TraumaRegister DGU®
DEUTSCHE GESELLSCHAFT FÜR UNFALLCHIRURGIE

German Trauma Society (DGU)

Committee on Emergency Medicine, Intensive Care and Trauma Management (Sektion NIS)

and AUC - Academy for Trauma Surgery

TraumaRegister DGU®

Annual Report 2017

with patients admitted until end of 2016

TR-DGU

TraumaRegister DGU®

All Hospitals

This report does not contain individual hospital results (where indicated as ‘Your hospital‘) but provides summary data from the whole registry, or artificial values, in order to generate an impression of how an individual hospital report looks like

Preface

Dear participant of TraumaRegister DGU®,

we are happy to present the **Annual Report 2017** of the TraumaRegister DGU® for your hospital. This report contains all trauma patients admitted until end of 2016, and documented completely until end of March 2017.

The number of documented patients has stabilized on a high level. Last year, more than 40,000 trauma patients have been documented in the registry. However, not all documented cases were severely injured. Like in the previous years, we used a **'basic patient group'** for this report. Patients with minor injuries only (e.g., a brain concussion) were excluded. Nearly all results were limited to this patient group in order to increase the comparability of the findings. This basic patient group consisted of **33 374 patients** in 2016.

Also the number of participating hospitals was rather stable (n=645), with nearly 600 trauma centers from Germany. Hospitals from eight other countries participated in the registry as well. Among them, Austria (n=23), Switzerland (n=7), and Belgium (n=6) provided the most hospitals.

What is new in this report 2017?

Early in 2016, after intensive discussions and preparations, the documentation interface has been adapted to the **updated dataset** of the TraumaRegister DGU®. Besides some thousand cases from 2015, nearly all patients from 2016 have now been documented with the new dataset. This has influence on the actual report, and in some places new results have been introduced. For example, tranexamic acid is now documented both in the pre-hospital setting and in the emergency room. There are also some items which are now obligatory in the reduced QM dataset, and thus available for all cases now, like surgical procedures and pupil reactivity.

The most obvious change, however, refers to page 4 where **quality indicators** are reported. This page has hardly been changed during the last decades and urgently needed an update. The existing quality indicators as well as a large number of new indicators (from the literature, the guideline, and other registries) were systematically reviewed and evaluated. As a result, some of the previously used indicators were discarded (like 'Time to abdominal sonography'), othe indicators were kept (like 'Time to whole-body CT'), and again others were newly introduced (like 'Capnometry in intubated patients'). The presentaion has also been updated, including a graphical comparison for each indicator. This needs, however, more space than before. The results are presented on three pages now.

On page 11 (General Results) you will find more details about the evaluation process of the quality indicators. There is also an overview about the different definitions of severely injured patients.

Kindest regards

Rolf Lefering Christian Waydhas Stefan Huber-Wagner Ulrike Nienaber

Sektion NIS of DGU – Arbeitskreis TraumaRegister and AUC - Akademie der Unfallchirurgie GmbH

Content

1. Sample and Severity

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

However, in recent years, the number of patients with only minor injuries continuously increased. On the one hand, this means a higher workload, but more important it limits also the comparability of findings both between hospitals and over time. Therefore, a '**basic patient group**' has been defined in 2015, and nearly all analyses presented in this report refer to this patient group only (and not to all documented patients).

The severity of an injury is determined by the *Abbreviated Injury Scale* (**AIS**) which assigns a severity grade from 1 (minor) to 6 (maximal) points to each injury. Using these severity grades, more sophisticated measures like the *maximum AIS* (**MAIS**), the *Injury Severity Score* (**ISS**) or the *New ISS* (**NISS**) could be derived.

The following table gives an overview about the different patient groups and severity levels in 2016.

