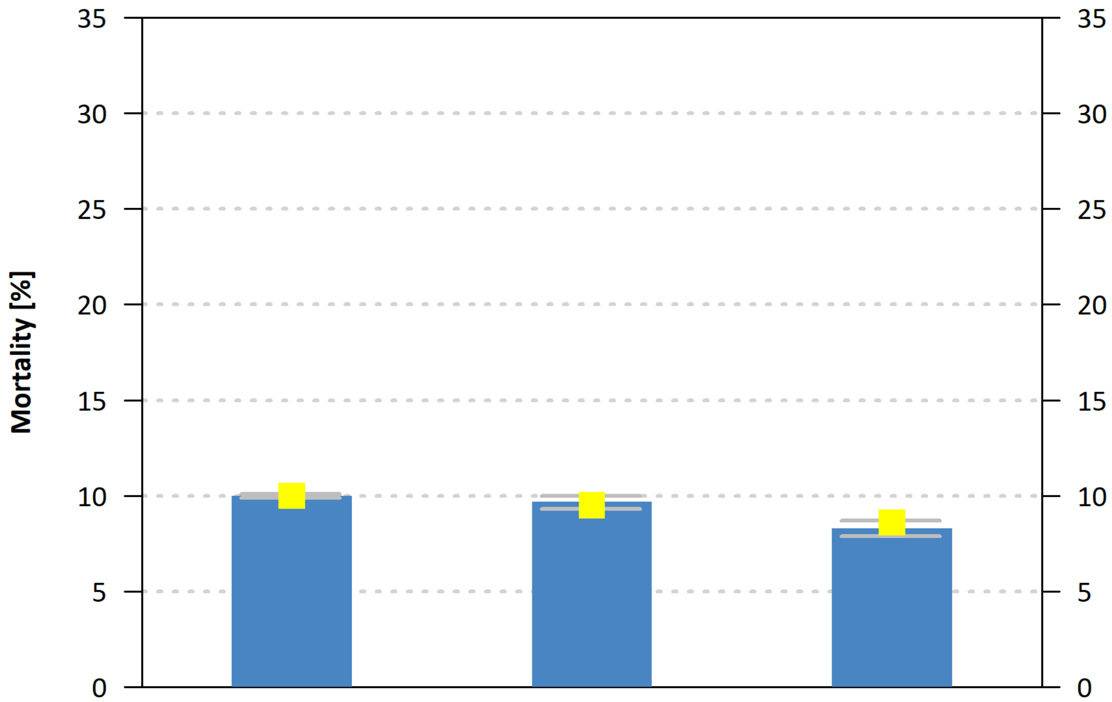
2 Observed mortality and prognosis

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 (2011-2020)	n = **303.876**
- of these, documented last year (2020)	n = **28.947**
- 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 = **23.733**

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 = 2.262 in 2020), the initial status from primary admission is missing; for patients **transferred out early** (within 48 hours after admission; n = 1.728 in 2020), no final outcome is documented. Additionally, patients deceased within the first week with a patient's volition (n = 1.224 in 2020) are excluded from this analysis to ensure a correct presentation of the quality of treatment in a hospital.

The mean age of the remaining 23.733 patients was 53,2 years and 71 % were male. The mean ISS was 17,5 points. Of these patients 1.970 died in hospital, which is **8,3 %** (95 % CI: 7,9 - 8,7). The risk of death prognosis based on RISC II is **8,6 %**. You find these values for the TR-DGU in figure 2.



	TR-DGU 10 years	TR-DGU 2019	TR-DGU 2020
No. of pat. (n):	252,143	24,641	23,733
Mortality [%]:	10.0	9.7	8.3
RISC II [%]:	10.0	9.5	8.6

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

Expanded information for Figure 2:

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 2016, 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 2019	TR-DGU 2020
Total cases (n)	252.143	24.641	23.733
„Well documented" (n)	199.528	19.944	19.152
„Well documented" (%)	79	81	81
Data quality colour code	(red)	(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

TR-DGU 2020:	Patients in the basic group:	**23.733**	primary admitted cases
	Deviation between mortality and prognosis:	**-0,3 %**	

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 2020**. 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.

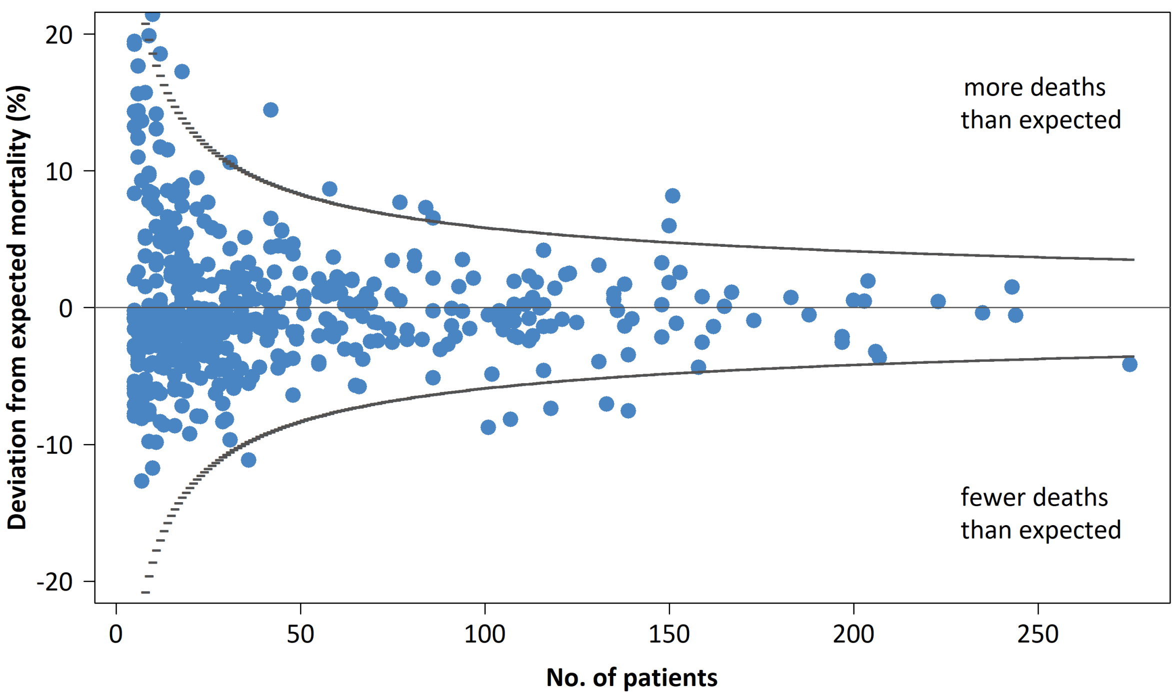


Figure 3: Deviation between the observed mortality and the risk of death prognosis (RISC II) of every hospital participating in the TR-DGU with more than 5 cases in the year 2020

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	2018	2019	**2020**
Total number of patients	(n)	303.876	33.401	30.136	**28.947**
Primary admitted and treated patients	(n)	256.210	28.316	25.300	**24.957**
Patients transferred out early	(n)	19.944	2.321	1.994	**1.728**
All primary admissions	(n)	276.154	30.637	27.294	**26.685**
Patients transferred in	(n)	27.722	2.764	2.842	**2.262**

Table 3 continuation:

		TR-DGU			
		10 years	2018	2019	**2020**
Demography (all patients in the basic group)					
Mean age	[years]	51,4	52,6	53,4	**54,2**
70 years or older	[%]	26,0	27,3	28,3	**29,0**
Proportion male	[%]	70,0	70,2	69,1	**70,1**
Trauma (all patients in the basic group)					
Blunt trauma	[%]	95,9	96,1	96,2	**96,3**
Mean ISS	[points]	18,6	18,3	18,2	**18,4**
ISS ≥ 16	[%]	54,8	54,1	53,4	**54,4**
TBI (AIS head ≥ 3)	[%]	37,0	36,0	35,7	**36,5**
Prehospital care (only primary admissions)					
Intubation by emergency physician	[%]	21,9	20,1	19,9	**14,5**
Unconscious (GCS ≤ 8)	[%]	17,0	15,8	16,3	**15,6**
Shock (RR ≤ 90 mmHg)	[%]	9,2	8,3	8,2	**7,9**
Average amount of volume	[ml]	664	634	615	**608**
Emergency room care (only primary admissions)					
Whole-body CT	[%]	77,1	79,4	78,7	**76,6**
X-ray of thorax	[%]	33,2	26,6	24,4	**21,5**
Patients with blood transfusion	[%]	7,8	6,8	6,7	**7,2**
Treatment in hospital (all patients in the basic group)					
Patients with surgery [1)]	[%]	67,0	65,3	66,1	**67,7**
if yes, no. of pat. with surgery [2)]	(n)	3,4	3,4	3,3	**3,3**
Patients treated on ICU	[%]	86,8	86,6	85,8	**85,9**
Length of stay on ICU [3)]	[days]	6,5	6,2	6,1	**6,0**
Intubated/ventilated patients on ICU [3)]	[%]	39,0	35,3	34,4	**35,2**
Length of intubation [3)]	[days]	7,4	7,3	7,3	**6,8**
Outcome (all patients in the basic group)					
Length of stay in hospital [4)]	[days]	16,1	15,3	15,2	**14,5**
Hospital mortality [4)]	[n]	32.596	3.628	3.361	**3.452**
	[%]	11,5	11,7	11,9	**12,7**
Multiple organ failure [2) 4)]	[%]	19,9	18,9	17,7	**17,2**
Discharge to other hospital	[%]	17,4	17,9	18,1	**16,9**

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

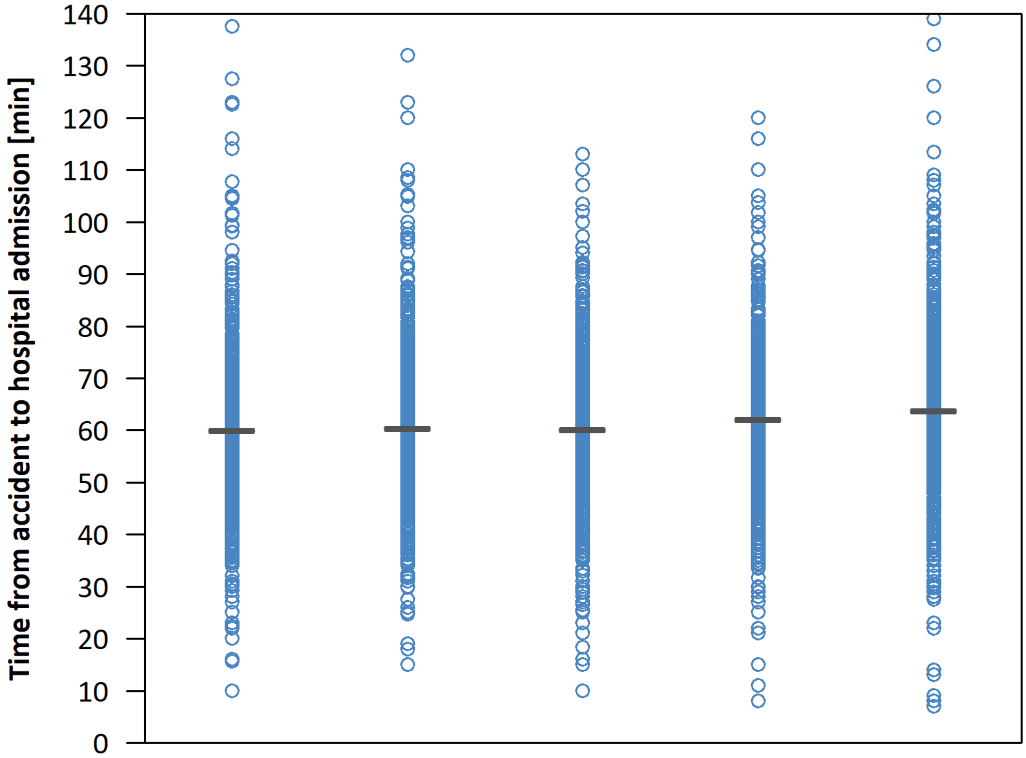
Quality indicators are measurements which are presumed to be associated with the quality of care and outcome. All results presented here are based on **primary admitted cases only from the basic group in 2020** with valid data or respective subgroups thereof. This includes early transfer out cases.

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.

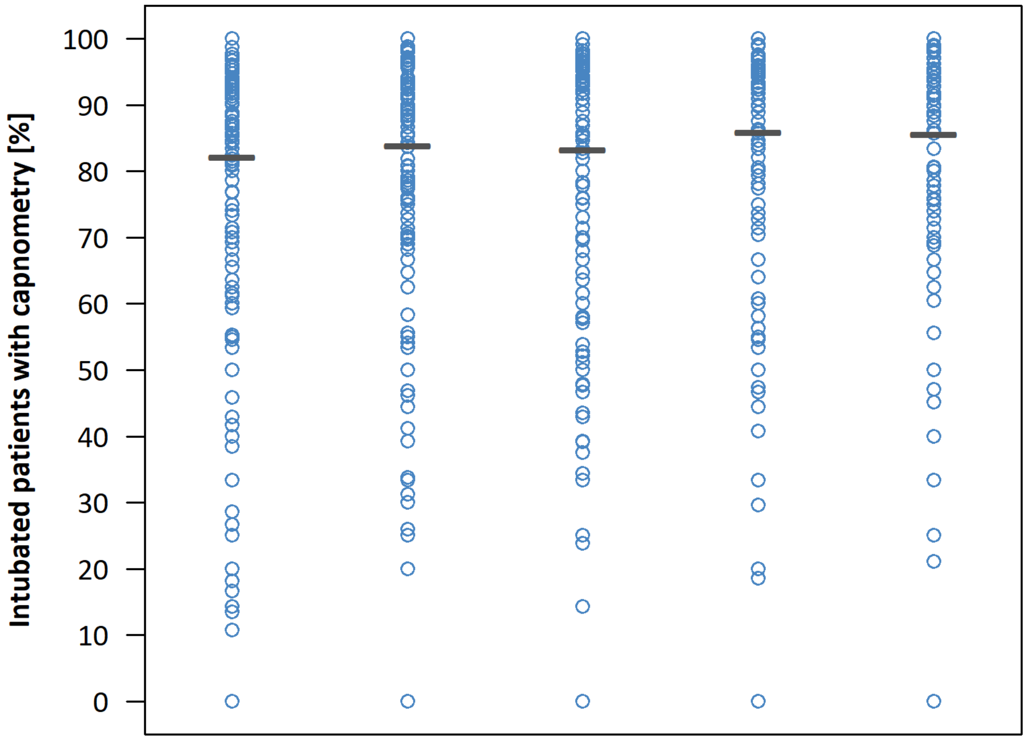


Year:	2016	2017	2018	2019	2020
TR-DGU:	60 [min]	60 [min]	60 [min]	62 [min]	64 [min]
n:	12,586	12,956	12,263	10,794	10,866
Min-Max:	5-240 [min]	5-240 [min]	5-240 [min]	5-240 [min]	5-240 [min]

Figure 4: Distribution of the mean duration from accident until hospital admission of patients with mit ISS ≥ 16 over all hospitals, 2016-2020, — 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 = 1.080).

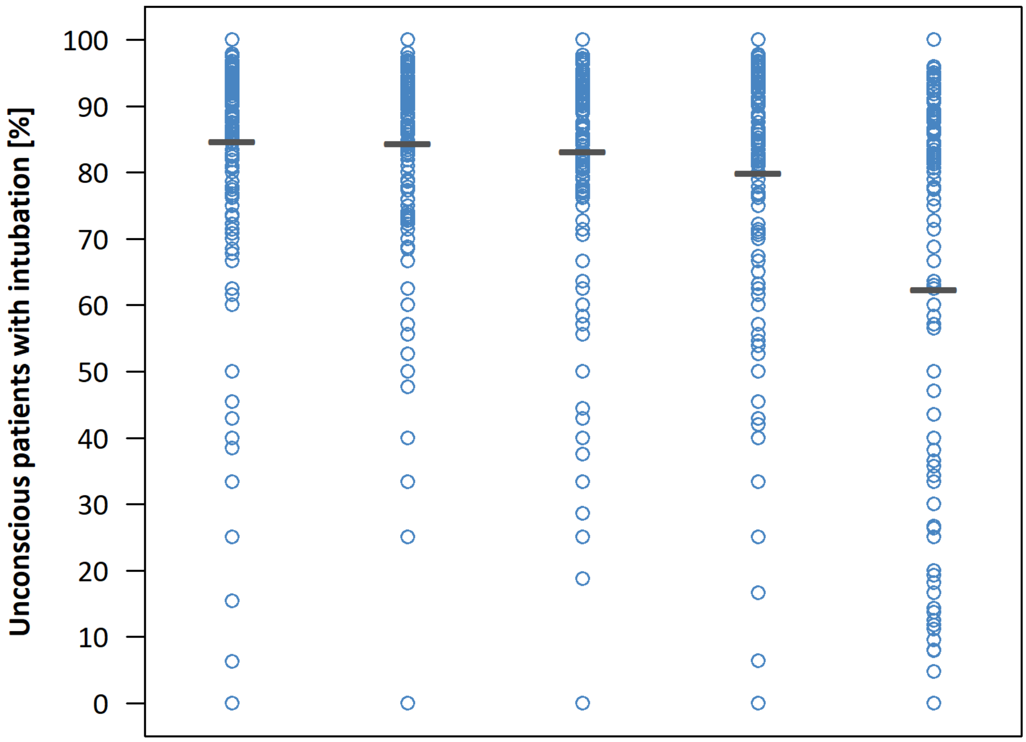


Year:	2016	2017	2018	2019	2020
TR-DGU:	82 %	84 %	83 %	86 %	86 %
Capnometry (n):	3,390	3,677	3,398	3,175	2,277
Intubated (N):	4,127	4,381	4,081	3,695	2,659

Figure 5: Distribution of the capnometry rate in prehospital intubated patients over all hospitals, 2016-2020, — 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".

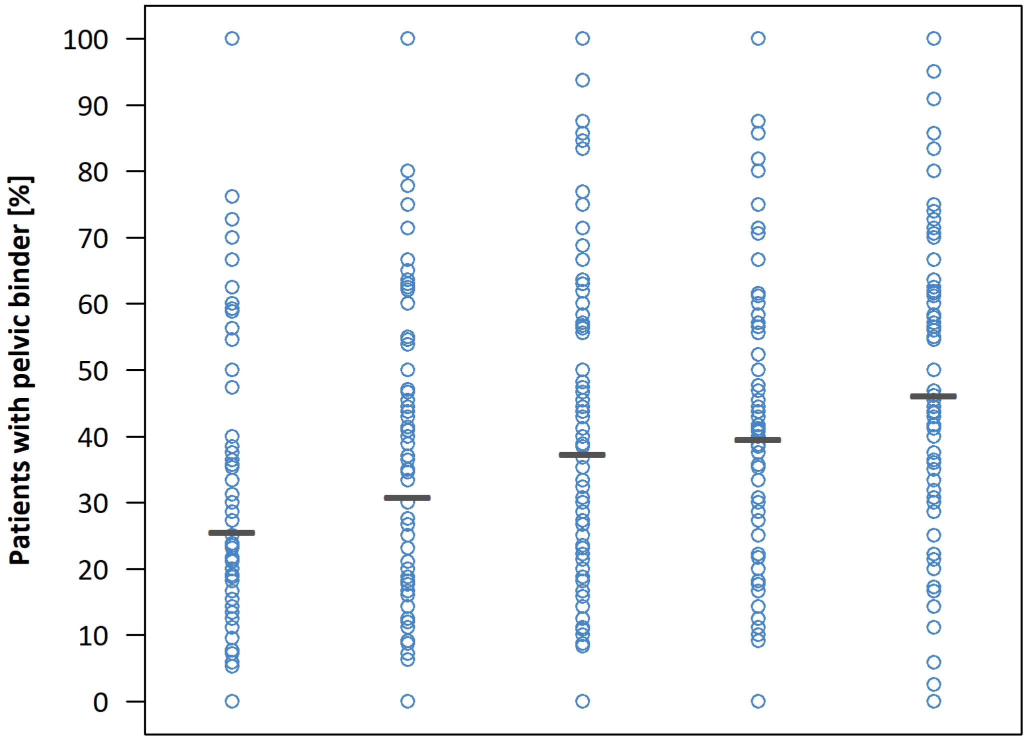


Year:	2016	2017	2018	2019	2020
TR-DGU:	85 %	84 %	83 %	80 %	62 %
Intubated (n):	4,228	4,074	3,732	3,304	2,381
Unconscious (N):	4,992	4,828	4,489	4,131	3,815

Figure 6: Distribution of the intubation rate in unconscious patients over all hospitals, 2016-2020, — 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.