	Your hospital 2016	primary admitted	transfer in	early transfer out	**TR-DGU 2016**
Total number of documented patients	**40 836**	35 066	3 095	2 675	40 836
MAIS 1 The most severe injury of these patients were of AIS grade 1 (MAIS = 1). Thus they were not severely injured. Furthermore, the RISC II prognostic score has not been validated for these cases. These cases were excluded from further analysis (except page 5, chapter 3)	**4 647** (11%)	4 482	32	133	4 647 (11%)
MAIS 2 The worst injury was of AIS grade 2	**9 042** (22%)	8 211	306	525	9 042 (23%)
MAIS 3+ The worst injury was of AIS grade 3 or more (MAIS 3+) which recently was defined as a „serious injury" by the EU when looking for an internationally agreed definition for road traffic research.	**27 147** (66%)	22 373	2 757	2 017	27 147 (66%)
Intensive care Patients who required intensive care due to their injuries (admission to ICU)	**31 504** (77%)	27 626	2 834	1 044	31 504 (77%)
Deceased These patients died in the acute care hospital	**3 554** (9%)	3 198	356		3 554 (9%)
Basic patient group This definition includes all MAIS 3+ patients. MAIS 2 patients were included only if they died or were treated on the intensive care unit. Patients also had to have valid age data.	**33 374** (82%)	**28 137**	**3 013**	**2 224**	**33 374** (82%)
ISS 16+ The definition ISS ≥ 16 (or > 15) is used in many scientific papers on trauma patients.	**18 479** (45%)	14 847	2 189	1 443	18 479 (45%)
Life-threatening severe injury Injury severity (ISS ≥ 16) is combined with physiological consequences as done with the new 'polytrauma' definition (see Paffrath et al. 2014).	**10 639** (26%)	8 785	1 070	784	10 639 (26%)
Polytrauma According to the new der „Berlin Definition" two body regions need to be severely affected (MAIS 3+ in each), and one or more physiological problems are present (see p. 11, and Pape et al. 2014)	**5 089** (12%)	4 379	385	325	5 089 (12%)

2. Observed Mortality and Prognosis

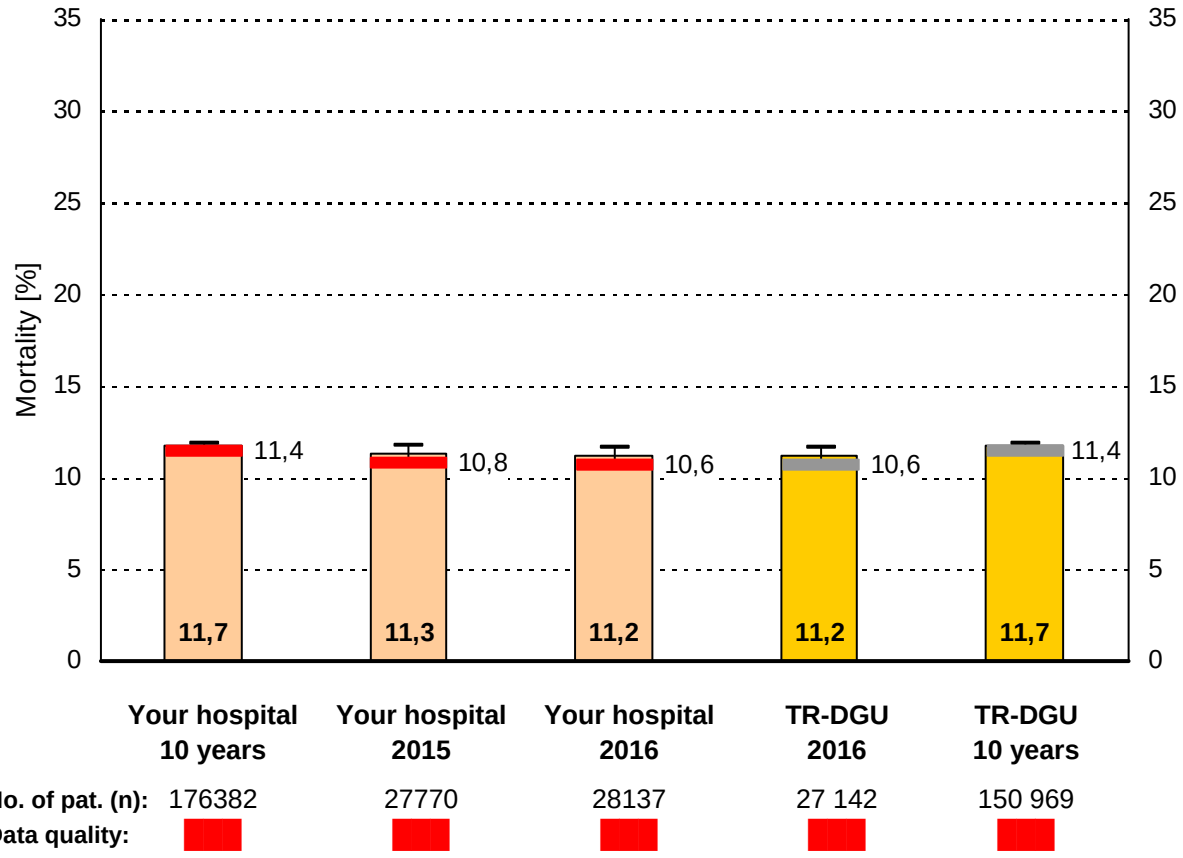
Comparing the **observed mortality** of severely injured trauma patients with their **prognosis** is a central element of quality assessment in the TraumaRegister DGU®. Here the prognosis is derived from the newly developed **RISC II** prognostic score (Revised Injury Severity Classification, see Lefering et al. 2014). This score could be calculated for all primary admitted patients. The analysis on this page is limited to the **basic patient group** as defined on page 1.