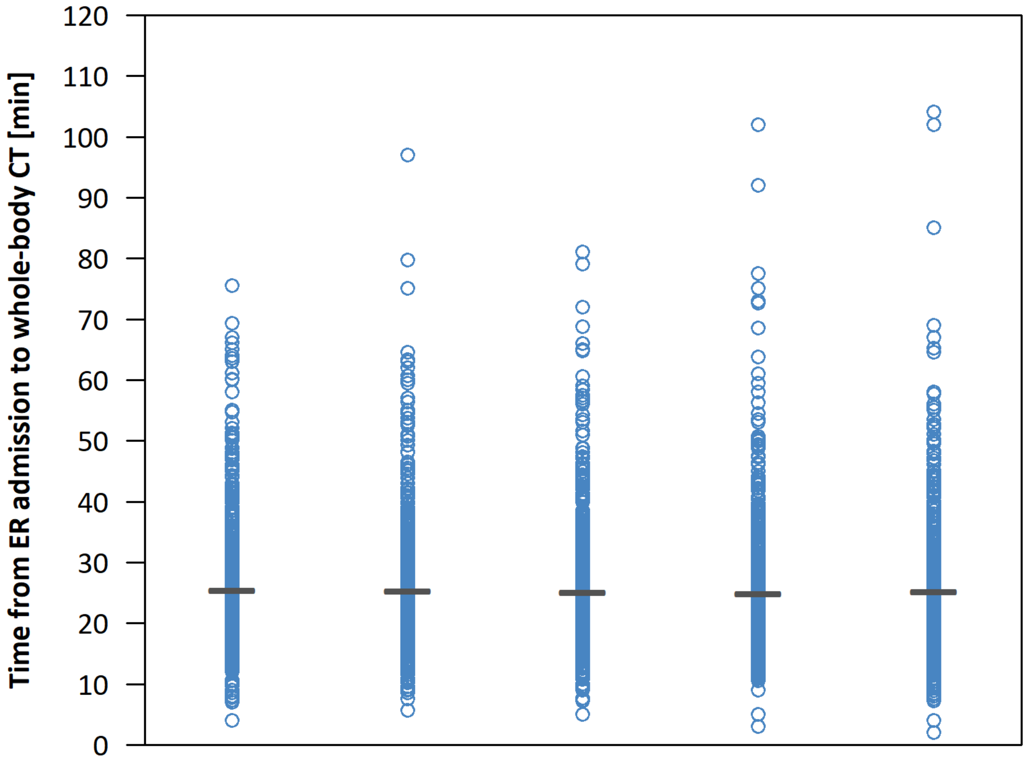
Year:	2016	2017	2018	2019	2020
TR-DGU:	26 %	31 %	37 %	40 %	46 %
Pelvic binder (n):	364	467	513	501	609
Pelvic fracture (N):	1,424	1,515	1,376	1,265	1,319

Figure 7: Distribution of the pelvic binder rate in patients with an instable pelvic fracture over all hospitals, 2016-2020, — 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.

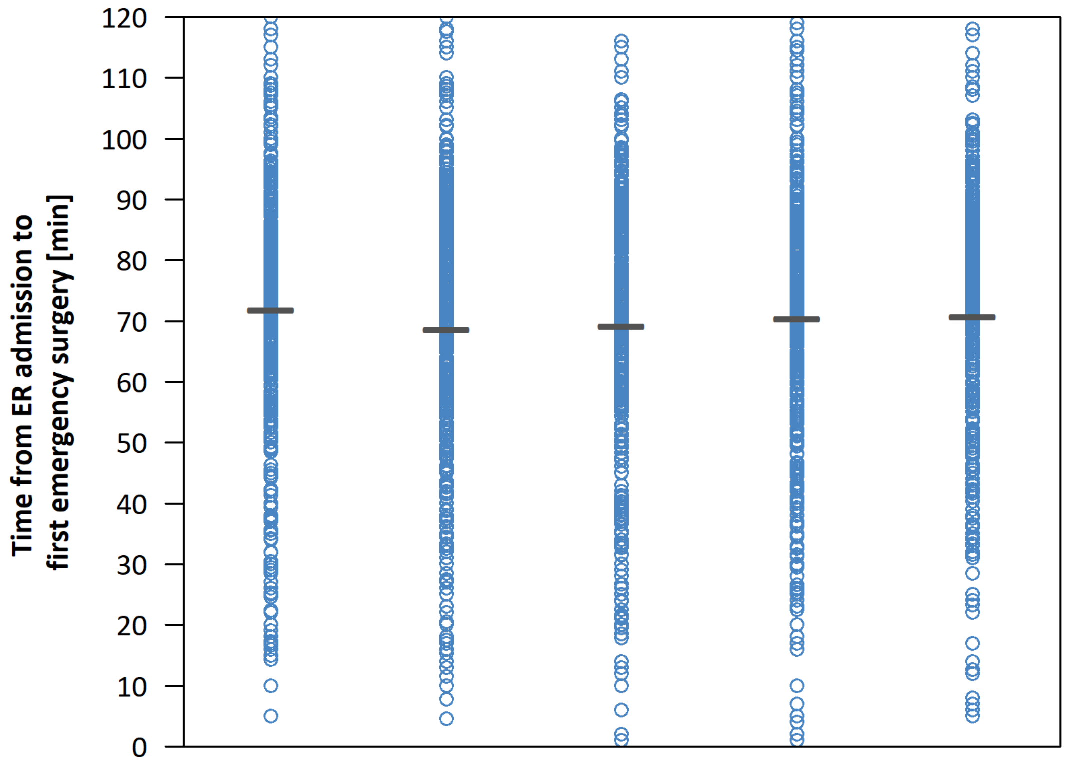


Year:	2016	2017	2018	2019	2020
TR-DGU:	26 [min]	25 [min]	25 [min]	25 [min]	25 [min]
n:	23,833	25,102	23,637	20,764	19,945
Min-Max:	1-120 [min]	1-120 [min]	1-120 [min]	1-120 [min]	1-120 [min]

Figure 8: Distribution of the mean duration from admission to the ER until whole-body CT over all hospitals, 2016-2020, — 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.

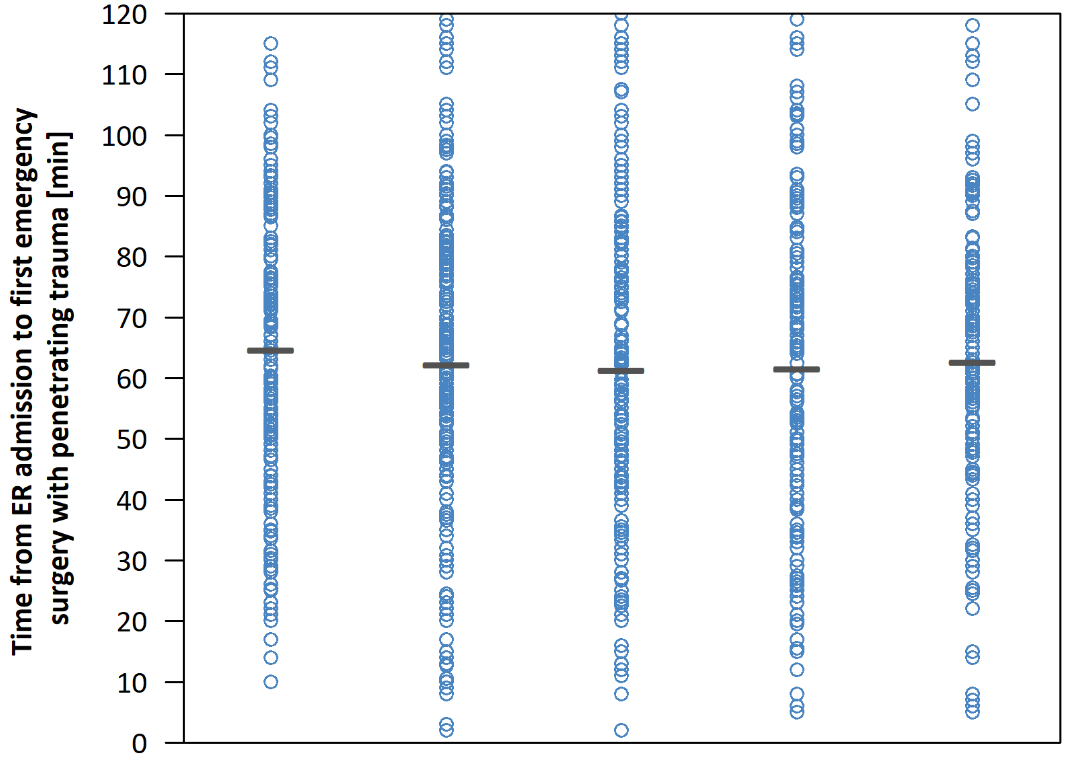


Year:	2016	2017	2018	2019	2020
TR-DGU:	72 [min]	69 [min]	69 [min]	70 [min]	71 [min]
n:	4,979	5,197	4,550	4,016	3,867
Min-Max:	1-120 [min]	1-120 [min]	1-120 [min]	1-120 [min]	1-120 [min]

Figure 9: Distribution of the mean duration from admission to the ER until the first emergency surgery over all hospitals, 2016-2020, — 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.

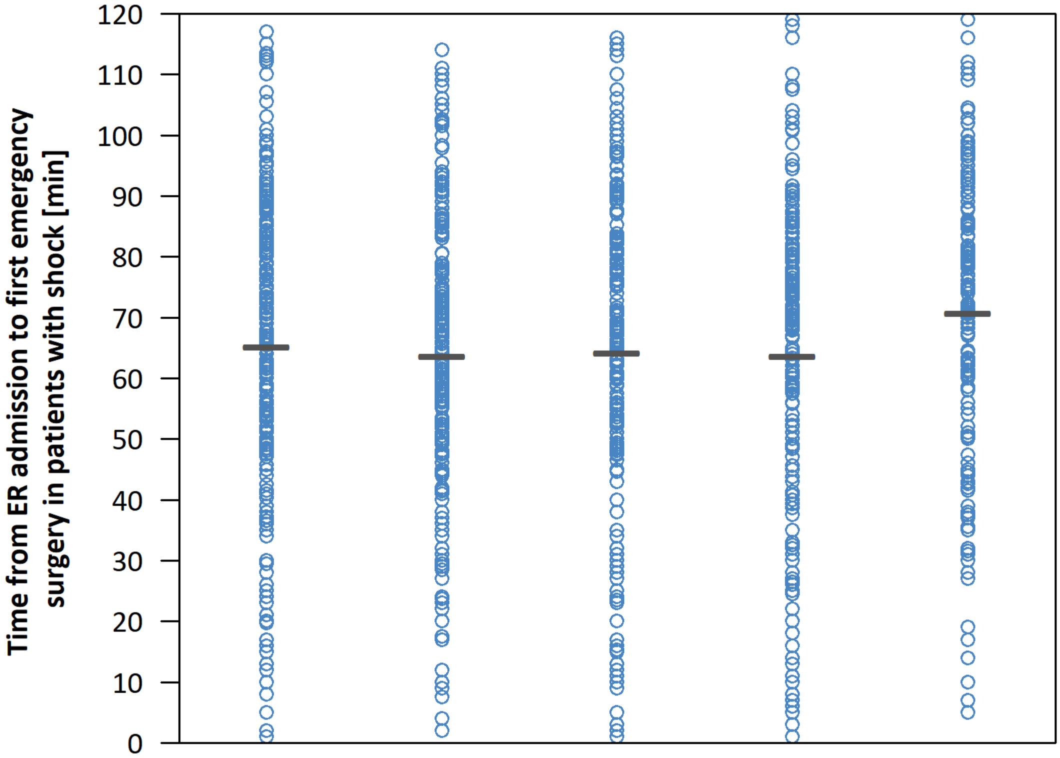


Year:	2016	2017	2018	2019	2020
TR-DGU:	65 [min]	62 [min]	61 [min]	62 [min]	63 [min]
n:	464	514	418	400	328
Min-Max:	1-120 [min]	1-120 [min]	1-120 [min]	1-119 [min]	1-120 [min]

Figure 10: Distribution of the mean duration from admission to the ER until surgery in patients with penetrating trauma over all hospitals, 2016-2020, — TR-DGU, o single hospital value

4.2.4 Time until surgery in patients with shock

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

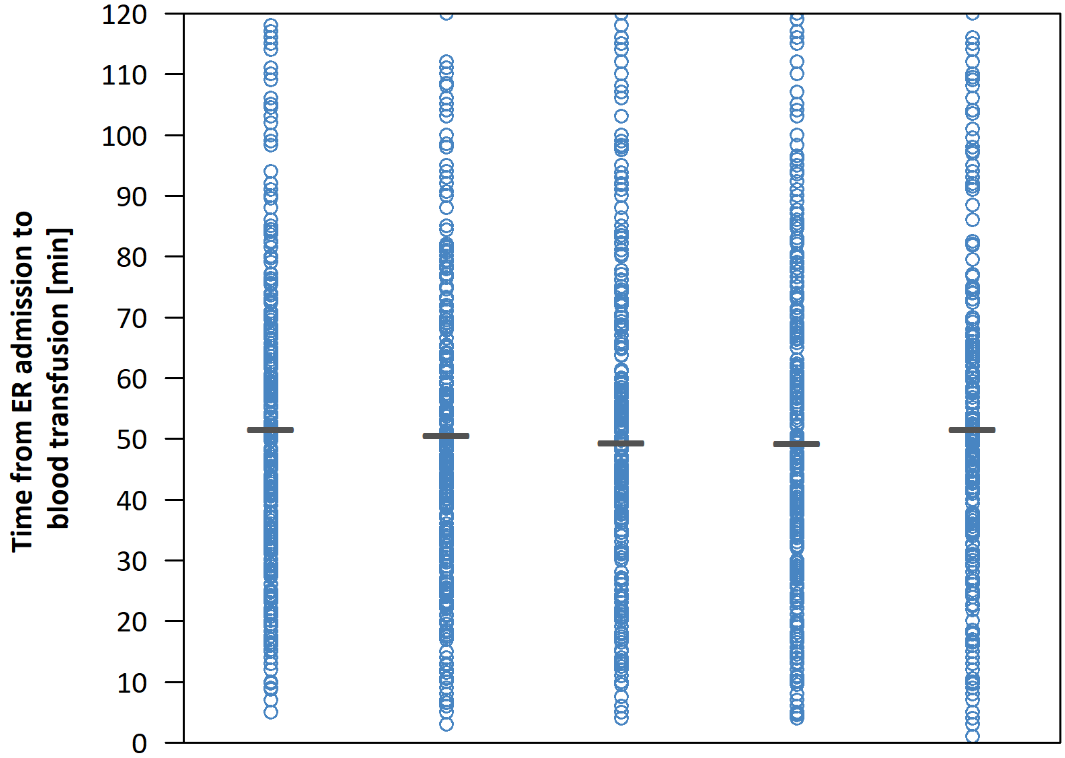


Year:	2016	2017	2018	2019	2020
TR-DGU:	65 [min]	64 [min]	64 [min]	64 [min]	71 [min]
n:	724	758	696	592	539
Min-Max:	1-120 [min]	1-120 [min]	1-120 [min]	1-120 [min]	1-120 [min]

Figure 11: Distribution of the mean duration from admission to the ER until surgery in patients with shock over all hospitals, 2016-2020, — 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.

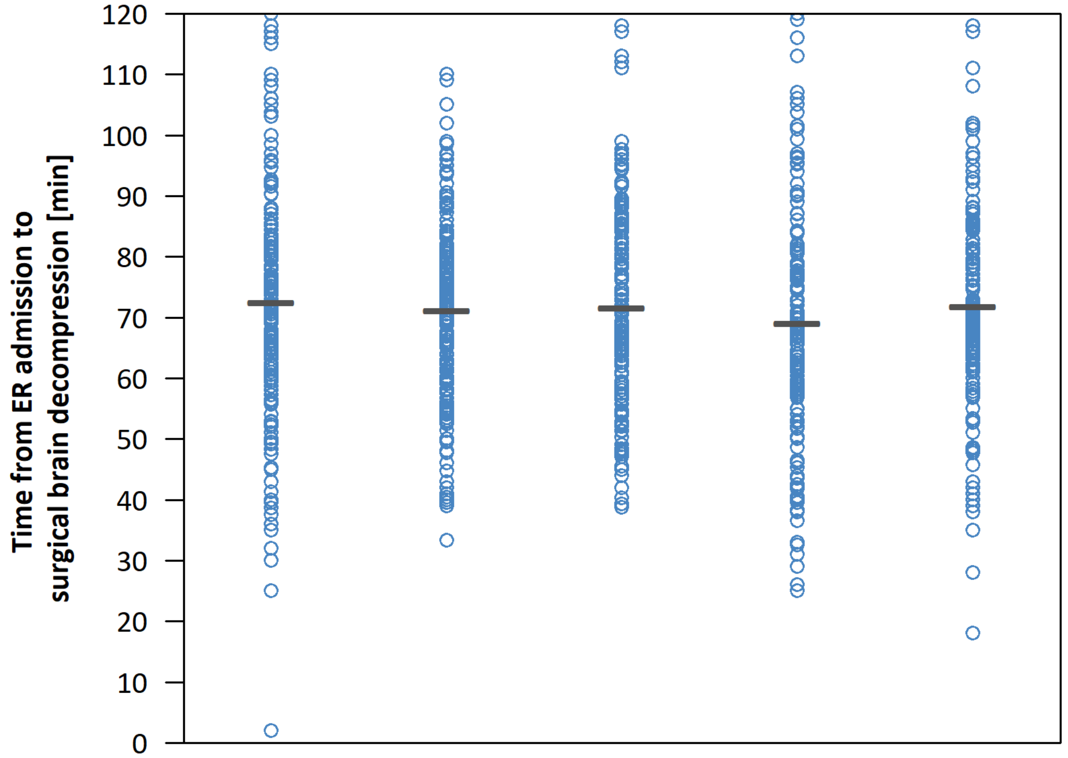


Year:	2016	2017	2018	2019	2020
TR-DGU:	52 [min]	51 [min]	49 [min]	49 [min]	52 [min]
n:	1,499	1,488	1,366	1,204	1,133
Min-Max:	1-120 [min]	1-120 [min]	1-120 [min]	1-120 [min]	1-120 [min]

Figure 12: Distribution of the mean duration from admission to the ER until start of the transfusion over all hospitals, 2016-2020, — 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.



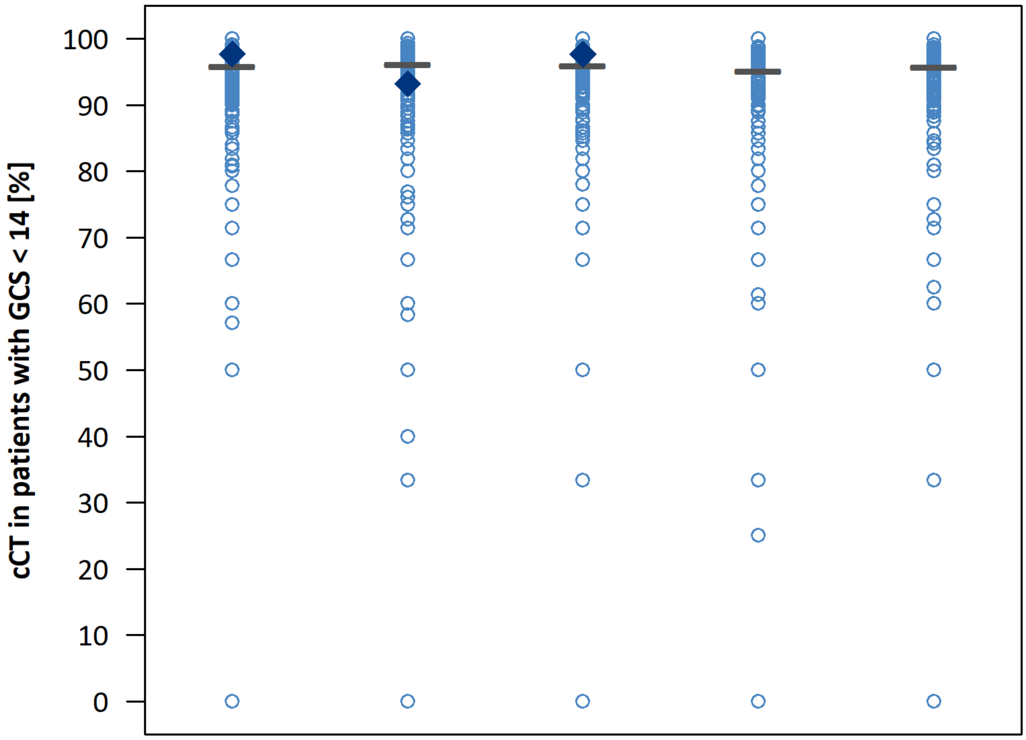
Year:	2016	2017	2018	2019	2020
TR-DGU:	72 [min]	71 [min]	72 [min]	69 [min]	72 [min]
n:	797	790	712	625	659
Min-Max:	2-120 [min]	1-120 [min]	1-120 [min]	1-120 [min]	14-120 [min]

Figure 13: Distribution of the mean duration from admission to the ER until surgical brain decompression over all hospitals, 2016-2020, — 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".

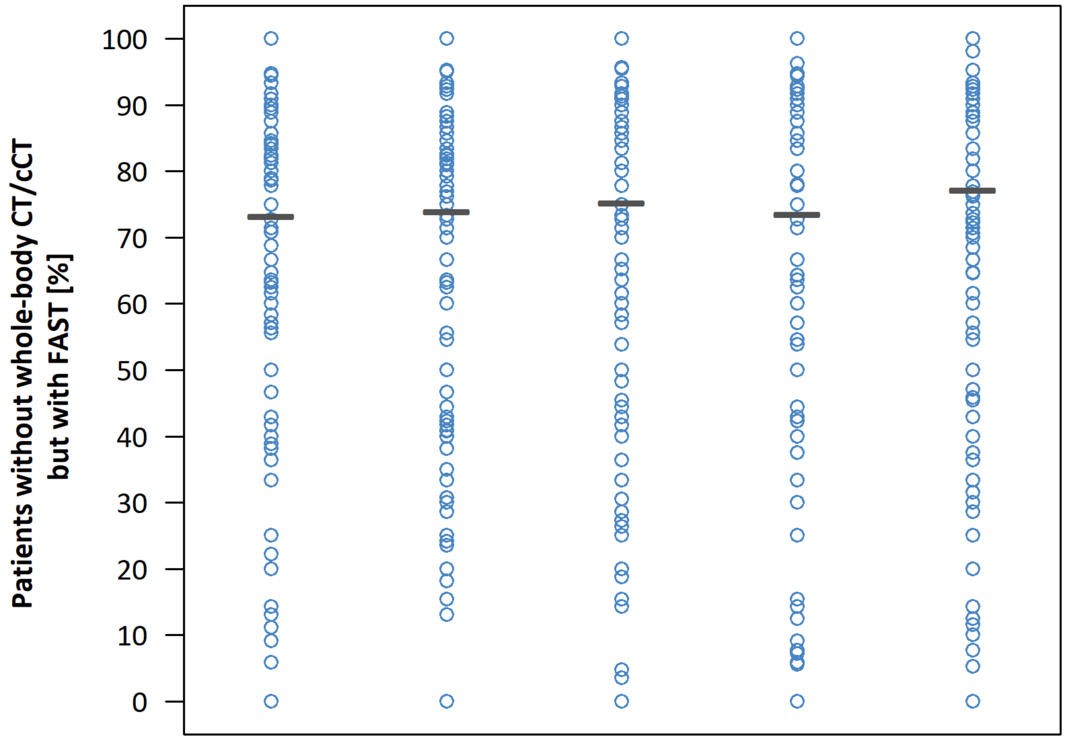


Year:	2016	2017	2018	2019	2020
TR-DGU:	96 %	96 %	96 %	95 %	96 %
cCT (n):	9,648	9,665	8,746	7,612	7,386
GCS < 14 (N):	10,065	10,049	9,119	8,004	7,715

Figure 14: Distribution of the cCT rate in patients with GCS < 14 over all hospitals, 2016-2020, — 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".

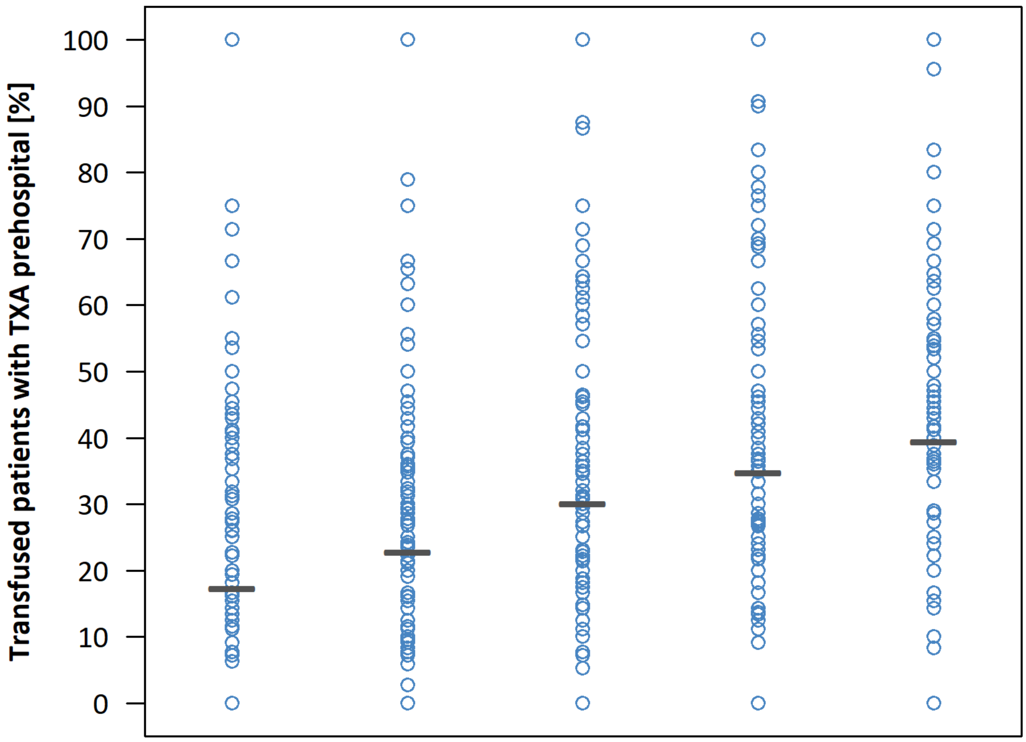


Year:	2016	2017	2018	2019	2020
TR-DGU:	73 %	74 %	75 %	74 %	77 %
FAST (n):	2,045	2,090	1,968	1,755	2,068
No WBCT/cCT (N):	2,791	2,827	2,614	2,385	2,679

Figure 15: Distribution of the sonography rate in patients without whole-body CT / ccT over all hospitals, 2016-2020, — 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".

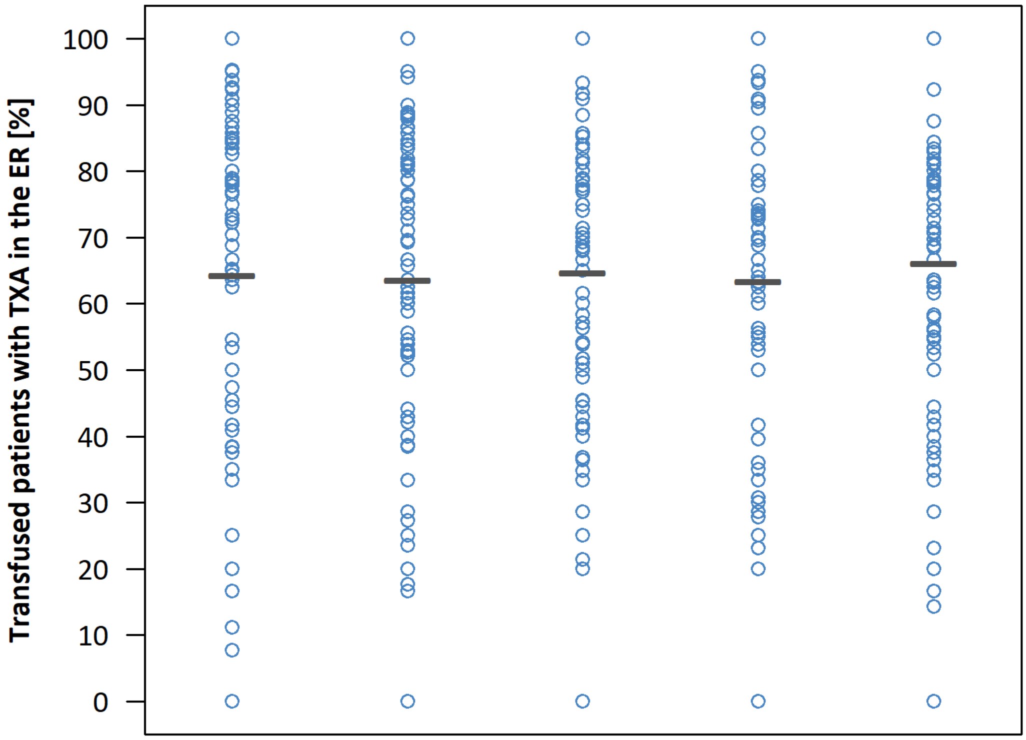


Year:	2016	2017	2018	2019	2020
TR-DGU:	17 %	23 %	30 %	35 %	39 %
TXA prehosp. (n):	381	509	618	628	751
Transfused (N):	2,202	2,227	2,054	1,805	1,906

Figure 16: Distribution of the prehospital tranexamic acid rate in the ER or surgery phase transfused patients over all hospitals, 2016-2020, — 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:	2016	2017	2018	2019	2020
TR-DGU:	64 %	64 %	65 %	63 %	66 %
TXA in ER (n):	952	996	921	780	847
Transfused (N):	1,481	1,567	1,423	1,231	1,281

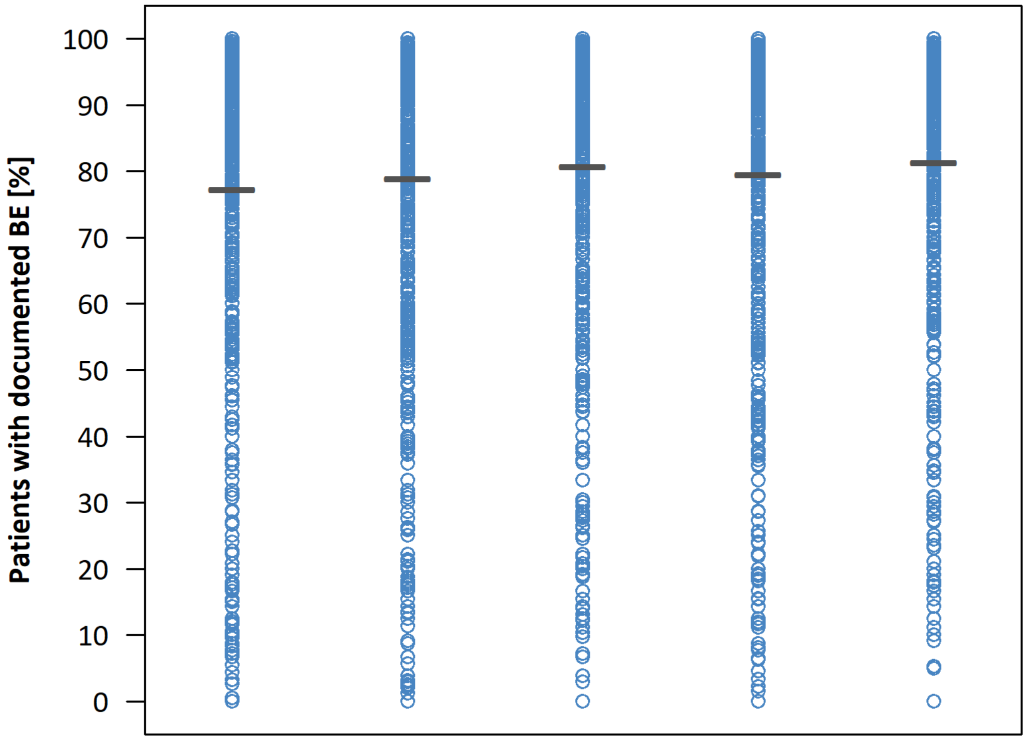
Figure 17: Distribution of the TXA admission rate in the ER in patients transfused between ER and intensive therapy over all hospitals, 2016-2020, — TR-DGU, o single hospital value

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:	2016	2017	2018	2019	2020
TR-DGU:	77 %	79 %	81 %	80 %	81 %
Document. BE (n):	24,258	25,774	24,729	21,706	21,700
Patients (N):	31,376	32,679	30,637	27,294	26,685

Figure 18: Distribution of the patient rate with documented base excess (BE) over all hospitals, 2016-2020, — 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 presents the number of documented trauma patients treated in certified TraumaNetzwerk DGU® centres in the last ten years. Only cases from the **basic group** are considered here (see page 5 for definition). In the TraumaNetzwerk DGU® **274,694 patients** were documented in the last 10 years, including **27,333 patients in 2020** alone.

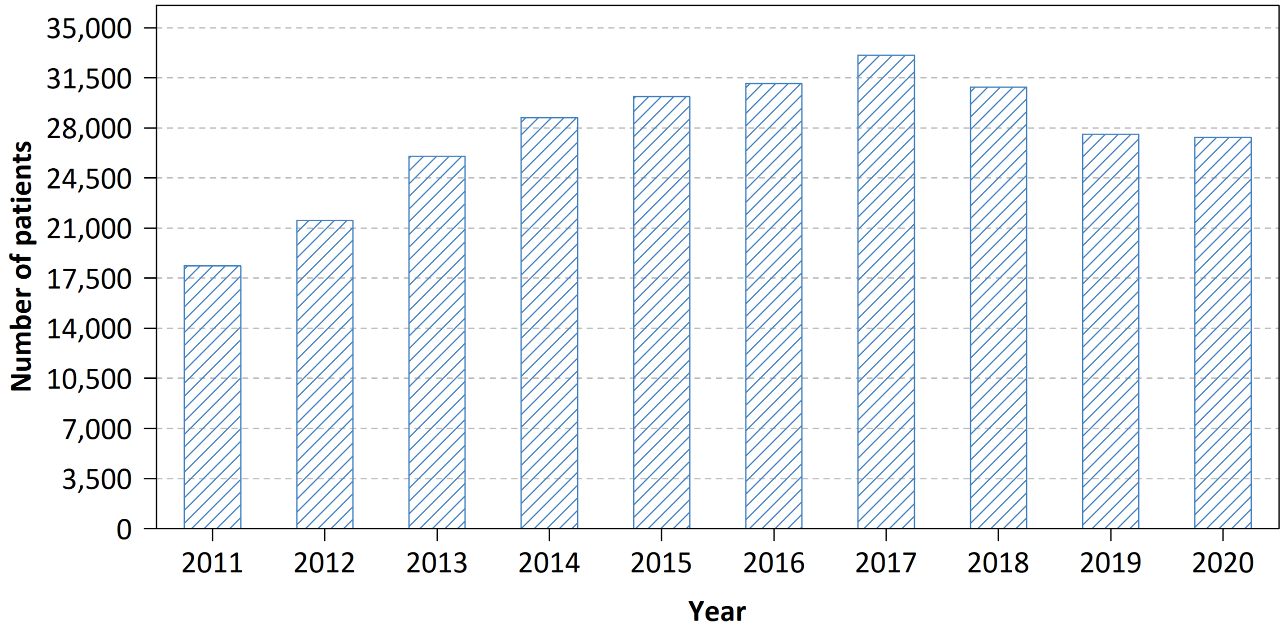


Figure 19: Documented number of patients in the TraumaNetzwerk DGU® basic group from 2011-2020 (bars)

5.2 Number of patients in each trauma level

In 2020, the TraumaNetzwerk DGU® documented **27,333 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.

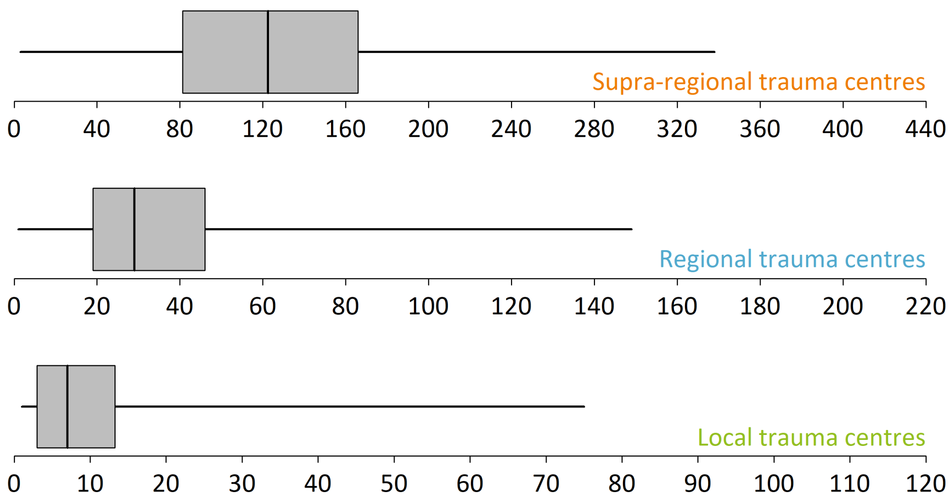


Figure 20: Median number of cases of the in the TraumaNetzwerk DGU® participating trauma centres separated by the trauma level in 2020

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		308	225	124	657
Number of patients in the TR-DGU		12 %	31 %	58 %	100 %
Patients per year and hospital (mean)	n	**11** / year	**39** / year	**132** / year	**43** / year
Patients (3 years, cumulated)	n	9.918	26.403	49.056	85.377
Primary admitted and treated	n (%)	7.829 (79 %)	22.522 (85 %)	42.519 (87 %)	72.870 (85 %)
Primary admitted and transferred out early (< 48 h)	n (%)	1.923 (19 %)	3.013 (11 %)	791 (2 %)	5.727 (7 %)
Transferred in from another hospital	n (%)	166 (2 %)	868 (3 %)	5.746 (12 %)	6.780 (8 %)

Table 4 continuation:

Characteristics		Trauma centre local	regional	supra-regional	TR-DGU
Patients					
Average age [years]	M	56,2	55,5	52,3	53,7
Patients aged 70 years and older	%	32 %	31 %	26 %	29 %
Males	%	67 %	68 %	71 %	70 %
ASA 3-4	%	21 %	22 %	18 %	20 %
Injuries					
Injury Severity Score (ISS) [points]	M	13,6	16,3	20,0	18,1
Proportion with ISS ≥ 16	%	34 %	47 %	61 %	53 %
Proportion polytrauma *	%	7 %	11 %	18 %	14 %
Proportion with life-threatening severe injury **	%	18 %	26 %	36 %	30 %
Patients with TBI, AIS ≥ 3	%	19 %	28 %	42 %	35 %
Patients with thoracic injury, AIS ≥ 3	%	34 %	38 %	38 %	38 %
Patients with abdominal injury, AIS ≥ 3	%	8 %	9 %	10 %	10 %
Prehospital care (primary admissions only)					
Rescue time (accident to hospital) [min]	M	58,2	61,0	69,3	65,0
Prehospital volume administration [ml]	M	468	572	688	622
Prehospital intubation	%	3 %	8 %	27 %	18 %
Proportion unconscious (GCS ≤ 8)	%	4 %	8 %	20 %	14 %
Emergency room (primary admissions only)					
Blood transfusion	%	3 %	4 %	9 %	7 %
Whole-body CT	%	66 %	75 %	83 %	78 %
Cardio-pulmonary resuscitation	%	2 %	2 %	4 %	3 %
Shock / hypotension	%	4 %	5 %	9 %	7 %
Coagulopathy	%	8 %	9 %	12 %	10 %
Length of stay (without early transfers out)					
Length of intubation on the intensiv care unit [days]	M	2,5	5,0	6,7	6,1
Length of stay on the intensiv care unit [days]	M	2,6	4,2	6,6	5,5
Length of stay in the hospital [days]	M	10,1	12,9	16,7	14,9
Outcome and prognosis (without transfers in and early transfers out and patients deceased within the first week with a patient's volition)					
Patients	n	7.829	22.522	42.519	72.870
Non-survivors	n	332	1.467	4.414	6.213
Hospital mortality	%	4,3 %	6,7 %	10,8 %	8,8 %
RISC II prognosis	%	4,7 %	6,7 %	10,8 %	8,8 %

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 2020. 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.

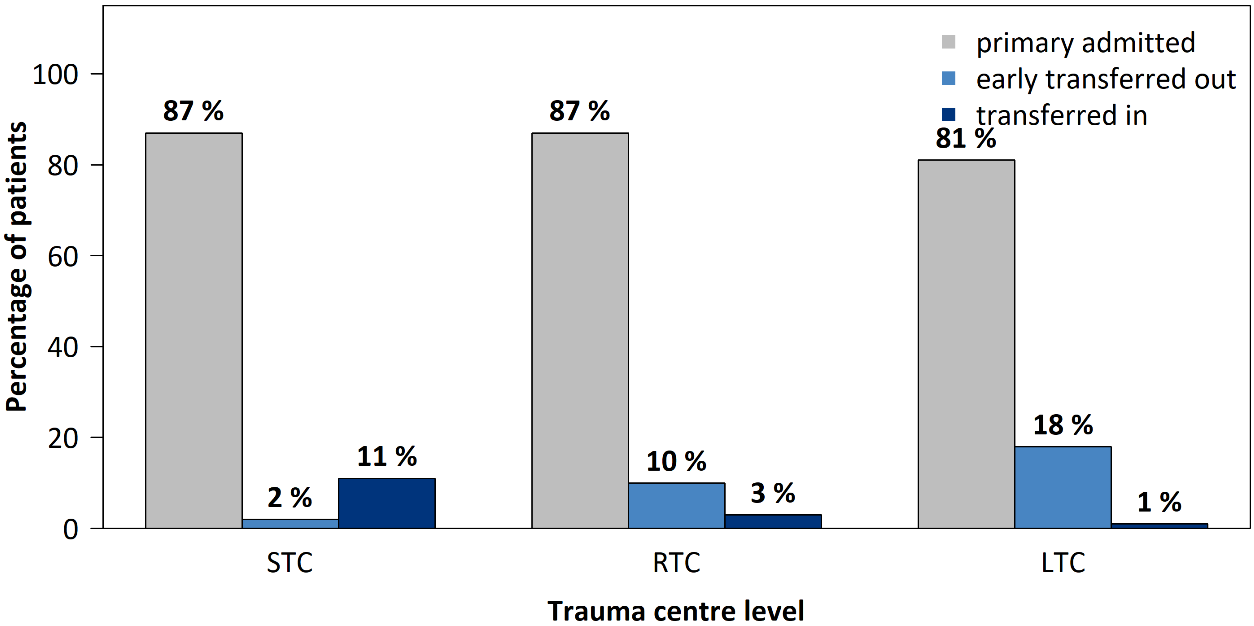


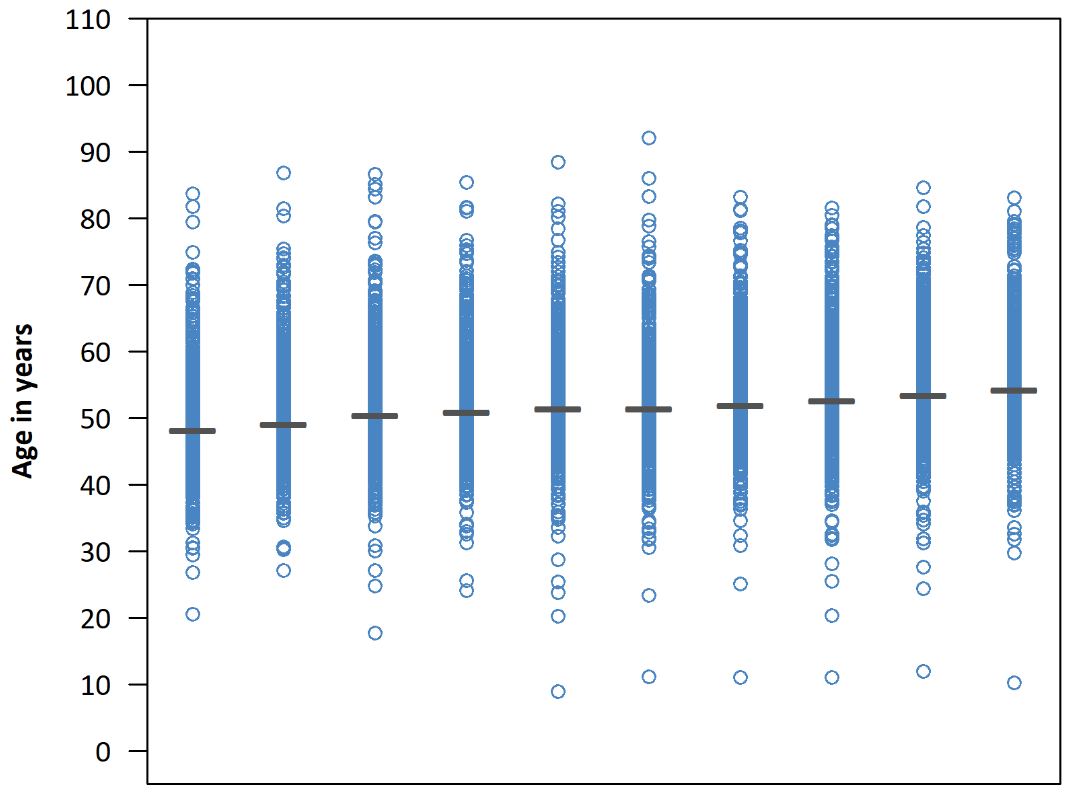
Figure 21: Transfer status classified according to the trauma level in 2020

6 Graphical comparisons with other hospitals

Below, selected information about the patients from the years **2011-2020** 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 lower figure shows the distribution of mean age of the patients from the TR-DGU over the past ten years **with at least 3 patients**).