Number of patients (basic patient group) documented in the last **10 years** (2007-16): n = **210478**
- among them, documented last year (**2016**): n = **33118**
- among them, **primary admitted** cases (no transfer in; no early transfer out): n = **28137**

Comparisons of outcome and prognosis will be performed in **primary admitted patients** only. For patients **transferred in** from another hospital (n=3013 in 2016) initial status from primary admission was missing; patients **transferred out** early (within 48 hours after admission; n=2224 in 2016) have no final outcome documented.

The mean age of the 28137 patients was 51.1 years, and 70% ware males. The mean ISS was 18.2 points. Of these patients 3152 died in hospital, which was **11.2%** (95% confidence interval: 10.8 - 11.6). The risk of death prognosis based on RISC II **10.6%**. You find these values in the figure below, where also your hospital results from previous years are presented together with the overall result in the registry.

Details and definition of **data quality** are given on the following page 2.2 (see also page 8).



Legend to the figure:

The bars represent the observed mortality rate; percentages are given at the bottom of each bar. The predicted mortality rate based on RISC II is given as a **grey** vertical bar. This bar turns to **green** or **red** in case that the observed mortality is significantly lower (= better) or higher (= worse) than expected, respectively.

The interpretation of the results has to consider that these findings depend on statistical uncertainty. Therefore, the 95% confidence interval for the observed mortality rate is given as well (***vertical line***). The confidence interval describes a range of values which cover the true value with a high probability (95%). The more patients a value is based on, the narrower is the confidence interval. In case that the expected prognosis lies outside the confidence interval, it could be interpreted as a significant deviation ($p<0.05$).

If the observed mortality rate is based on ***less than 5 cases***, the large confidence interval will not be presented.

Data Quality of Prognosis

The validity of a prognosis depends on the quality and the completeness of variables required for its calculation. The **RISC II** score requires 13 different pieces of information; these data are wighted and combined into a final prognosis. The only compulsory components were age and injury severity, however, every additional information about the patient makes the outcome prediction more precise.

Therefore, we added supplementary information about the data quality of the prognosis. If all data required for calculating the RISC II score were available, 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. We defined three colour-coded categories:

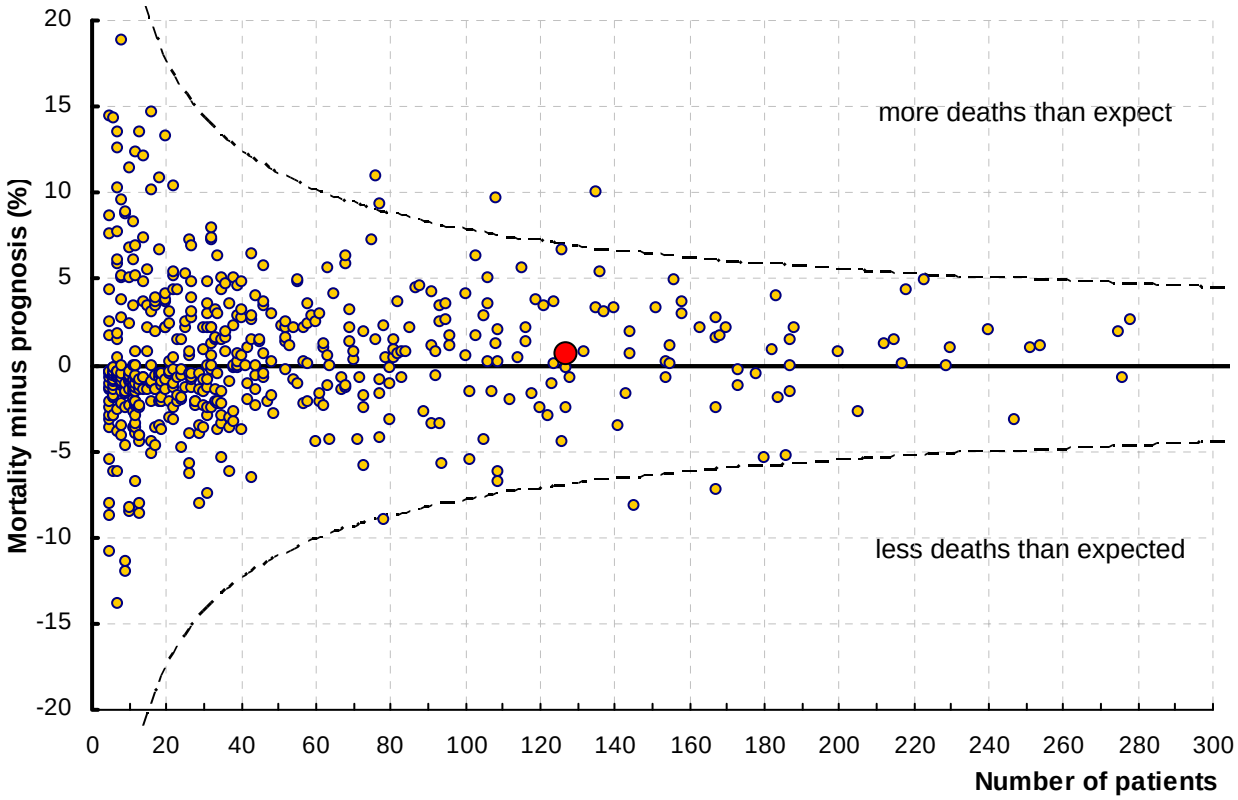
means: **95-100%** of cases were well documented,
means: **80-94%** of cases were well documented,
means: **less than 80%** of cases were well documented.