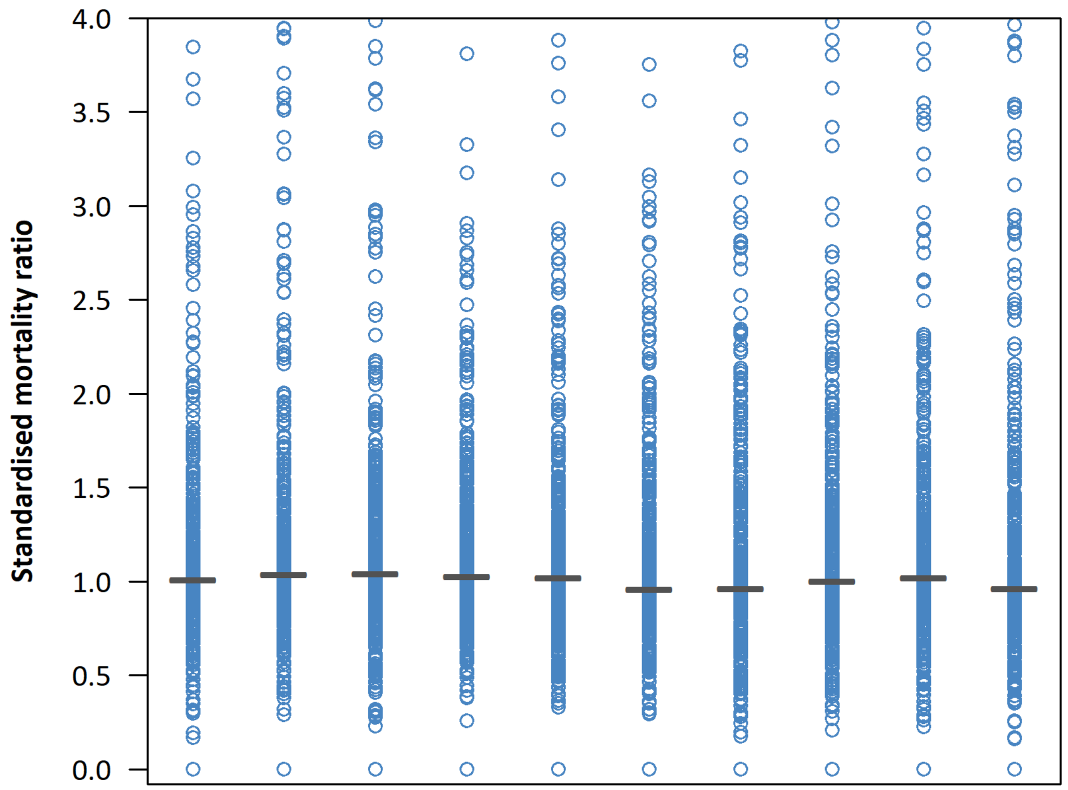


Year:	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
TR-DGU:	48.1	49.1	50.4	50.9	51.4	51.4	51.9	52.6	53.4	54.2

Figure 22: Mean patient's age in the — TR-DGU compared to the o single hospital values in the TR-DGU for the years 2011-2020

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

Only primary admitted patients are displayed here (with at least 3 cases). Early transfers out (< 48 h) are excluded. Also, 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 2020.



Year:	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
TR-DGU:	1.01	1.04	1.04	1.03	1.02	0.96	0.96	1.00	1.02	0.96

Figure 23: Standardised mortality ratio of the — TR-DGU compared to the o single hospital values in the TR-DGU for the years 2011-2020

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= 4.303) are excluded here. Hospitals with **fewer than 3 patients** are **not** displayed in the figure due to their statistical uncertainty.

TR-DGU 2020:

The value is based on:
21.190 patients

Mean length of stay:
15,3 days

Mean ISS:
16,0 points

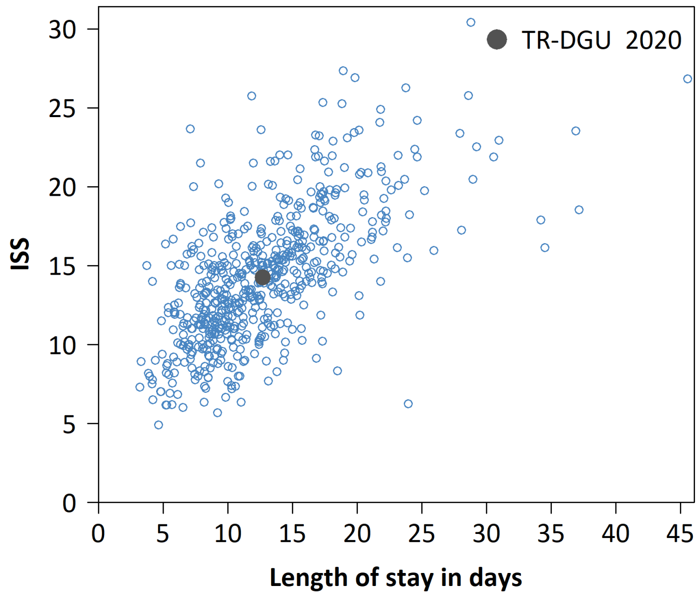


Figure 24: Relationship between length of stay and injury severity over all hospitals in 2020

6.4 Length of stay of the deceased patients

The following figure shows the distribution of length of stay of the deceased patients (N = 3.452) within the first 30 days (n = 3.315) in the TR-DGU in 2020.

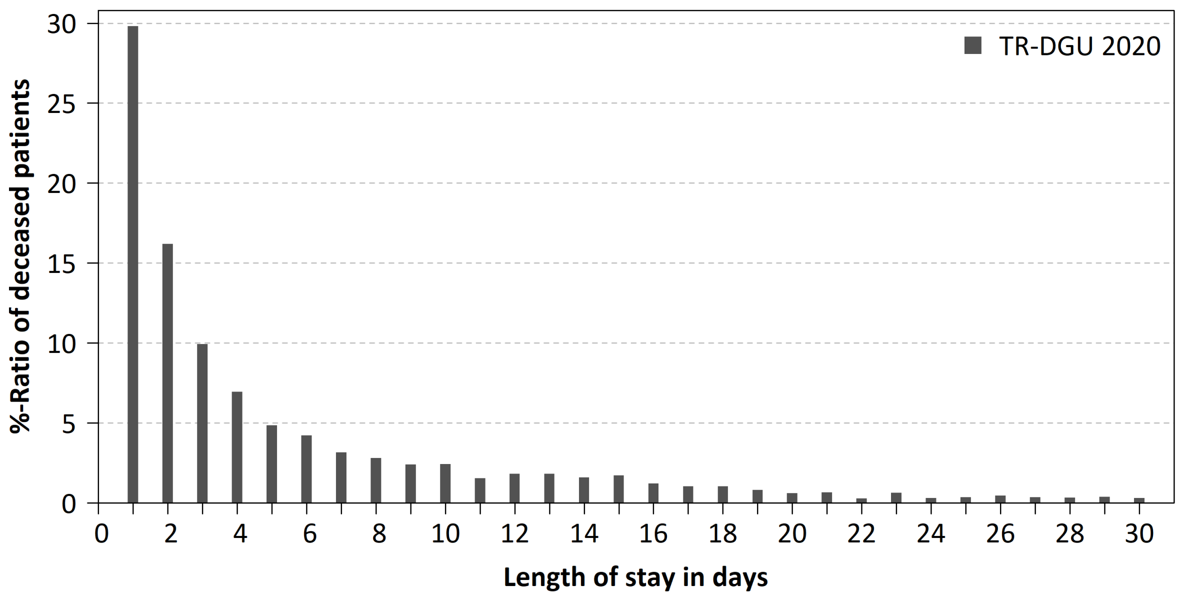


Figure 25: Time point of death of the patients from the TR-DGU [length of stay in days] in 2020

7 Basic data of trauma care

The following pages present basic data from the trauma care of the actual year 2020. The data refer to patients from the **basic group** (see page 5). Shown is data from the TraumaRegister DGU® basic group of the current year, (**TR-DGU 2020**), and the registry data sumarized over the last 10 years, 2011-2020 (**TR-DGU 10 years**).

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

(S) Patient and accident	TR-DGU 2020		TR-DGU 10 years	
Patients of the **basic group** (n)	28.947		303.876	
Primary admissions / transfers	%	n	%	n
Primary admitted	**92,2 %**	26.685	**90,9 %**	276.154
Among these transferred out within 48 h	**6,0 %**	1.728	**6,6 %**	19.944
Transferred in within 24 h after accident	**7,2 %**	2.093	**8,2 %**	24.985
Transferred in after 24 h	**0,6 %**	169	**0,9 %**	2.737
Patient characteristics	**M** ± SD*/%	n	**M** ± SD*/%	n
Age [years]	**54,2** ± 22,5	28.947	**51,4** ± 22,6	303.876
Children under 16 years	**3,5 %**	1.005	**4,1 %**	12.466
Elderly over 70 years	**29,0 %**	8.387	**26,0 %**	79.045
Males	**70,1 %**	20.292	**70,0 %**	212.543
ASA 3-4 prior to trauma (since 2009)	**21,6 %**	5.904	**17,5 %**	47.225
Mechanism of injury	%	n	%	n
Blunt	**96,3 %**	26.119	**95,9 %**	276.926
Penetrating	**3,7 %**	1.013	**4,1 %**	11.712
Type and cause of accident	%	n	%	n
Traffic: Car	**16,2 %**	4.664	**19,0 %**	56.707
Traffic: Motor bike	**12,0 %**	3.452	**12,2 %**	36.529
Traffic: Bicycle	**13,0 %**	3.747	**9,6 %**	28.747
Traffic: Pedestrian	**4,3 %**	1.226	**6,0 %**	17.825
High fall (> 3m)	**15,6 %**	4.489	**15,4 %**	45.987
Low fall (≤ 3m)	**27,9 %**	8.017	**24,5 %**	73.247
Suicide (suspected)	**4,6 %**	1.305	**4,4 %**	13.033
Assault (suspected)	**2,4 %**	690	**2,5 %**	7.359

* M = Mean; SD = Standard deviation

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

Time point A: Findings at the accident scene	TR-DGU 2020		TR-DGU 10 years	
Primary admitted patients (n) (%-ratio of the basic group)	26.685 (92 %)		276.154 (91 %)	
Vital signs	**M** ± SD*	n	**M** ± SD*	n
Systolic blood pressure [mmHg]	**134,8** ± 33,0	22.832	**132,4** ± 33,2	239.722
Respiratory rate [1/min]	**15,8** ± 5,7	18.032	**15,7** ± 5,8	173.353
Glasgow Coma Scale (GCS) [points]	**12,7** ± 3,9	24.479	**12,6** ± 4,0	255.516
Findings	**%**	n	**%**	n
Shock (systolic blood pressure ≤ 90 mmHg)	**7,9 %**	1.795	**9,2 %**	22.043
Unconsciousness (GCS ≤ 8)	**15,6 %**	3.815	**17,0 %**	43.517
Therapy	**%**	n	**%**	n
Cardio-pulmonary resuscitation	**3,4 %**	868	**3,0 %**	7.940
Endotracheal intubation	**14,5 %**	3.739	**21,9 %**	58.401
Alternative airway	**1,4 %**	366	**,9 %**	2.284
Analgo-sedation **	**58,2 %**	7.958	**60,3 %**	80.978
Chest drain (with and without needle decompression) **	**3,7 %**	503	**3,1 %**	4.159
Catecholamines **	**9,9 %**	1.348	**8,3 %**	11.122
Pelvic binder **	**17,1 %**	2.345	**6,7 %**	8.981
Tranexamic acid	**13,7 %**	3.556	**4,8 %**	12.911
Volume administration	**M** ± SD*/%	n	**M** ± SD*/%	n
Patients without volume administration	**18,6 %**	4.572	**17,1 %**	43.804
with volume administration	**81,4 %**	19.990	**82,9 %**	212.944
with colloids	**1,6 %**	391	**6,4 %**	15.878
Average amount in patients with volume administration [ml]	**608** ± 509	24.562	**664** ± 560	256.748
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 2020		TR-DGU 10 years	
Primary admitted patients (n) (%-ratio of the basic group)	26.685 (92 %)		276.154 (91 %)	
Transportation to the hospital	%	n	%	n
With helicopter	**19,5 %**	5.208	**19,1 %**	52.795
Glasgow Coma Scale (GCS)	**MW** ± SA*	n	**MW** ± SA*	n
Prehospital intubated patients	**3,3** ± 1,5	2.906	**3,2** ± 1,4	34.471
Patients not prehospital intubated	**13,9** ± 2,3	9.735	**13,8** ± 2,5	91.798
Initial diagnostics	%	n	%	n
Sonography of the abdomen	**81,8 %**	21.605	**81,6 %**	222.759
X-ray of the thorax	**21,7 %**	5.730	**33,6 %**	91.587
cCT (isolated or whole-body)	**89,0 %**	23.741	**89,3 %**	246.552
Whole-body CT	**76,6 %**	20.229	**77,1 %**	210.428
Time period in the emergency room	**M** ± SD*/%	n	**M** ± SD*/%	n
Transfer to the operating theatre	**24,3 %**	6.183	**24,0 %**	35.665
If so: Duration from admission to the ER* until surgery [min]	**79,1** ± 62,0	5.629	**76,6** ± 61,4	32.005
Transfer to intensive care unit	**63,0 %**	16.005	**63,8 %**	95.032
If so: Duration from admission to the ER* until ICU* [min]	**91,7** ± 76,1	14.203	**86,9** ± 74,6	81.916
Bleeding and transfusion	**M** ± SD*/%	n	**M** ± SD*/%	n
Pre-existing coagulopathy	**21,4 %**	4.992	**19,8 %**	24.826
Systolic blood pressure ≤ 90 mmHg	**7,0 %**	1.743	**7,9 %**	20.295
Hemostasis therapy**	**23,0 %**	2.713	**17,6 %**	21.367
Administration of tranexamic acid**	**15,5 %**	459	**15,7 %**	7.868
ROTEM / thrombelastography**	**11,2 %**	1.274	**10,6 %**	10.686
Patients with blood transfusion	**7,2 %**	1.925	**7,8 %**	21.464
Number of pRBC, if transfused	**5,1** ± 7,7	1.925	**5,3** ± 6,4	21.464
Number of FFP, if transfused	**0,7** ± 3,6	1.925	**3,0** ± 5,7	21.464
Treatment in the ER*	%	n	%	n
Cardio-pulmonary resuscitation **	**2,6 %**	339	**2,5 %**	3.432
Chest drain**	**10,5 %**	1.360	**10,4 %**	14.066
Endotracheal intubation**	**10,8 %**	1.385	**14,9 %**	19.403
Initial laboratory values	**M** * ± SD	n	**M** * ± SD	n
Base excess [mmol/l]	**-1,7** ± 4,9	21.738	**-1,8** ± 4,7	207.742
Hemoglobine [g/dl]	**13,1** ± 2,2	25.958	**13,1** ± 2,2	263.860
INR	**1,1** ± 00,5	25.067	**1,2** ± 00,5	253.872
Quick's value [%]	**89,2** ± 21,5	24.474	**87,4** ± 21,5	247.840
Temperature [C°]**	**36,2** ± 1,2	8.746	**36,2** ± 1,1	74.727

* 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 2020		TR-DGU 10 years	
Patients with **intensive care therapy** (n) (%-ratio of the basic group)	24.863 (86 %)		263.753 (87 %)	
Treatment	%	n	%	n
Hemostasis therapy **	**12,9 %**	1.654	**14,8 %**	19.304
Dialysis / hemofiltration **	**2,0 %**	257	**2,2 %**	2.914
Blood transfusion ** (within the first 48 h after admission to ICU)	**24,1 %**	2.471	**26,5 %**	28.637
Mechanical ventilation / intubated	**35,2 %**	8.747	**39,0 %**	102.892
Complications on ICU	%	n	%	n
Organ failure **	**30,2 %**	3.945	**33,8 %**	44.676
Multiple organ failure (MOF) **	**17,2 %**	2.225	**19,9 %**	26.007
Sepsis **	**4,6 %**	598	**5,7 %**	7.401
Length of stay and ventilation	**M** ± SD*	n	**M** ± SD*	n
Length of intubation [days]	**6,8** ± 9,1 Median **3**	8.665	**7,4** ± 10,3 Median **3**	101.760
Length of stay on ICU* [days]	**6,0** ± 9,2 Median **2**	24.863	**6,5** ± 10,2 Median **2**	263.753

* 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 2020		TR-DGU 10 years	
Patients from the basic group	28.947		303.876	
Diagnoses	**M** ± SD*/%	n	**M** ± SD*/%	n
Number of injuries / diagnoses per patient	**4,6** ± 3,1		**4,5** ± 2,9	
Patients with only **one** injury	**10,2 %**	2.951	**10,1 %**	30.557
Surgeries	**M** ± SD*/ %	n	**M** ± SD*/ %	n
Patients with surgery	**67,7 %**	10.546	**67,0 %**	103.943
Number of surgeries per patient, if undergone surgery**	**3,3** ± 3,8		**3,4** ± 4,0	
Thrombo-embolic events (MI; pulmonary embolism; DVT; stroke; etc.)	%	n	%	n
Patients with at least one event **	**3,0 %**	424	**2,7 %**	3.926

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

Table 9 continuation:

Time point D: Discharge / outcome	**TR-DGU 2020**		**TR-DGU 10 years**	
Patients from the basic group	28.947		303.876	
Outcome (without early transfers out)	%	n	%	n
Survivors	**87,3 %**	23.767	**88,5 %**	251.336
Hospital mortality	**12,7 %**	3.452	**11,5 %**	32.596
Died within 30 days	**12,2 %**	3.315	**11,0 %**	31.240
Died within 24 hours	**4,8 %**	1.311	**4,5 %**	12.743
Died in the ER (without ICU)	**1,6 %**	441	**1,6 %**	4.467
Transfer / discharge (all survivors)	%	n	%	n
Survivors who were discharged and …	**100,0 %**	25.495	**100,0 %**	271.280
transferred into another hospital	**16,9 %**	4.303	**17,4 %**	47.310
... among them early discharges (< 48 h)	**6,8 %**	1.728	**7,4 %**	19.944
transferred into a rehabilitation center	**14,8 %**	3.782	**17,8 %**	48.308
other destination	**3,3 %**	832	**3,6 %**	9.653
sent home	**65,0 %**	16.578	**61,2 %**	166.009
Condition at the time of discharge (according to the parameter „outcome"; without early transfers out)	%	n	%	n
Patients with a valid value		26.982		275.486
of these surviving patients	**100 %**	23.530	**100 %**	242.890
- good recovery	**60,5 %**	14.226	**65,3 %**	158.509
- moderate disability	**28,5 %**	6.704	**24,8 %**	60.283
- severe disability	**9,7 %**	2.288	**8,5 %**	20.680
- persistant vegetative state	**1,3 %**	312	**1,4 %**	3.418
Length of stay in hospital [days] (all patients from the basic group)	**M** ± SD*	n	**M** ± SD*	n
All patients	**13,7** ± 16,0	28.945	**15,1** ± 17,4	303.836
Median	Median **9**		Median 10	
Only survivors	**14,5** ± 16,0	25.493	**16,1** ± 17,6	271.245
Median survivors	10		**11**	
Only non-survivors	**7,6** ± 14,6	3.452	**7,4** ± 12,7	32.591
Median non-survivors	3		3	
LOS when transferred to a rehabilitation centre	**26,4** ± 20,1	3.781	**28,8** ± 22,0	48.302
when transferred to another hospital	**10,4** ± 15,0	4.303	**10,2** ± 14,7	47.306
when sent home	**12,6** ± 13,4	16.577	**13,8** ± 14,5	165.986
Costs of treatment *** (without early transfers out)	**€**	n	**€**	n
Average costs in € per patient				
... all patients	**22.052**	9.316	**22.439**	117.348
... only non-survivors	**13.139**	2.351	**12.609**	24.969
... only survivors	**25.061**	6.965	**25.096**	92.379
... only patients with ISS ≥ 16	**24.222**	7.225	**25.342**	87.425
Sum of all costs	205.440.279 €		2.633.189.523 €	
Sum of all days in hospital	187.980 days		2.455.829 days	
Average costs per day per patient	1092,9 €		1072,2 €	