	Your hospital 10 years	Your hospital 2015	Your hospital 2016	TR-DGU 2016	TR-DGU 10 years
Primary cases, basic group (n)	176382	27770	28137	27 142	150 969
'well documented' cases (n)	125880	19963	21922	21 287	109 726
(%)	71.4	71.9	77.9	78.4	72.7
Data quality. colour code					
Average number of missing values per patient	1.2	1.1	0.9	0.9	1.1

Mortality *versus* prognosis

Your hospital 2016: Patients in the basic group: **28 137** primary admitted cases
Deviation from prognosis: **+0.6%** (TR-DGU: +0.6%)

The following figure compares each hospital's **observed mortality rate** with the respective **RISC II prognosis in 2016,** like on page 2.1. The deviation of the observed mortality rate from the expected prognosis is plotted against the number of patients on the horizontal axis. Negative values correspond to lower than expected mortality rates. The dotted lines represent the 95% confidence interval. Hospitals with **less than 5 patients** were **not included** in this figure, due to the large statistical uncertainty.



3. Basic data from the last 3 years

The results in this table refer to the **basic patient group** only excluding patients with minor injuries (see page 1).
Attention: Results have to be interpreted with caution when the number of patients is low!

		Your hospital				TraumaRegister DGU®	
		10 years	2014	2015	**2016**	2016	10 years
Total no. of patients	[n]	210478	31708	33118	**33374**	33 374	210 478
Primary adm. & treated	[n]	176382	26741	27770	**28137**	28 137	176 382
Early transferred out	[n]	13109	2084	2263	**2224**	2 224	13 109
All primary admissions	[n]	189491	28825	30033	**30361**	30 361	189 491
From other hospital	[n]	20987	2883	3085	**3013**	3 013	20 987
Patients							
Mean age	[years]	49.7	50.9	51.4	**51.4**	51.4	49.7
70 years or older	[%]	24%	26%	26%	**26%**	26%	24%
Male patients	[%]	71%	70%	69%	**70%**	70%	71%
Trauma							
Blunt trauma	[%]	96%	96%	96%	**96%**	96%	96%
Mean ISS	[points]	19.4	18.3	18.4	**18.6**	18.6	19.4
ISS ≥ 16	[%]	58%	54%	54%	**55%**	55%	58%
Head injury (AIS head ≥ 3)	[%]	39%	37%	37%	**38%**	38%	39%
Pre-hospital Care (only primary admissions)							
Intubation	[%]	27%	23%	22%	**22%**	22%	27%
Unconscious (GCS ≤ 8)	[%]	19%	17%	17%	**17%**	17%	19%
Shock (BP ≤ 90 mmHg)	[%]	11%	9%	9%	**9%**	9%	11%
Avg. amount of volume	[ml]	753	658	655	**653**	653	753
Shock Room / ER (only primary admissions)							
Whole body CT	[%]	75%	76%	77%	**79%**	79%	75%
X-ray of thorax	[%]	41%	38%	36%	**33%**	33%	41%
Blood transfusion	[%]	10%	8%	8%	**7%**	7%	10%
Treatment in the Hospital							
Operated patients [1]	[%]	68%	68%	67%	**58%**	58%	68%
No. of op. if operated [1) 4)]	[n]	3.5	3.4	3.3	**3.3**	3.3	3.5
Treatment on ICU	[%]	88%	87%	88%	**88%**	88%	88%
LOS on ICU [2]	[days]	7.2	6.6	6.4	**6.5**	6.5	7.2
Intubated/ventilated [2]	[%]	46%	40%	39%	**39%**	39%	46%
Days intubated [2]	[days]	3.5	3.0	2.9	**2.9**	2.9	3.5
Outcome							
LOS in hospital [3]	[days]	17.8	16.8	15.9	**16.2**	16.2	17.8
Hospital mortality [3]	[%]	11.0%	10.1%	10.5%	**10.5%**	10.5%	11.0%
Multiple organ failure [1)3)]	[%]	22%	20%	20%	**20%**	20%	22%
Discharge to other hosp.	[%]	17%	17%	18%	**18%**	18%	17%