* 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, 2018). Assuming a cost increase of 2 % per year the costs today would be 25 % 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 (2018-2020) 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 **78.573 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 2018-2020	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	78.573	40.026	28.678	9.869	5.360	23.982	21.765
	%	100 %	50,9 %	36,5 %	12,6 %	6,8 %	30,5 %	27,7 %
Patients								
Age [years]	M	53,2	50,4	54,3	61,7	52,5	62,1	80,5
Males	%	69,6 %	71,2 %	69,3 %	64,0 %	69,9 %	66,5 %	56,1 %
ASA 3-4	%	18,9 %	14,6 %	20,1 %	33,4 %	22,9 %	31,8 %	47,7 %
Injuries								
ISS [points]	M	18,0	14,4	22,9	18,3	29,9	28,5	18,7
Head injury (AIS ≥ 3)	%	33,5 %		57,3 %	100,0 %	47,0 %	63,9 %	45,0 %
Thoracic injury (AIS ≥ 3)	%	38,7 %	45,1 %	43,0 %		55,7 %	51,7 %	35,9 %
Abdominal injury (AIS ≥ 3)	%	9,5 %	13,1 %	7,6 %		23,5 %	13,8 %	5,0 %
Prehospital care								
Duration from accident to hospital [min]	M	66	64	67	68	71	71	67
Intubation	%	18,9 %	9,3 %	28,5 %	29,4 %	55,4 %	42,6 %	17,9 %
Volume [ml]	M	625,3	627,3	662,5	504,8	970,1	751,7	533,5
Emergency room								
Blood transfusion	%	7,1 %	6,7 %	9,0 %	3,0 %	36,7 %	17,2 %	5,9 %
Whole-body CT	%	78,9 %	80,4 %	83,9 %	58,0 %	80,2 %	80,4 %	71,2 %
Cardio-pulmonary resuscitation	%	2,5 %	2,1 %	3,2 %	1,8 %	15,2 %	6,5 %	2,7 %
Physiological problems *								
Age ≥ 70 years	%	27,7 %	21,3 %	30,0 %	47,2 %	28,1 %	51,6 %	100,0 %
Shock (sBP ≤ 90 mmHg)	%	11,5 %	10,1 %	14,1 %	9,3 %	100,0 %	29,1 %	11,2 %
Acidosis (BE < -6)	%	12,0 %	9,6 %	15,1 %	12,1 %	43,4 %	28,8 %	11,7 %
Coagulopathy	%	11,2 %	8,4 %	13,9 %	14,7 %	34,8 %	26,3 %	19,6 %
Unconsciousness (GCS ≤ 8)	%	16,2 %	4,4 %	25,9 %	35,9 %	46,1 %	44,1 %	18,8 %

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

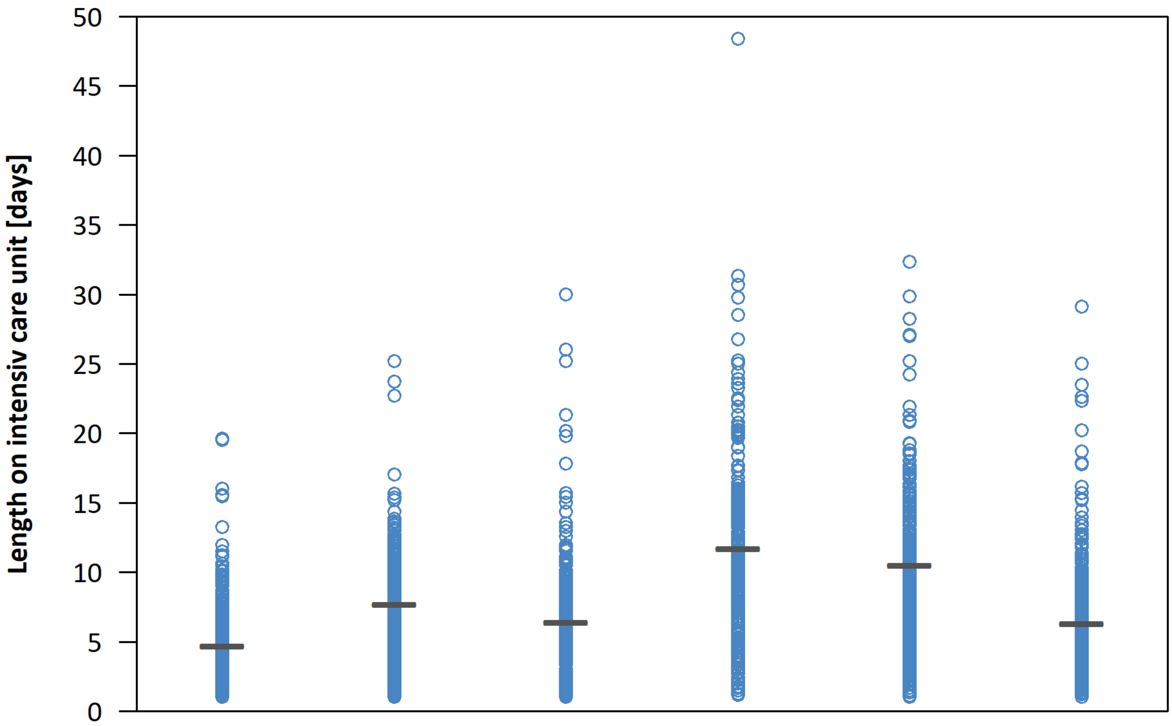
Table 10 continuation:

		Primary patients 2018-2020	Subgroups					
			No TBI	Combined trauma	Isolated TBI	Shock	Severe injuries	Elderly
Length of stay								
Patients with intensive care therapy	n	69.809	34.264	26.663	8.882	4.562	21.587	19.070
- Intubation on intensive care unit [days]	M	7,2	5,7	8,4	6,5	8,6	8,5	7,0
- Intensive care unit [days]	M	6,1	4,7	7,7	6,4	11,7	10,5	6,3
Days in hospital, all patients	M	14,8	14,7	15,8	12,2	19,2	18,5	14,4
Mortality and prognosis (without patients deceased within the first week with a patient's volition)								
Non-survivors	n	6.870	1.685	3.362	1.823	1.638	5.694	3.604
Mortality	%	9,0 %	4,2 %	12,2 %	20,8 %	33,3 %	26,2 %	18,2 %
Risk of death prognosis (RISC II)	%	9,1 %	4,1 %	12,9 %	19,8 %	36,0 %	26,5 %	17,9 %

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.

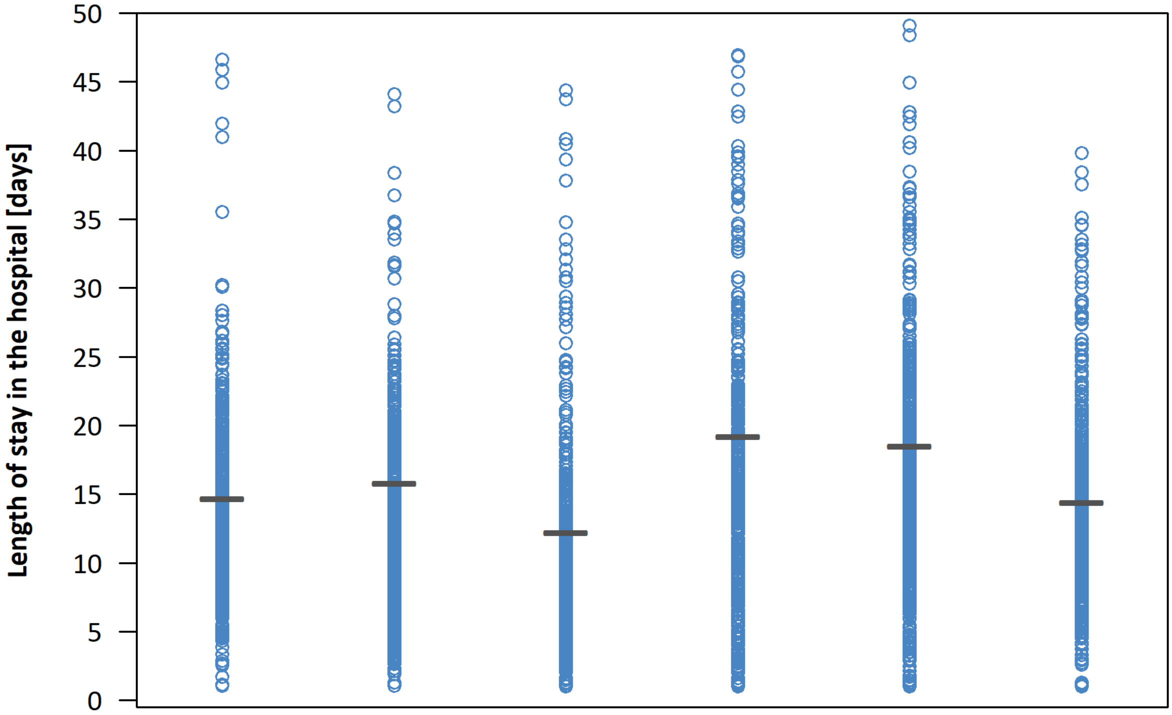
Figure 26 shows the **length of stay on intensive care unit** in days for 2018-2020 between the subgroups defined in table 10 for all primary admitted and treated patients of the TR-DGU in the basic group (patients ≥ 3).



	No TBI	Combined trauma	Isolated TBI	Shock	Severe injuries	Elderly
TR-DGU:	4.7	7.7	6.4	11.7	10.5	6.3
n:	34,192	26,517	8,635	4,303	21,420	18,942

Figure 26: Length of stay on intensive care unit [days] and number of patients divided into subgroups, for definition see tab. 10, patients 2018-2020, — TR-DGU, o single hospital value

Figure 27 compares the **length of stay in hospital** in days for 2018-2020 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:	14.7	15.8	12.2	19.2	18.5	14.4
n:	40,026	28,678	9,869	5,360	23,982	21,765

Figure 27: Length of stay in hospital [days] and number of patients divided into subgroups, for definition see tab. 10, patients 2018-2020, — 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 2020** are compared with the data from the previous years (**since 2011**). 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 2020		TR-DGU 2011-2019	
Prehospital data (A)		%	{}	%	{}
Only primary admitted patients, who have not admitted themselves / were not admitted privately		n = 26.108		n = 244.557	
GCS	RISC II requires the motor component; quality indicators use the GCS for the definition of cases	**93 %**	1.767	**94 %**	15.508
Blood pressure	Initial blood pressure is important for validating the volume therapy and for the definition of shock	**87 %**	3.333	**88 %**	28.517
Pupils *	Pupil size and reactivity are relevant for prognosis (RISC II)	**92 %**	2.169	**68 %**	78.928
CPR	Cardio-pulmonary resuscitation is seldom but highly predictive for outcome; required for RISC II	**87 %**	3.360	**92 %**	18.981
Emergency room (B)					
Only primary admitted patients		n = 26.685		n = 249.469	
Time of admission	Required to calculate the diagnostic time periods (quality indicators)	**100 %**	46	**99 %**	2.402
Blood pressure	Blood pressure on admission is used by RISC II as a prognostic variable and to define shock	**93 %**	1.756	**93 %**	17.918
Base excess	The initial base excess is part of the RISC II and an important prognostic factor	**81 %**	4.985	**74 %**	63.616
Coagulation	The INR (or Quick's value) is needed for the RISC II as coagulation marker	**94 %**	1.618	**92 %**	20.664
Hemoglobine	Prognostic factor; is part of the RISC II prognosis	**97 %**	727	**95 %**	11.567
Patients and outcome					
All patients from the basic group		n = 28.947		n = 274.929	
ASA	Prior diseases are relevant for outcome prediction (RISC II)	**94 %**	1.667	**88 %**	32.060
Surgical treatment *	A low rate of surgical patients could be based on incomplete documentation	**62 %**	11.032	**46 %**	147.656
Outcome	The levels according to the parameter „outcome" describe the patient's condition at discharge or transfer	**98 %**	503	**95 %**	12.795
Process data - Period of time until documentation					
All patients from the basic group		n = 28.947		n = 274.929	
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	**4,0 months**		**4,4 months**	
Time from discharge to case completion in the TR-DGU**	Time from discharge of a patient to **completion** of documentation in the registry	**5,2 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 2020 and comparison over the time

Data quality: Completeness	TR-DGU 2020	TR-DGU 2011-2019
Primary admitted patients from the basic group	n = 26.685	n = 249.469
Expected number of documented values	n = 266.850	n = 2.494.690
Number of missing values	{} 20.889	{} 229.129
Average completeness rate (%) based on the 10 specified parameters	**92,2 %**	**90,8 %**

9.2.1 Graphical comparison with other hospitals

Figure 28 summarises the average completeness value from all 681 hospitals with documented basic group cases **in 2020**. It follows the idea of a box plot in which the light blue box ranging from 86,6 % to 96,0 % covers half of all hospital values. The black vertical line within the box is the median average completeness value 92,5 %.

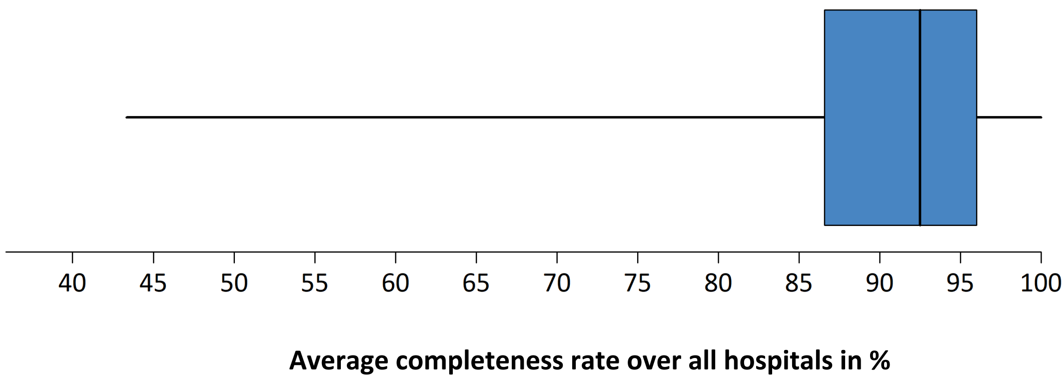


Figure 28: Distribution of the data completeness rate in 2020 over all hospitals

9.2.2 Development over time

Figure 29 shows the development of data completeness over the last ten years since 2011. 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 2012. The data completeness of the standard dataset has approached to the line of the QM dataset since 2013, so that the data completeness in 2020 is similar between the two datasets with a notable value over 90 %.

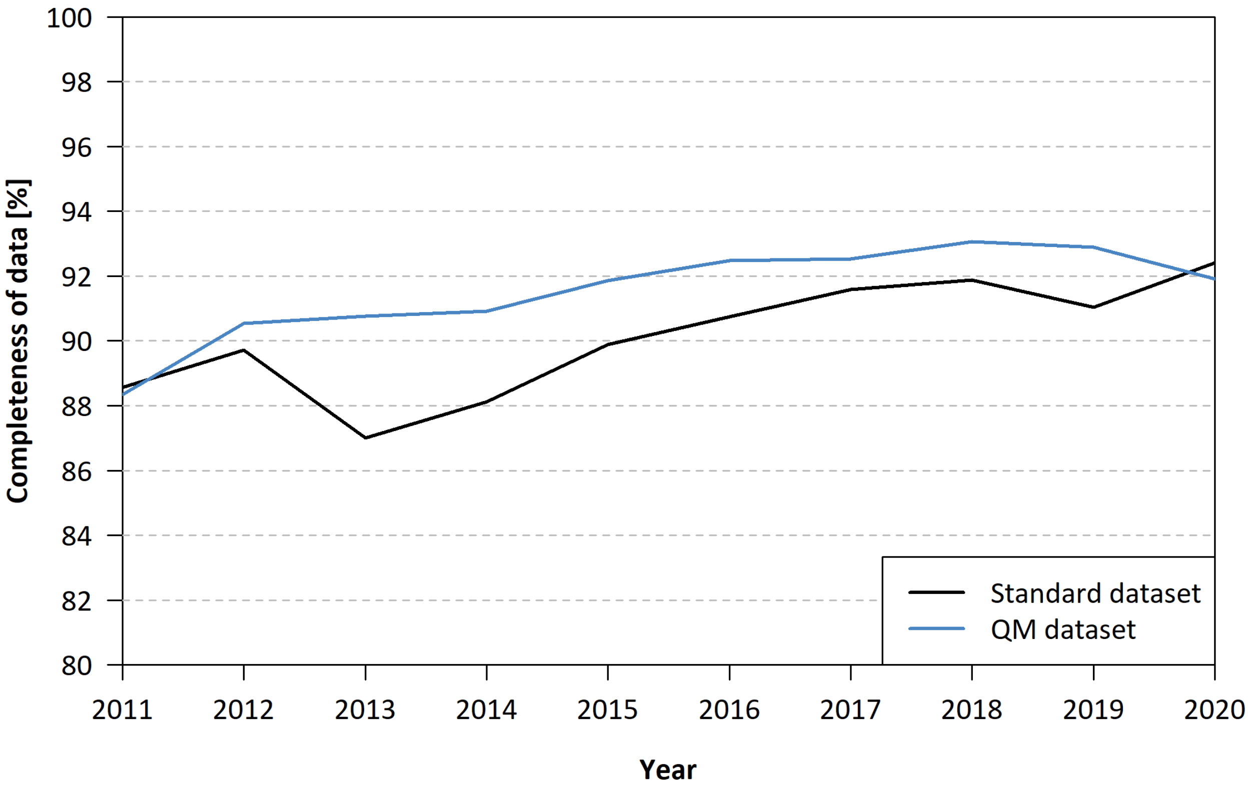


Figure 29: Development over time of the documentation quality: completeness rate in the TR-DGU 2011-2020

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 reduce the statistical uncertainty, all patients from the **last three years (2018-2020)** 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 2020.

Table 14: Distribution of the injuries from all recorded patients (basic group) for the years 2018-2020

	TR-DGU 2018-2020
Patients in the basic group	**100 %** (N = 92.484)
Head	**45,9 %** (n = 42.440)
Face	**10,8 %** (n = 9.967)
Neck	**1,6 %** (n = 1.514)
Thorax	**45,4 %** (n = 42.004)
Abdomen	**14,1 %** (n = 13.075)
Spine	**29,6 %** (n = 27.366)
Arms	**29,2 %** (n = 26.967)
Pelvis	**15,2 %** (n = 14.082)
Legs	**23,2 %** (n = 21.407)

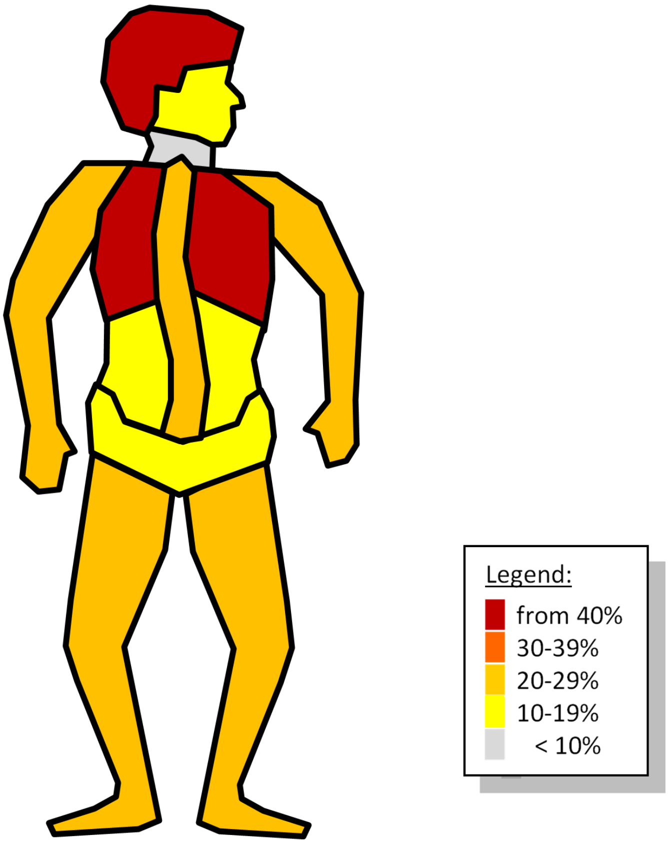


Figure 30: Injury pattern in the TR-DGU for the basic group from 2020

Serious injuries (AIS 3+)

Injuries with a severity of 3 points or more (AIS) are considered as „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). So, spine 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 2018-2020 (basic group)

	TR-DGU 2018-2020
Serious injury (AIS ≥ 3)	**81,5 %** (N = 75.341)
... of the **head**	**44,2 %** (n = 33.341)
... of the **thorax**	**46,3 %** (n = 34.858)
... of the **abdomen**	**11,9 %** (n = 8.941)
... of the **extremities**	**28,2 %** (n = 21.252)
Patients with **more than one** seriously injured body region	**29,3 %** (n = 22.094)

11 General results

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 2020, 36.222 patients were registered from 689 hospitals that documented cases in the TraumaRegister DGU®. The **basic group** that this report is based on comprises **28.947 patients** from 681 hospitals (details on the definition see chapter 1). There are already **184.973 patients** that have been documented with the in 2015 updated dataset.

There were 15.743 patients with ISS ≥ 16 from 629 hospitals in the basic group. The distribution of the number of ISS ≥ 16 patients per hospital is shown in figure 31.

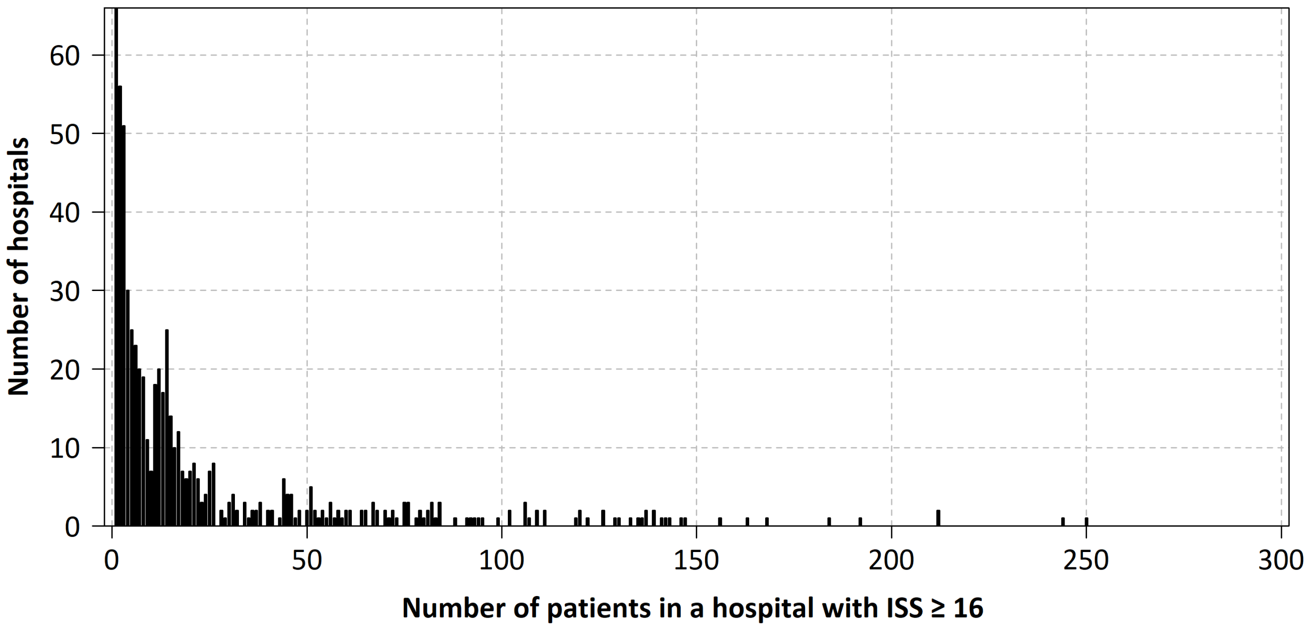


Figure 31: Frequency distribution of ISS ≥ 16 patients numbers per hospital in the TR-DGU 2020

Patients

Figure 32 demonstrates the continuous increase of registered patients over time since 2002. In 2020, 7.275 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 48,1 % German patients in the basic group that were documented by the standard dataset (S) in 2020.

In 2020, there were **681 hospitals** that documented patients in the basic group, 60 hospitals were from foreign countries (8,8 %), namely Belgium, Finland, Luxembourg, The Netherlands, Austria, Switzerland, Slovenia and the United Arab Emirates and 621 hospitals from Germany.

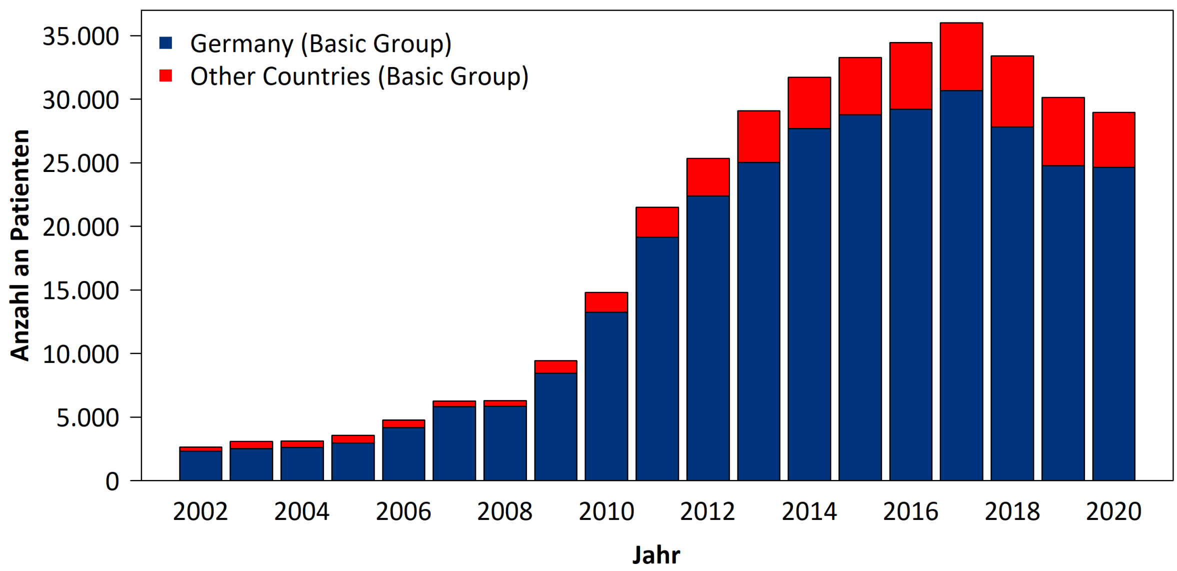


Figure 32: Number of cases in the TR-DGU 2002-2020

11.2 COVID-19

In July 2020, in parallel to the introduction of the new data set version (V2020), questions pertaining to COVID-19 were added to the emergency room questionairre.
Here we present the number of COVID-19 tests conducted, the distribution of test results and mortality rates of tested patients since July 2020.

Tabelle 16: Number of Patients tested for COVID-19, their test results and the distrubtion of deaths

	2020
Number of patients from the basic group tested for COVID-19	**11,986 / 28,947 (41 %)**
COVID +	**115 (1 %)**
.... of these, number of deaths	27 (23 %)
COVID -	**11,797 (98 %)**
.... of these, number of deaths	1,261 (11 %)
COVID test result unknown	**94 (1 %)**
.... of these, number of deaths	13 (18 %)

11.3 Patients with a documented patient's volition

With the revision of the data set in 2016, 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 17: Number of deceased patients with a documented patient's volition for the years 2016-2020

Year	2016	2017	2018	2019	2020
Number of deceased	3.610	3.711	3.628	3.361	3.452
Number of deceased **without** a patient's volition	1,754	1,751	1,674	1,046	1,027
Number of deceased **with** a patient's volition	1,140	1,239	1,322	1,141	1,973
...among them deceased within the first 7 days	707	759	812	732	1,309
Proportion of deceased **with a patient's volition**	39 %	41 %	44 %	52 %	66 %

The analysis of the age of the deceased shows (Table 18) that their mean age in the past 5 years was over 65. Furthermore, that deceased patients with a patient's volition were on average approximately 15 years older compared to the deceased without a patient's volition.

Table 18: Mean age of the deceased separated by availability of a patient's volition in the years 2016-2020

Year	2016	2017	2018	2019	2020
Mean age of the deceased [years]	66.0	66.7	67.7	67.4	68.3
Mean age of the deceased **with** a patient's volition [years]	76.8	77.5	76.9	76.5	74.2
Mean age of the deceased **without** a patient's volition [years]	60.0	60.6	61.2	59.7	58.5

12 Publications from the TraumaRegister DGU®

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

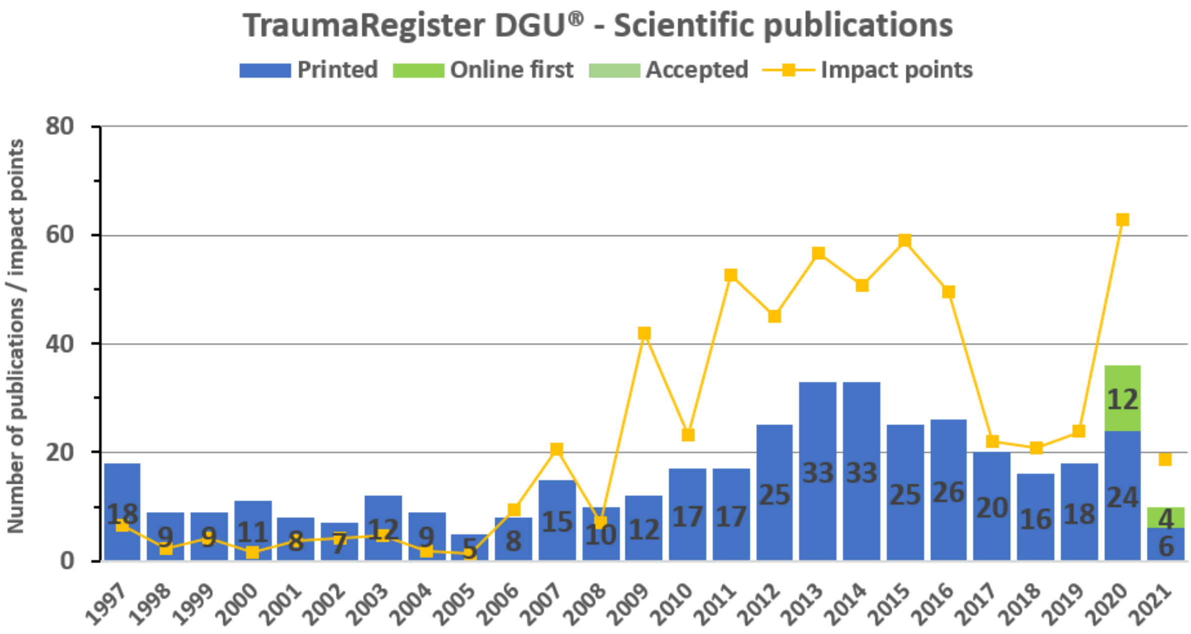


Figure 33: Number of publications from the TraumaRegister DGU® and their impact points since 1997

12.1 Facts from the Reviewboard in 2020

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 and Ms. Nienaber. The administrative management is performed by Ms. Isserstedt. Table 19 gives an overview over the work of the TraumaRegister DGU® Reviewboard in the year 2020.

Table 19: Facts from the Reviewboard 2020

	2020
Number of new research proposals	65
Number of research proposals discussed in the Reviewboard (incl. Revisions)	88
Number of research proposals reviewed (incl. resubmissions)	35
Number of manuscripts reviewed	37
Number of manuscripts approved for publication	25
Number of participating reviewers	65

12.2 Publications from the TR-DGU 2019 - 07/2021

2021

Bieler D, Kollig E, Hackenberg L, Rathjen JH, Lefering R, Franke A, Committee on Emergency Medicine, Intensive Care and Trauma Management (Sektion NIS) of the German Trauma Society (DGU). Penetrating injuries in Germany - epidemiology, management and outcome an analysis based on the TraumaRegister DGU®. Scand J Trauma Resusc Emerg Med. 2021; 29: 80.

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12.3 Abstracts 08/2020 - 07/2021

Scand J Trauma Resusc Emerg Med. 2021; 29: 80.

Penetrating injuries in Germany - epidemiology, management and outcome an analysis based on the TraumaRegister DGU®.

Bieler D, Kollig E, Hackenberg L, Rathjen JH, Lefering R, Franke A; Committee on Emergency Medicine, Intensive Care and Trauma Management(Sektion NIS) of the German Trauma Society (DGU)

BACKGROUND: The management of penetrating wounds is a rare challenge for trauma surgeons in Germany and Central Europe as a result of the low incidence of this type of trauma. In Germany, penetrating injuries are reported to occur in 4–5 % of the severely injured patients who are enrolled in the TraumaRegister DGU® (trauma registry of the German Trauma Society). They include gunshot injuries, knife stab injuries, which are far more common, and penetrating injuries of other origin, for example trauma caused by accidents. The objective of this study was to assess the epidemiology and outcome of penetrating injuries in Germany, with a particular focus on the level of care provided by the treating trauma centre to gain more understanding of this trauma mechanism and to anticipate the necessary steps in the initial treatment.

MATERIALS AND METHODS: Since 2009, the TraumaRegister DGU® has been used to assess not only whether a trauma was penetrating but also whether it was caused by gunshot or stabbing. Data were taken from the standard documentation forms that participating German hospitals completed between 2009 and 2018. Excluded were patients with a maximum abbreviated injury scale (MAIS) score of 1 with a view to obtaining a realistic idea of this injury entity, which is rare in Germany.

RESULTS: From 2009 to 2018, there were 1123 patients with gunshot wounds, corresponding to a prevalence rate of 0.5 %, and 4333 patients with stab wounds (1.8 %), which were frequently caused by violent crime. The high proportion of intentionally self-inflicted gunshot wounds to the head resulted in a cumulative mortality rate of 41 % for gunshot injuries. Stab wounds were associated with a lower mortality rate (6.8 %). Every fourth to fifth patient with a gunshot or stab wound presented with haemorrhagic shock, which is a problem that is seen during both the prehospital and the inhospital phase of patient management. Of the patients with penetrating injuries, 18.3 % required transfusions. This percentage was more than two times higher than that of the basic group of patients of the TraumaRegister DGU®, which consists of patients with a MAIS ≥ 3 and patients with a MAIS of 2 who died or were treated on the intensive care unit.

CONCLUSIONS: In Germany, gunshot and stab wounds have a low incidence and are mostly caused by violent crime or attempted suicides. Depending on the site of injury, they have a high mortality and are often associated with major haemorrhage. As a result of the low incidence of these types of trauma, further data and analyses are required in order to provide the basis for evaluating the long-term quality of the management of patients with stab or gunshot wounds.

Eur J Trauma Emerg Surg. 2021 doi: 10.1007/s00068-021-01668-2 [Epub ahead of print].

Evaluation of a standardized instrument for post hoc analysis of trauma-team-activation-criteria in 75,613 injured patients an analysis of the TraumaRegister DGU®.

Bieler D, Trentzsch H, Franke A, Baacke M, Lefering R, Paffrath T, Becker L, Düsing H, Heindl B, Jensen KO, Oezkurtul O, Schweigkofler U, Sprengel K, Wohlrath B, Waydhas C; Committee on Emergency Medicine, Intensive Care and Trauma Management (Sektion NIS) of the German Trauma Society (DGU)

INTRODUCTION: To improve the quality of criteria for trauma-team-activation it is necessary to identify patients who benefited from the treatment by a trauma team. Therefore, we evaluated a post hoc criteria catalogue for trauma-team-activation which was developed in a consensus process by an expert group and published recently. The objective was to examine whether the catalogue can identify patients that died after admission to the hospital and therefore can benefit from a specialized trauma team mostly.

MATERIALS AND METHODS: The catalogue was applied to the data of 75,613 patients from the TraumaRegister DGU® between the 01/2007 and 12/2016 with a maximum abbreviated injury score (AIS) severity ≥ 2. The endpoint was hospital mortality, which was defined as death before discharge from acute care.

RESULTS: The TraumaRegister DGU® dataset contains 18 of the 20 proposed criteria within the catalogue which identified 99.6% of the patients who were admitted to the trauma room following an accident and who died during their hospital stay. Moreover, our analysis showed that at least one criterion was fulfilled in 59,785 cases (79.1%). The average ISS in this group was 21.2 points (SD 9.9). None of the examined criteria applied to 15,828 cases (average ISS 8.6; SD 5). The number of consensus-based criteria correlated with the severity of injury and mortality. Of all deceased patients (8,451), only 31 (0.37%) could not be identified on the basis of the 18 examined criteria. Where only one criterion was fulfilled, mortality was 1.7%; with 2 or more criteria, mortality was at least 4.6%.

DISCUSSION: The consensus-based criteria identified nearly all patients who died as a result of their injuries. If only one criterion was fulfilled, mortality was relatively low. However, it increased to almost 5% if two criteria were fulfilled. Further studies are necessary to analyse and examine the relative weighting of the various criteria. Our instrument is capable to identify severely injured patients with increased in-hospital mortality and injury severity. However, a minimum of two criteria needs to be fulfilled. Based on these findings, we conclude that the criteria list is useful for post hoc analysis of the quality of field triage in patients with severe injury.

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Helicopter Emergency Medical Service and Hospital Treatment Levels Affect Survival in Pediatric Trauma Patients.

Bläsius FM, Horst K, Brokmann JC, Lefering R, Andruszkow H, Hildebrand F, TraumaRegister Dgu.

BACKGROUND: Data on the effects of helicopter emergency medical service (HEMS) transport and treatment on the survival of severely injured pediatric patients in high-level trauma centers remain unclear.

METHODS: A national dataset from the TraumaRegister DGU® was used to retrospectively compare the mortality rates among severely injured pediatric patients (1-15 years) who were transported by HEMS to those transported by ground emergency medical service (GEMS) and treated at trauma centers of different treatment levels (levels I-III).

RESULTS: In total, 2755 pediatric trauma patients (age: 9.0 ± 4.8 years) were included in this study over five years. Transportation by HEMS resulted in a significant survival benefit compared to GEMS (odds ratio (OR) 0.489; 95% confidence interval (CI): 0.282-0.850). Pediatric trauma patients treated in level II or III trauma centers showed 34% and fourfold higher in-hospital mortality risk than those in level I trauma centers (level II: OR 1.34, 95% CI: 0.70-2.56; level III: OR 4.63, 95% CI: 1.33-16.09).

CONCLUSIONS: In our national pediatric trauma cohort, both HEMS transportation and treatment in level I trauma centers were independent factors of improved survival in pediatric trauma patients.

Eur J Trauma Emerg Surg. 2021 doi: 10.1007/s00068-020-01599-4 [Epub ahead of print]

Strategies for the treatment of femoral fractures in severely injured patients: trends in over two decades from the TraumaRegister DGU®

Bläsius FM, Laubach M, Andruszkow H, Lichte P, Pape HC, Lefering R, Horst K, Hildebrand F; Trauma Register DGU®.

PURPOSE: Treatment strategies for femoral fracture stabilisation are well known to have a significant impact on the patient's outcome. Therefore, the optimal choices for both the type of initial fracture stabilisation (external fixation/EF, early total care/ETC, conservative treatment/TC) and the best time point for conversion from temporary to definitive fixation are challenging factors.

PATIENTS: Patients aged ≥ 16 years with moderate and severe trauma documented in the TraumaRegister DGU® between 2002 and 2018 were retrospectively analysed. Demographics, ISS, surgical treatment strategy (ETC vs. EF vs. TC), time for conversion to definitive care, complication (MOF, sepsis) and survival rates were analysed.

RESULTS: In total, 13,091 trauma patients were included. EF patients more often sustained high-energy trauma (car: 43.1 vs. 29.5%, $p < 0.001$), were younger (40.6 vs. 48.1 years, $p < 0.001$), were more severely injured (ISS 25.4 vs. 19.1 pts., $p < 0.001$), and had higher sepsis (11.8 vs. 5.4%, $p < 0.001$) and MOF rates (33.1 vs. 16.0%, $p < 0.001$) compared to ETC patients. A shift from ETC to EF was observed. The time until conversion decreased for femoral fractures from 9 to 8 days within the observation period. Sepsis incidences decreased in EF (20.3 to 12.3%, $p < 0.001$) and ETC (9.1–4.8%, $p < 0.001$) patients.

CONCLUSIONS: Our results show the changes in the surgical treatment of severely injured patients with femur fractures over a period of almost two decades caused by the introduction of modern surgical strategies (e.g., Safe Definitive Surgery). It remains unclear which subgroups of trauma patients benefit most from these strategies.

J Clin Med. 2021; 10: 700. doi: 10.3390/jcm10040700

Curiosity or Underdiagnosed? Injuries to Thoracolumbar Spine with Concomitant Trauma to Pan-creas.

Hax J, Halvachizadeh S, Jensen KO, Berk T, Teuber H, Di Primio T, Lefering R, Pape HC, Sprengel K, TraumaRegister Dgu.

The pancreas is at risk of damage as a consequence of thoracolumbar spine injury. However, there are no studies providing prevalence data to support this assumption. Data from European hospitals documented in the TraumaRegister DGU® (TR-DGU) between 2008–2017 were analyzed to estimate the prevalence of this correlation and to determine the impact on clinical outcome. A total of 44,279 patients with significant thoracolumbar trauma, defined on Abbreviated Injury Scale (AIS) as ≥2, were included. Patients transferred to another hospital within 48 h were excluded to prevent double counting. A total of 135,567 patients without thoracolumbar injuries (AIS ≤ 1) were used as control group. Four-hundred patients with thoracolumbar trauma had a pancreatic injury. Pancreatic injuries were more common after thoracolumbar trauma (0.90% versus (vs.) 0.51%, odds ratio (OR) 1.78; 95% confidence intervals (CI), 1.57–2.01). Patients with pancreatic injuries were more likely to be male (68%) and had a higher mean Injury Severity Score (ISS) than those without (35.7 ± 16.0 vs. 23.8 ± 12.4). Mean length of stay (LOS) in intensive care unit (ICU) and hospital was longer with pancreatic injury. In-hospital mortality was 17.5% with and 9.7% without pancreatic injury, respectively. Although uncommon, concurrent pancreatic injury in the setting of thoracolumbar trauma can portend a much more serious injury.

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Survival among patients with severe high cervical spine injuries - a TraumaRegister DGU® database study.

Kamp O, Jansen O, Lefering R, Aach M, Waydhas C, Dudda M, Schildhauer TA, Hamsen U; TraumaRegis-ter DGU.

BACKGROUND: Trauma is a significant cause of death and impairment. The Abbreviated Injury Scale (AIS) differentiates the severity of trauma and is the basis for different trauma scores and prediction models. While the majority of patients do not survive injuries which are coded with an AIS 6, there are several patients with a severe high cervical spinal cord injury that could be discharged from hospital despite the prognosis of trauma scores. We estimate that the trauma scores and prediction models miscalculate these injuries. For this reason, we evaluated these findings in a larger control group.

METHODS: In a retrospective, multi-centre study, we used the data recorded in the TraumaRegister DGU® (TR-DGU) to select patients with a severe cervical spinal cord injury and an AIS of 3 to 6 between 2002 to 2015. We compared the estimated mortality rate according to the Revised Injury Severity Classification II (RISC II) score against the actual mortality rate for this group.

RESULTS: Six hundred and twelve patients (0.6%) sustained a severe cervical spinal cord injury with an AIS of 6. The mean age was 57.8 ± 21.8 years and 441 (72.3%) were male. 580 (98.6%) suffered a blunt trauma, 301 patients were injured in a car accident and 29 through attempted suicide. Out of the 612 patients, 391 (63.9%) died from their injury and 170 during the first 24 h. The group had a predicted mortality rate of 81.4%, but we observed an actual mortality rate of 63.9%.

CONCLUSIONS: An AIS of 6 with a complete cord syndrome above C3 as documented in the TR-DGU is survivable if patients get to the hospital alive, at which point they show a survival rate of more than 35%. Compared to the mortality prognosis based on the RISC II score, they survived much more often than expected.

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The Influence of Alcohol on The Base Excess Parameter in Trauma Patients.

Leiblein M, Sturm R, Franz N, Mühlenfeld N, Relja B, Lefering R, Marzi I, Wagner N.

BACKGROUND: The base excess (BE) parameter can be used as an indicator of mortality. However, study results on the influence of alcohol on the validity of BE as a prognostic parameter in alcohol-intoxicated patients are controversial. Thus, this study examined the hypothesis: An increasing blood alcohol level reduces the prognostic value of the Base Excess parameter on mortality.

MATERIAL METHODS: In a retrospective analysis of the multi-centre database of the TraumaRegister DGU®, patients from 2015 to 2017 were grouped depending on their blood alcohol level (BAL) into a BAL+ and BAL- group. The hypothesis was verified using logistic regression with an assumed significance level of 1% (p < 0.01).

RESULTS: 11889 patients were included; 9472 patients in the BAL- group and 2417 patients in the BAL+ group. Analysis of the BE showed lower values in the BAL+ group (BAL-: -1.8 ± 4.4 mmol/l vs. BAL+: -3.4 ± 4.6 mmol/l). There is a trend towards lower BE levels when BAL increases. Assuming a linear relationship, then BE decreases by 0.6 points per mille alcohol (95%CI: 0.5-0.7; p < 0.001). The mortality rate was significantly lower in the BAL+ group (BAL-: 11.1% vs. BAL+: 7.9%). The logistic regression analysis showed a significant beneficial influence of BAL+ on the mortality rate (OR 0.706, 95% CI 0.530 - 0.941, p = 0.018). To analyse whether a low BE (≤ -6 mmol/l) has different prognostic effects in patients with and without alcohol, logistic regression models were calculated. However, the effect of BE ≤ -6 mmol/l was similar in both models (regression coefficients in BAL-/+ patients: 0.379 / 0.393).

CONCLUSIONS: The data demonstrate an existing influence of alcohol on the BE parameter; however, this does not negatively affect the BE as a prognostic parameter at a threshold of ≤ -6 mmol/l.

J Clin Med. 2021; 10: 1362. doi: 10.3390/jcm10071362.

The GERtality Score: The Development of a Simple Tool to Help Predict in-Hospital Mortality in Geriatric Trauma Patients.

Scherer J, Kalbas Y, Ziegenhain F, Neuhaus V, Lefering R, Teuben M, Sprengel K, Pape HC, Jensen KO.

Feasible and predictive scoring systems for severely injured geriatric patients are lacking. Therefore, the aim of this study was to develop a scoring system for the prediction of in-hospital mortality in severely injured geriatric trauma patients. The TraumaRegister DGU® (TR-DGU) was utilized. European geriatric patients (≥65 years) admitted between 2008 and 2017 were included. Relevant patient variables were implemented in the GERtality score. By conducting a receiver operating characteristic (ROC) analysis, a comparison with the Geriatric Trauma Outcome Score (GTOS) and the Revised Injury Severity Classification II (RISC-II) Score was performed. A total of 58,055 geriatric trauma patients (mean age: 77 years) were included. Univariable analysis led to the following variables: age ≥ 80 years, need for packed red blood cells (PRBC) transfusion prior to intensive care unit (ICU), American Society of Anesthesiologists (ASA) score ≥ 3, Glasgow Coma Scale (GCS) ≤ 13, Abbreviated Injury Scale (AIS) in any body region ≥ 4. The maximum GERtality score was 5 points. A mortality rate of 72.4% was calculated in patients with the maximum GERtality score. Mortality rates of 65.1 and 47.5% were encountered in patients with GERtality scores of 4 and 3 points, respectively. The area under the curve (AUC) of the novel GERtality score was 0.803 (GTOS: 0.784; RISC-II: 0.879). The novel GERtality score is a simple and feasible score that enables an adequate prediction of the probability of mortality in polytraumatized geriatric patients by using only five specific parameters.

World J Surg. 2021 Jul;45(7):2037-2045. doi: 10.1007/s00268-021-06074-8 [Epub ahead of print]

Simultaneous Casualty Admissions-Do they Affect Treatment in the Receiving Trauma Center?

Teuben MPJ, Mand C, Moosdorf L, Sprengel K, Shehu A, Pfeifer R, Ruchholtz S, Lefering R, Pape HC, Jensen KO.

BACKGROUND: Simultaneous trauma admissions expose medical professionals to increased workload. The impact of simultaneous trauma admissions on hospital allocation, therapy, and outcome is currently unclear. We hypothesized that multiple admission-scenarios impact the diagnostic pathway and outcome.

METHODS: The TraumaRegister DGU® was utilized. Patients admitted between 2002-2015 with an ISS ≥ 9, treated with ATLS®- algorithms were included. Group ´IND´ included individual admissions, two individuals that were admitted within 60 min of each other were selected for group ´MULT´. Patients admitted within 10 min were considered as simultaneous (´SIM ´) admissions. We compared patient and trauma characteristics, treatment, and outcomes between both groups.

RESULTS: 132,382 admissions were included, and 4,462/3.4% MULTiple admissions were found. The SIM-group contained 1,686/1.3% patients. The overall median injury severity score was 17 and a mean age of 48 years was found. MULT patients were more frequently admitted to level-one trauma centers (68%) than individual trauma admissions were (58%, p < 0.001). Mean time to CT-scanning (24 vs. 26/28 min) was longer in MULT / SIM patients compared to individual admissions. No differences in utilization of damage control principles were seen. Moreover, mortality rates did not differ between the groups (13.1% in regular admissions and 11.4%/10,6% in MULT/SIM patients).

CONCLUSION: This study demonstrates that simultaneous treatment of injured patients is rare. Individuals treated in parallel with other patients were more often admitted to level-one trauma centers compared with individual patients. Although diagnostics take longer, treatment principles and mortality are equal in individual admissions and simultaneously admitted patients. More studies are required to optimize health care under these conditions.

Medicina 2021; 57: 330. https://doi.org/10.3390/medicina57040330 [Epub ahead of print]

Age-Dependent Patient and Trauma Characteristics and Hospital Resource Requirements—Can Improvement Be Made? An Analysis from the German Trauma Registry

Ziegenhain F, Scherer J, Kalbas Y, Neuhaus V, Lefering R, Teuben M, Sprengel K, Pape HC, Jensen KO and the TraumaRegister DGU.

BACKGROUND AND OBJECTIVES: The burden of geriatric trauma patients continues to rise in Western society. Injury patterns and outcomes differ from those seen in younger adults. Getting a better understanding of these differences helps medical staff to provide a better care for the elderly. The aim of this study was to determine epidemiological differences between geriatric trauma patients and their younger counterparts. To do so, we used data of polytraumatized patients from the TraumaRegister DGU®.

MATERIALS AND METHODS: All adult patients that were admitted between 1 January 2013 and 31 December 2017 were included from the TraumaRegister DGU®. Patients aged 55 and above were defined as the elderly patient group. Patients aged 18–54 were included as control group. Patient and trauma characteristics, as well as treatment and outcome were compared between groups.

RESULTS: A total of 114,169 severely injured trauma patients were included, of whom 55,404 were considered as elderly patients and 58,765 younger patients were selected for group 2. Older patients were more likely to be admitted to a Level II or III trauma center. Older age was associated with a higher occurrence of low energy trauma and isolated traumatic brain injury. More restricted utilization of CT-imaging at admission was observed in older patients. While the mean Injury Severity Score (ISS) throughout the age groups stayed consistent, mortality rates increased with age: the overall mortality in young trauma patients was 7.0%, and a mortality rate of 40.2% was found in patients >90 years of age.

CONCLUSIONS: This study shows that geriatric trauma patients are more frequently injured due to low energy trauma, and more often diagnosed with isolated craniocerebral injuries than younger patients. Furthermore, utilization of diagnostic tools as well as outcome differ between both groups. Given the aging society in Western Europe, upcoming studies should focus on the right application of resources and optimizing trauma care for the geriatric trauma patient.

Sci Rep. 2020; 10: 21606.

Acromioclavicular and sternoclavicular joint dislocations indicate severe concomitant thoracic and upper extremity injuries in severely injured patients.

Bakir MS, Lefering R, Haralambiev L, Kim S, Ekkernkamp A, Gümbel D, Schulz-Drost S.

Preliminary studies show that clavicle fractures (CF) are known as an indicator in the severely injured for overall injury severity that are associated with relevant concomitant injuries in the thorax and upper extremity. In this regard, little data is available for the rarer injuries of the sternoclavicular and acromioclavicular joints (SCJ and ACJ, respectively). Our study will answer whether clavicular joint injuries (CJI), by analogy, have a similar relevance for the severely injured. We performed an analysis from the TraumaRegister DGU (TR-DGU). The inclusion criterion was an Injury Severity Score (ISS) of at least 16. In the TR-DGU, the CJI were registered as one entity. The CJI group was compared with the CF and control groups (those without any clavicular injuries). Concomitant injuries were distinguished using the Abbreviated Injury Scale according to their severity. The inclusion criteria were met by n = 114,595 patients. In the case of CJI, n = 1228 patients (1.1%) were found to be less severely injured than the controls in terms of overall injury severity. Compared to the CF group (n = 12,030; 10.5%) with higher ISS than the controls, CJI cannot be assumed as an indicator for a more severe trauma; however, CF can. Concomitant injuries were more common for severe thoracic and moderate upper extremity injuries than other body parts for CJI. This finding confirms our hypothesis that CJI could be an indicator of further specific severe concomitant injuries. Despite the rather lower relevance of the CJI in the cohort of severely injured with regard to the overall injury severity, these injuries have their importance in relation to the indicator effect for thoracic concomitant injuries and concomitant injuries of the upper extremity. A limitation is the collective registration of SCJ and ACJ injuries as one entity in the TR-DGU. A distorted picture of the CJI in favor of ACJ injuries could arise from the significantly higher incidence of the ACJ dislocation compared to the SCJ. Therefore, these two injury entities should be recorded separately in the future, and prospective studies should be carried out in order to derive a standardized treatment strategy for the care of severely injured with the respective CJI.

Eur J Trauma Emerg Surg. 2020; 46: 449-460. Erratum: 2020; 46: 461-462. doi: 10.1007/s00068-018-1055-z.

Evaluation of new quality indicators for the TraumaRegister DGU® using the systematic QUALIFY methodology.

Bieler D, Hörster A, Lefering R, Franke A, Waydhas C Huber-Wagner S, Baacke M, Paffrath T, Wnent J, Volland R, Jakisch B, Walcher F, Kulla M.

BACKGROUND: The TraumaRegister DGU® (TR-DGU) of the German Trauma Society (Deutsche Gesellschaft für Unfallchirurgie, DGU) enables the participating hospitals to perform quality management. For that purpose, nine so-called audit filters have existed, since its foundation, which, inter alia, is listed in the Annual Report. The objective of this study effort is a revision of these quality indicators with the aim of developing pertinent new and reliable quality indicators for the management of severely injured patients.

MATERIALS AND METHODS: Apart from indicators already used at national and international levels, a systematic review of the literature revealed further potential key figures for quality of the management of severely injured patients. The latter were evaluated by an interdisciplinary and interprofessional group of experts using a standardized QUALIFY process to assess their suitability as a quality indicator.

RESULTS: By means of the review of the literature, 39 potential indicators could be identified. 9 and 14 indicators, respectively, were identified in existing trauma registries (TR-DGU and TARN), 17 in the ATLS® training concept, and 57 in the S3 guideline on the treatment of polytrauma/severe injuries. The exclusion of duplicates and the limitation to indicators that can be collected using the TR-DGU Version 2015 data set resulted in a total of 43 indicators to be reviewed. For each of the 43 indicators, 13 quality criteria were assessed. A consensus was achieved in 305 out of 559 individual assessments. With 13 quality criteria assessed and 43 indicators correspond this to a relative consensus value of 54.6%. None of the indicators achieved a consensus in all 13 quality criteria assessed. The following 13 indicators achieved a consensus in at least 9 quality criteria: time between hospital admission and WBCT, mortality, administration of tranexamic acid to bleeding patients, use of CCT with GCS <14, time until first emergency surgical intervention (7-item list in the TR-DGU), time until surgical intervention for penetrating trauma, application of pelvic sling belt (prehospital), capnometry (etCO2) in intubated patients, time until CCT with GCS < 15, time until surgery for hemorrhagic shock, time until craniotomy for severe TBI, prehospital airway management in unconscious patients (GCS < 9), and complete basic diagnostics available. Two indicators achieved a consensus in 11 criteria and thus represent the maximum consensus achieved within the group of experts. Four indicators only achieved a consensus in three quality criteria. 17 indicators had a mean value for the 3 relevance criteria of ≥ 3.5 and were, therefore, assessed by the group of experts as being highly relevant.

CONCLUSION: Not all the key figures published for the management of severely injured patients are suitable for use as quality indicators. It remains to be seen whether the quality indicators identified by experts using the QUALIFY process will meet the requirements in practice. Prior to the implementation of the assessed quality indicators in standardized quality assurance programs, a scientific evaluation based on national data will be required.

J Clin Med. 2020; 9: 3235. doi: 10.3390/jcm9103235 [Epub ahead of print]

Predictive Factors for Massive Transfusion in Trauma: A Novel Clinical Score from an Italian Trauma Center and German Trauma Registry.

Cornero SG, Maegele M, Lefering R, Abbati C, Gupta S, Sammartano F, Cimbanassi S, Chiara O.

Early management of critical bleeding and coagulopathy can improve patient survival. The aim of our study was to identify independent predictors of critical bleeding and to build a clinical score for early risk stratification. A prospective analysis was performed on a cohort of trauma patients with at least one hypotensive episode during pre-hospital (PH) care or in the Emergency Department (ED). Patients who received massive transfusion (MT+) (≥4 blood units during the first hour) were compared to those who did not (MT−). Hemodynamics, Glagow Coma Score (GCS), diagnostics and blood tests were evaluated. Using multivariate analysis, we created and validated a predictive score for MT+ patients. The predictive score was validated on a matched cohort of patients of the German Trauma Registry TR-DGU. One hundred thirty-nine patients were included. Independent predictors of MT+ included a prehospital (PH) GCS of 3, PH administration of tranexamic acid, hypotension and tachycardia upon admission, coagulopathy and injuries with significant bleeding such as limb amputation, hemoperitoneum, pelvic fracture, massive hemothorax. The derived predictive score revealed an area under the curve (AUC) of 0.854. Massive transfusion is essential to damage control resuscitation. Altered GCS, unstable hemodynamics, coagulopathy and bleeding injuries can allow early identification of patients at risk for critical hemorrhage.

Med Klin Intensivmed Notfmed. 2020 Apr;115(3):222-227. doi: 10.1007/s00063-019-0565-8.

Continuous lateral rotational bed therapy in patients with traumatic lung injury: an analysis from the TraumaRegister DGU®.

Defosse J, Grensemann J, Gerbershagen MU, Paffrath T, Böhmer A, Joppich R, Lefering R, Wappler F, Schieren M; TraumaRegister DGU®.

BACKGROUND: Patients with severe thoracic trauma often receive continuous lateral rotational bed therapy (CLRT) for the treatment of lung contusions. In this study, the effects of CLRT on mortality, morbidity and length of stay (LOS) in the intensive care unit (ICU) and in the hospital were evaluated.

METHODS: Retrospective data from the TraumaRegister DGU® were analysed, focusing on patients with severe thoracic trauma. Patients treated with CLRT were compared to a control group with comparable trauma severity who had received conventional therapy.

RESULTS: A total of 1476 patients (239 with CLRT, 1237 without CLRT) were included in this study. Both groups were similar for demographic characteristics. The median CLRT duration was 6 (4-10) days. Patients receiving CLRT were ventilated for 17 (10-26) days compared to 14 (8-22) days ($p = 0.001$) in the control group. The ICU length of stay differed significantly (CLRT: 23 [14-32] days; control: 19 [13-28] days; $p = 0.002$). Also, organ failure occurred more frequently in patients treated with CLRT (CLRT: 76.6%, control: 67.6%; $p = 0.006$). No differences could be detected regarding mortality rates, multiple organ failure and hospital LOS.

CONCLUSIONS: The results of this retrospective analysis fail to detect a benefit for CLRT therapy in trauma patients. Considering inherent limitations of retrospective studies, caution should be exerted when interpreting these results. Further research is warranted to confirm these findings in a prospective trial.

Brain Sci. 2020; 10: E842. doi: 10.3390/brainsci10110842 [Epub ahead of print]

Is the Regular Intake of Anticoagulative Agents an Independent Risk Factor for the Severity of Traumatic Brain Injuries in Geriatric Patients? A Retrospective Analysis of 10,559 Patients from the TraumaRegister DGU®.

Eibinger N, Halvachizadeh S, Hallmann B, Seibert FJ, Puchwein P, Berk T, Lefering R, Sprengel K, Pape HC, Jensen KO, The TraumaRegister DGU.

The purpose of this study was to assess anticoagulant medication as an independent factor influencing the occurrence of a severe traumatic brain injury in geriatric patients. Data were collected from the TraumaRegister DGU® between January 2015 and December 2018. We included patients with an age of ≥65 years with a blunt TBI; an AISHead ≥2 but no other relevant injuries. Patients were divided into five subgroups: no anticoagulant medication, anti-platelet drugs, vitamin K antagonists, direct-oral-anticoagulants, and heparinoids. Separation between moderate TBI (AISHead 2-3) and severe TBI (AISHead ≥ 4) and multivariable regression analysis were performed. The average age of 10,559 included patients was 78.8 years with a mean ISS of 16.8 points and a mortality of 22.9%. The most common cause of injury was a low fall of <3 m with 72.8%. With increasing age, the number of patients without any anticoagulant therapy decreased from 65.9% to 29.9%. The intake of coagulation medication increased mortality significantly. Severe TBI was observed in 51% of patients without medication and ranged from 61 to 67% with anticoagulant drugs. After adjusting for confounding variables, the intake of VKA or DOACs was significantly associated with an increased risk of severe TBI. The use of anticoagulant medication is an independent factor and is associated with an increased severity of TBI depending on the type of medication used.

BMC Musculoskelet Disord 2020 Aug; 21: 568. doi: https://doi.org/10.1186/s12891-020-03572-z

The influence of foehn winds on the incidence of severe injuries in southern Bavaria - an analysis of the TraumaRegister DGU®.

Greve F, Kanz KG, Zyskowski M, von Matthey F, Biberthaler P, Muthers S, Matzarakis A, Lefering R, Hu-ber-Wagner S.

BACKGROUND: Foehn describes a wind which occurs in areas with close proximity to mountains. The presence of foehn wind is associated with worsening health conditions. This study analyzes the correlation between a foehn typical circulation and the incidence for suffering a severe trauma.

METHODS: This is a retrospective, multicentre observational register study. The years from 2013 to 2016 were analyzed for the presence of foehn winds. A logistic regression analysis with the number of daily admitted trauma patients as the primary target value was performed in dependence of foehn winds. Southern Bavaria is a typical foehn wind region. Individuals were treated in 37 hospitals of Southern Bavaria which participate in the TraumaRegister DGU®, an international register that includes all severe trauma patients, mainly in Germany. We analyzed patients with an Injury Severity Score (ISS) of at least nine with admission to intensive care units or prior death in the emergency room.

RESULTS: 6215 patients were enrolled in this study. A foehn-typical circulation was present on 65 days (4.5%). 301 patients (5%) suffered a trauma with an ISS ≥ 9 on a foehn day. The mean ISS was 20.2 (9–75). On average, 4.3 patients (0–15 patients) were admitted on a daily basis due to a severe trauma. The multivariate regression analysis revealed a daily increase of 0.87 individuals (p = 0.004; 95% CI 0.23–1.47) on foehn days. During spring 1.07 patients (p = < 0.001; 95% CI 0.72–1.42), in summer 1.98 patients (p = < 0.001; 95% CI 1.63–2.32), in fall 0.63 (p = < 0.001; 95% CI 0.28–0.97) and on Saturdays, 0.59 patients (p = < 0.001; 95% CI 0.24–0.93) were additionally admitted due to severe trauma.

CONCLUSION: Foehn winds are significantly associated with severe trauma in trauma centers of the TraumaNetzwerk DGU®.

Eur J Trauma Emerg Surg. 2020 https://doi.org/10.1007/s00068-020-01515-w

Epidemiology and predictors of traumatic spine injury in severely injured patients: implications for emergency procedures.

Häske D, Lefering R, Stock JP, Kreinest M; TraumaRegister DGU.

PURPOSE: This study aimed to identify the prevalence and predictors of spinal injuries that are suitable for immobilization.

METHODS: Retrospective cohort study drawing from the multi-center database of the TraumaRegister DGU®, spinal injury patients ≥ 16 years of age who scored ≥ 3 on the Abbreviated Injury Scale (AIS) between 2009 and 2016 were enrolled.

RESULTS: The mean age of the 145,833 patients enrolled was 52.7 ± 21.1 years. The hospital mortality rate was 13.9%, and the mean injury severity score (ISS) was 21.8 ± 11.8. Seventy percent of patients had no spine injury, 25.9% scored 2–3 on the AIS, and 4.1% scored 4–6 on the AIS. Among patients with isolated traumatic brain injury (TBI), 26.8% had spinal injuries with an AIS score of 4–6. Among patients with multi-system trauma and TBI, 44.7% had spinal injuries that scored 4–6 on the AIS. Regression analysis predicted a serious spine injury (SI; AIS 3–6) with a prevalence of 10.6% and cervical spine injury (CSI; AIS 3–6) with a prevalence of 5.1%. Blunt trauma was a predictor for SI and CSI (OR 4.066 and OR 3.640, respectively; both p < 0.001) and fall > 3 m for SI (OR 2.243; p < 0.001) but not CSI (OR 0.636; p < 0.001). Pre-hospital shock was predictive for SI and CSI (OR 1.87 and OR 2.342, respectively; both p < 0.001), and diminished or absent motor response was also predictive for SI (OR 3.171) and CSI (OR 7.462; both p < 0.001). Patients over 65 years of age were more frequently affected by CSI.

CONCLUSIONS: In addition to the clinical symptoms of pain, we identify ‘4S’ [spill (fall) > 3 m, seniority (age > 65 years), seriously injured, skull/traumatic brain injury] as an indication for increased attention for CSIs or indication for spinal motion restriction.

BMC Anesthesiol. 2020; 20: 243. https://doi.org/10.1186/s12871-020-01159-8

Mortality in severely injured patients: nearly one of five non-survivors have been already discharged alive from ICU.

Hamsen U, Drotleff N, Lefering R, Gerstmeyer J, Schildhauer TA, Waydhas C; TraumaRegister DGU.

BACKGROUND: Most trauma patients admitted to the hospital alive and die later on, decease during the initial care in the emergency department or the intensive care unit (ICU). However, a number of patients pass away after having been discharged from the ICU during the initial hospital stay. On first sight these cases could be seen as “failure to rescue” of potentially salvageable patients. A low rate of such patients might be a potential indicator of quality for trauma care on ICUs and surgical wards.

METHODS: Retrospective analysis of the TraumaRegister DGU® with data from 2015 to 2017. Patients that died during the initial ICU stay were compared to those who were discharged from the initial ICU stay for at least 24 h but died later on.

RESULTS: A total of 82,313 trauma patients were included in the TraumaRegister DGU®. In total, 6576 patients (8.0%) died during their hospital stay. Out of those, 5481 were admitted to the ICU alive and 972 patients (17.7%) were discharged from ICU and died later on. Those were older (mean age: 77 vs. 68 years), less severely injured (mean ISS: 23.1 vs. 30.0 points) and had a longer mean ICU length of stay (10 vs. 6 days). A limitation of life-sustaining therapy due to a documented living will was present in 46.1% of all patients who died during their initial ICU stay and in 59.9% of patients who died after discharge from their initial ICU stay.

CONCLUSIONS: 17.7% of all non-surviving severely injured trauma patients died within the hospital after discharge from their initial ICU treatment. Their death can partially be explained by a limitation of therapy due to a living will. In conclusion, the rate of such late deaths may partially represent patients that died of potentially avoidable or treatable complications.

Eur J Trauma Emerg Surg. 2020 Jul 26. doi: 10.1007/s00068-020-01448-4. [Epub ahead of print]

The AdHOC (age, head injury, oxygenation, circulation) score: a simple assessment tool for early assessment of severely injured patients with major fractures.

Knoepfel A, Roman Pfeifer R, Lefering R, Pape HC, TraumaRegister DGU.

PURPOSE: We sought to develop a simple, effective and accurate assessment tool using well-known prognostic parameters to predict mortality and morbidity in severely injured patients with major fractures at the stage of the trauma bay.

METHODS: European Data from the TraumaRegister DGU® were queried for patients aged 16 or older and with an ISS of 9 and higher with major fractures. The development (2012-2015) and validation (2016) groups were separated. The four prognostic aspects Age, Head injury, Oxygenation and Circulation along with parameters were identified as having a relevant impact on the outcome of severely injured patients with major fractures. The performance of the score was analyzed with the area under the receiver operating characteristics curve and compared to other trauma scores.

RESULTS: An increasing AdHOC (Age, Head injury, Oxygenation, Circulation) score value in the 17,827 included patients correlated with increasing mortality (0 points = 0.3%, 1 point = 5.3%, 2 points = 15.6%, 3 points = 42.5% and 4 points = 62.6%). With an AUROC of 0.858 for the development (n = 14,047) and 0.877 for the validation (n = 3780) group dataset, the score is superior in performance compared to the Injury Severity Score (0.806/0.815).

CONCLUSION: The AdHOC score appears to be easy and accessible in every emergency room without the requirement of special diagnostic tools or knowledge of the exact injury pattern and can be useful for the planning of further surgical treatment.

Eur J Trauma Emerg Surg. 2020 doi: 10.1007/s00068-020-01544-5 [Epub ahead of print].

Traumatic brain injury with concomitant injury to the spleen: characteristics and mortality of a high-risk trauma cohort from the TraumaRegister DGU®.

Mader MM, Lefering R, Westphal M, Maegele M, Czorlich P.

PURPOSE: Based on the hypothesis that systemic inflammation contributes to secondary injury after initial traumatic brain injury (TBI), this study aims to describe the effect of splenectomy on mortality in trauma patients with TBI and splenic injury.

METHODS: A retrospective cohort analysis of patients prospectively registered into the TraumaRegister DGU® (TR-DGU) with TBI (AISHead ≥ 3) combined with injury to the spleen (AISSpleen ≥ 1) was conducted. Multivariable logistic regression modeling was performed to adjust for confounding factors and to assess the independent effect of splenectomy on in-hospital mortality.

RESULTS: The cohort consisted of 1114 patients out of which 328 (29.4%) had undergone early splenectomy. Patients with splenectomy demonstrated a higher Injury Severity Score (median: 34 vs. 44, $p < 0.001$) and lower Glasgow Coma Scale (median: 9 vs. 7, $p = 0.014$) upon admission. Splenectomized patients were more frequently hypotensive upon admission (19.8% vs. 38.0%, $p < 0.001$) and in need for blood transfusion (30.3% vs. 61.0%, $p < 0.001$). The mortality was 20.7% in the splenectomy group and 10.3% in the remaining cohort. After adjustment for confounding factors, early splenectomy was not found to exert a significant effect on in-hospital mortality (OR 1.29 (0.67-2.50), $p = 0.45$).

CONCLUSION: Trauma patients with TBI and spleen injury undergoing splenectomy demonstrate a more severe injury pattern, more compromised hemodynamic status and higher in-hospital mortality than patients without splenectomy. Adjustment for confounding factors reveals that the splenectomy procedure itself is not independently associated with survival.

Neurosurg Rev. 2020 doi: 10.1007/s10143-020-01456-3

The faster the better? Time to first CT scan after admission in moderate-to-severe traumatic brain injury and its association with mortality.

Mader MM, Rotermund R, Lefering R, Westphal M, Maegele M, Czorlich P; TraumaRegister DGU.

Fast acquisition of a first computed tomography (CT) scan after traumatic brain injury (TBI) is recommended. This study is aimed at investigating whether the length of the period preceding initial CT scan influences mortality in patients with leading TBI. A retrospective cohort analysis of patients registered in the TraumaRegister DGU® was conducted including adult patients with TBI, defined as Abbreviated Injury ScaleHead ≥ 3 and GCS ≤ 13 who had been treated in level 1 or 2 trauma centers from 2007–2016. Patients were grouped according to time intervals either from trauma or from admission to CT. A total of 6904 patients met the inclusion criteria. Mean time period from trauma to hospital admission was 68.8 min. From admission to first CT, a mean of 19.0 min elapsed. Trauma severity was higher in groups with a longer duration from trauma to CT as represented by a mean (± standard deviation) Injury Severity Score (ISS) of 19.8 ± 9.0, 20.7 ± 9.3, and 21.4 ± 7.5 and similar distribution of mortality of 24.9%, 29.9%, and 36.3% in the ≤ 60-min, 61–120-min, and ≥ 121-min groups, respectively. An adjusted multivariable logistic regression model showed a significant influence of the level of the trauma center ($p = 0.037$) but not for interval from admission to CT ($p = 0.528$). TBI patients with a longer time span from trauma to first CT were more severely injured and demonstrated a worse prognosis, but received a CT scan faster when duration from admission is observed. The duration until the CT scan was obtained showed no significant impact on the mortality.

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Training to identify red flags in the acute care of trauma: who are the patients at risk for early death despite a relatively good prognosis? An analysis from the TraumaRegister DGU®.

Nolte PC, Häske D, Lefering R, Bernhard M, Casu S, Frankenhauser S, Gather A, Grützner PA, Münzberg M, TraumaRegister DGU.

BACKGROUND: In the acute care of trauma, some patients with a low estimated risk of death die suddenly and unexpectedly. In this study, we aim to identify predictors for early death within 24 h following hospital admission in low-risk patients.

METHODS: The TraumaRegister DGU® was used to collect records of patients who were primarily treated in a participating hospital between 2004 and 2013 with a RISC II score below 10%.

RESULTS: During the study period, 64,379 patients met the inclusion criteria. The mean RISC II score was 2.0%, and the mean ISS was 16 ± 9. The overall hospital mortality rate was 2.1%, and 0.5% of patients ($n = 301$) died within the first 24 h. A SPB of ≤ 90 mmHg was associated with an increased risk of death ($p < 0.001$). An AIS abdomen score of ≥ 3 was associated with increased risk of death within the first 24 h ($p < 0.001$). A high risk of early death was also seen in patients with an AIS score (thorax) ≥ 3; 51% of those who died died within the first 24 h ($p < 0.005$). Death in patients over 60 years was more common after 24 h ($p < 0.001$). Patients with an ASA score of ≥ 3 were more likely to die after the first 24 h ($p < 0.001$).

CONCLUSIONS: Indicators predicting a high risk of early death in patients with a low RISC II score include a SPB ≤ 90 mmHg and severe chest and abdominal trauma. Emergency teams involved in the acute care of trauma patients should be aware of these “red flags” and treat their patients accordingly.

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Changes in transfusion and fluid therapy practices in severely injured children: an analysis of 5118 children from the TraumaRegister DGU®.

Piekarski F, Kaufmann J, Engelhardt T, Raimann FJ, Lustenberger T, Marzi I, Lefering R, Zacharowski K, Meybohm P, TraumaRegister DGU.

PURPOSE: Trauma is the leading cause of death in children. In adults, blood transfusion and fluid resuscitation protocols changed resulting in a decrease of morbidity and mortality over the past 2 decades. Here, transfusion and fluid resuscitation practices were analysed in severe injured children in Germany.

METHODS: Severely injured children (maximum Abbreviated Injury Scale (AIS) ≥ 3) admitted to a certified trauma-centre (TraumaZentrum DGU®) between 2002 and 2017 and registered at the TraumaRegister DGU® were included and assessed regarding blood transfusion rates and fluid therapy.

RESULTS: 5,118 children (aged 1-15 years) with a mean ISS 22 were analysed. Blood transfusion rates administered until ICU admission decreased from 18% (2002-2005) to 7% (2014-2017). Children who are transfused are increasingly seriously injured. ISS has increased for transfused children aged 1-15 years (2002-2005: mean 27.7-34.4 in 2014-2017). ISS in non-transfused children has decreased in children aged 1-15 years (2002-2005: mean 19.6 to mean 17.6 in 2014-2017). Mean prehospital fluid administration decreased from 980 to 549 ml without affecting hemodynamic instability.

CONCLUSION: Blood transfusion rates and amount of fluid resuscitation decreased in severe injured children over a 16-year period in Germany. Restrictive blood transfusion and fluid management has become common practice in severe injured children. A prehospital restrictive fluid management strategy in severely injured children is not associated with a worsened hemodynamic state, abnormal coagulation or base excess but leads to higher hemoglobin levels.

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A nationwide fluidics biobank of polytraumatized patients: implemented by the Network "Trauma Research" (NTF) as an expansion to the TraumaRegister DGU® of the German Trauma Society (DGU).

Relja B, Huber-Lang M, van Griensven M, Hildebrand F, Maegele M, Nienaber U, Brucker DP, Sturm R, Marzi I.

To decrypt the complexity of the posttraumatic immune responses and to potentially identify novel research pathways for exploration, large-scale multi-center projects including not only in vivo and in vitro modeling, but also temporal sample and material collection along with clinical data capture from multiply injured patients is of utmost importance. To meet this gap, a nationwide biobank for fluidic samples from polytraumatized patients was initiated in 2013 by the task force Network "Trauma Research" (Netzwerk Traumaforschung, NTF) of the German Trauma Society (Deutsche Gesellschaft für Unfallchirurgie e.V., DGU). The NTF-Biobank completes the clinical NTF-Biobank Database and complements the TR-DGU with temporal biological samples from multiply injured patients. The concept behind the idea of the NTF-Biobank was to create a robust interface for meaningful innovative basic, translational and clinical research. For the first time, an integrated platform to prospectively evaluate and monitor candidate biomarkers and/or potential therapeutic targets in biological specimens of quality-controlled and documented patients is introduced, allowing reduction in variability of measurements with high impact due to its large sample size. Thus, the project was introduced to systemically evaluate and monitor multiply injured patients for their (patho-)physiological sequalae together with their clinical treatment strategies applied for overall outcome improval.

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Traumatic tracheobronchial injuries: incidence and outcome of 136.389 patients derived from the DGU traumaregister.

Schibilsky D, Driessen A, White WJ, Lefering R, Paffrath T, Bouillon B, Walker T, Schlensak C, Mutschler M.

To describe the incidence, therapy and outcome of traumatic tracheobronchial injuries (TTBI) in trauma patients with multiple injuries derived from the DGU TraumaRegister. We analyzed the data on all patients listed on the TraumaRegister DGU (TR-DGU) in Germany between 2002 and 2015 aged 16 years or older and with an Injury Severity Score (ISS) of ≥ 9. We analyzed the data on 136,389 trauma patients, 561 of whom had suffered tracheobronchial injuries (0.4%). The majority were male (73.4%) and had a mean age of 43.7 years. In total, 84.0% of all TTBI injuries occurred secondary to blunt trauma, caused mainly by accidents (71.2%). TTBI was accompanied by several concomitant thoracic injuries such as pneumo- (41.2%) and hemothorax (23.2%), lacerations (7.8%) and contusions (32.3%) of the lung, as well as multiple rib fractures (29.6%). The severity of injury was classified via the abbreviated injury scale (AIS): 39.3% with AIS = 3, 51.3% with AIS = 4 and 60% with AIS = 5 patients underwent surgical interventions. The mortality of patients with tracheobronchial injuries was higher: 24.6%, versus 13.7% in all patients (control group). This high percentage reflects their generally severe injury burden through concomitant injuries. The incidence of TTBI in this large cohort of trauma patients is very low. However, its high mortality rate emphasizes its importance. Mortality was associated with higher ISS and AIS scores. Higher rates of concomitant injuries were therefore associated with a higher mortality rate. TTBI injuries revealed a higher rate of progression to surgical management, with 35% undergoing surgery within the first 24 h. This excessive mortality rate demonstrates a high overall injury burden in patients with TTBI and high mortality of associated injuries. A surgical intervention's impact on mortality cannot be assessed in this study, as it would need to be investigated in a case-matched study.

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Herausforderungen der Digitalisierung in der Traumaversorgung.

Trentzsch H, Osterhoff G, Heller R, Nienaber U, Lazarovici M; AG Digitalisierung; der Deutschen Gesell-schaft für Orthopädie und Unfallchirurgie (DGOU); Sektion Notfall-, Intensivmedizin und Schwerverletztenversorgung (NIS) der Deutschen Gesellschaft für Unfallchirurgie (DGU).

The increasing digitalization of social life opens up new possibilities for modern health care. This article describes innovative application possibilities that could help to sustainably improve the treatment of severe injuries in the future with the help of methods such as big data, artificial intelligence, intelligence augmentation, and machine learning. For the successful application of these methods, suitable data sources must be available. The TraumaRegister DGU® (TR-DGU) currently represents the largest database in Germany in the field of care for severely injured patients that could potentially be used for digital innovations. In this context, it is a good example of the problem areas such as data transfer, interoperability, standardization of data sets, parameter definitions, and ensuring data protection, which still represent major challenges for the digitization of trauma care. In addition to the further development of new analysis methods, solutions must also continue to be sought to the question of how best to intelligently link the relevant data from the various data sources.

Unfallchirurg. 2020; 123: 954-960. doi: https://doi.org/10.1007/s00113-020-00890-8

Entwicklung eines neuen Moduls für das TraumaRegister DGU®: Folgen schwerer Verletzungen während der Schwangerschaft besser erfassen.

Trentzsch H, Weißleder A, Annecke T, Beinkofer D, Beese A, Kulla M, Kraft K, Pecks U, Hoffmann F, Bieler D; Sektion Notfall-, Intensivmedizin und Schwerverletztenversorgung (NIS) der Deutschen Ge-sellschaft für Unfallchirurgie (DGU).

HINTERGRUND: Lebensbedrohliche Verletzungen während der Schwangerschaft sind ein seltenes Ereignis. Das TraumaRegister DGU® (TR-DGU) erfasst seit 2016, ob bei weiblichen Schwerverletzten eine Schwangerschaft vorlag. Diese Information reicht nicht aus, um eine differenzierte Beurteilung der Versorgungsqualität zu ermöglichen, weil z. B. Gestationsalter, Zustand der Schwangerschaft bei Entlassung oder Überleben des Kindes fehlen. Der Arbeitskreis TraumaRegister der Sektion Notfall-, Intensivmedizin und Schwerverletztenversorgung (Sektion NIS) der Deutschen Gesellschaft für Unfallchirurgie (DGU) e. V. kam daher zu der Überzeugung, dass das fetale Outcome bzw. die Intaktheit der Schwangerschaft nach Abschluss der Akutbehandlung ein wichtiges Maß für die Versorgungsqualität der schwangeren Frau ist, und beauftragte eine Task Force mit der Ausarbeitung eines geeigneten Datensatzes, um solche Fälle besser analysieren zu können. Dieser Beitrag stellt das sog. Fetus-Modul im Detail vor.

METHODEN: Der Datensatz wurde in einem interdisziplinären Prozess zusammen mit akkreditierten Fachexperten der Deutschen Gesellschaft für Gynäkologie und Geburtshilfe (DGGG) e. V., der Deutschen Gesellschaft für Perinatale Medizin (DGPM) e. V. und der Gesellschaft für Neonatologie und pädiatrische Intensivmedizin (GNPI) e. V. erarbeitet.

ERGEBNIS: Das Fetus-Modul umfasst 20 Parameter zur Beschreibung der Schwangerschaft, des Zustands von Mutter und Kind bei Aufnahme sowie bei Entlassung.

SCHLUSSFOLGERUNG: Das Fetus-Modul wird wichtige Daten liefern, um die Prozess- und Ergebnisqualität der Versorgung von schwer verletzten, schwangeren Frauen messbar zu machen, und um Prognoseinstrumenten entwickeln zu können, mit denen Vorhersagen zu Hochrisikokonstellationen für das Outcome von Mutter und Kind getroffen werden können.

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ISS alone, is not sufficient to correctly assign patients post hoc to trauma team requirement.

Waydhas C, Bieler D, Hamsen U, Baacke M, Lefering R, TraumaRegister DGU.

PURPOSE: An injury severity score (ISS) ≥ 16 alone, is commonly used post hoc to define the correct activation of a trauma team. However, abnormal vital functions and the requirement of life-saving procedures may also have a role in defining trauma team requirement post hoc. The aim of this study was to describe their prevalence and mortality in severely injured patients and to estimate their potential additional value in the definition of trauma team requirement as compared to the definition based on ISS alone.

METHODS: Retrospective analysis of a trauma registry including patients with trauma team activation from the years 2009 until 2015, who were 16 years of age or older and were brought to the trauma center directly from the scene. Patients were divided into a group with an ISS ≥ 16 vs. ISS < 16. For analysis a predefined list of abnormal vital functions and life-saving interventions was used.

RESULTS: 58,723 patients were included in the study (N = 32,653 with ISS ≥ 16; N = 26,070 with ISS < 16). From the total number of patients that required life-saving procedures or presented with abnormal vital functions 29.1% were found in the ISS < 16 group. From the ISS < 16 group, 36.7% of patients required life-saving procedures or presented with abnormal vital signs. The mortality of those was 8.1%.

CONCLUSIONS: Defining the true requirement of trauma team activation post hoc by using ISS ≥ 16 alone does miss a considerable number of subjects who require life-saving interventions or present with abnormal vital functions. Therefore, life-saving interventions and abnormal vital functions should be included in the definitions for trauma team requirement. Further studies have to evaluate, which life-saving procedures and abnormal vital functions are most relevant.

Unfallchirurg. 2020; 123: 944-953. doi: https://doi.org/10.1007/s00113-020-00915-2

Akutbehandlung schwangerer Patientinnen nach schwerem Trauma – eine retrospektive Multicenteranalyse.

Weißleder A, Kulla M, Annecke T, Beese A, Lang P, Beinkofer D, Lefering R, Trentzsch H, Jost C, Treffer D; das TraumaRegister DGU®.

HINTERGRUND: Die Versorgung schwangerer Traumapatientinnen stellt das gesamte medizinische Team vor eine besondere Herausforderung. Ziel unserer Studie war es, diese Daten zu erheben und die Unterschiede zu nichtschwangeren Traumapatientinnen zu ermitteln.

MATERIAL UND METHODEN: Wir führten eine retrospektive Datenanalyse aus dem TraumaRegister DGU® durch und verglichen 102 schwangere mit 3135 nichtschwangeren Patientinnen im gebärfähigen Alter (16–45 Jahre) aus den Jahren 2016–2018, welche in Traumazentren behandelt worden sind. Die Patientinnen sind jeweils über den Schockraum aufgenommen und auf Intensivstation behandelt worden.

ERGEBNISSE: In Deutschland, Österreich und der Schweiz waren 3,2 % der Traumapatientinnen schwanger, d. h. 102 Frauen. Frauen im durchschnittlichen Alter von 29 Jahren erlitten am häufigsten ein Trauma infolge eines Verkehrsunfalls. Ein schweres Trauma („Injury Severity Score" [ISS] ≥16 Punkte) erlitten 24,5 % der Schwangeren und 37,4 % der Nichtschwangeren. Bei schwangeren Patientinnen wurde nur in 32,7 % der Fälle eine Computertomographie (Traumaspirale) durchgeführt – bei nichtschwangeren Frauen dagegen in 79,8 %. Infolge des Traumas verstarben 2,9 % der schwangeren und 3,5 % der nichtschwangeren Patientinnen. Die standardisierte Mortalitätsrate (SMR) hatte einen Wert bei Schwangeren von 0,42 und bei Nichtschwangeren von 0,63.

DISKUSSION: Erstmalig liegen nun Daten für die Länder Deutschland, Österreich und Schweiz zu Inzidenz, Traumamechanismen, prähospitaler und innerklinischer Versorgungsphase sowie Intensivtherapiephase für schwangere Traumapatientinnen vor. Weitere Untersuchungen zu Daten bezüglich des fetalen Outcomes und traumaassoziierten Verletzungen der schwangeren Traumapatientinnen wären wünschenswert. Gynäkologen bzw. Geburtshelfer sollten hier im Bedarfsfall standardisiert in das Schockraumteam integriert werden können.

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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