[1] not available in the reduced QM dataset [2] only ICU patients [3] without patients transferred out early [4] years with incomplete documentation excluded

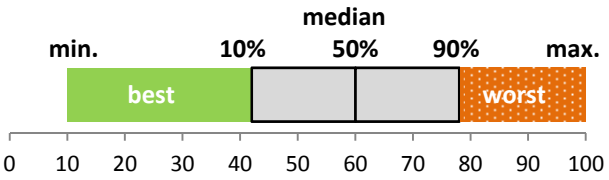
4. Indicators of Process Quality

Quality indicators are measurements which are presumed to be associated with the quality of care and outcome. The quality indicators previously used in the TraumaRegister DGU® were now critically reviewed by experts. As a result, some of the previously used indicators were skipped, while new ones were accepted. Also the style and the structure of reporting have changed. The results are now grouped according to

- 4.1 Pre-hospital indicators (which only marginally could be influenced by a hospital),
- 4.2 Times in the emergency room (ER), and
- 4.3 Diagnostics and interventions performed in the ER.

All results presented here are based on primary admitted cases only from the **basic patient group** (Your hospital: n=30361) with valid data, or respective subgroups thereof. This includes early transfer out cases.

For each indicator you find a graphical presentation of the distribution of **all hospital values**, like in the example on the right side. The grey box covers 80% of all hospital values, with the median value in the middle. The range of values for the 10% best and worst hospitals is given in green and red colour, respectively. **Your hospital value** (blue number in the table) is not marked in the graph, but you could imagine how many hospitals had better or worse values than you.

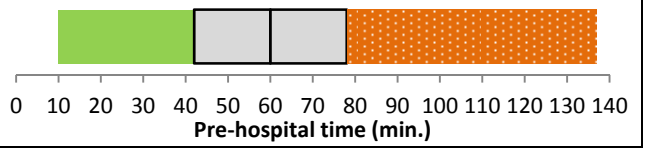


4.1 Pre-hospital Indicators

Pre-1 Pre-hospital time

The faste a patient reaches a trauma center, the earlier life-saving interventions could be performed. Only patients with ISS ≥ 16 were included here. The time from accident until hospital admission in minutes is presented as an avewrage value. Time values <5 minutes and >4 hours were excluded.

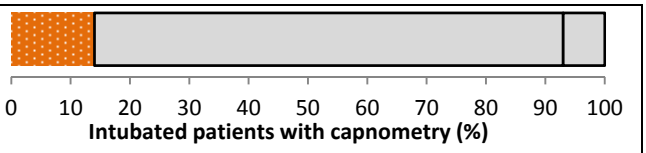
	patients	average time	min-max
Your hospital:	12 240	**66 min.**	5-240
TR-DGU:	12 240	66 min.	5-240



Pre-2 Capnometry in intubated patients

A Capnometry in intubated patients allows to detect a malpositioning of the tubus. Only patients with a pre-hospital endotracheal intubation with valid data for capnometry were considered here (available since 2016).

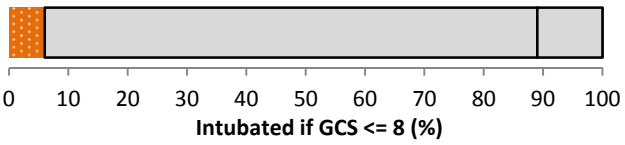
	capnometry in intubated			%	no data
Your hospital:	4 185	of	5 059	**83%**	(n=2999)
TR-DGU:	4 185	of	5 059	83%	(n=2 999)



Pre-3 Intubation of unconscious patients

The pre-hospital intubation of unconscious patients should grant the oxygen supply until the hospital is reached. Only patients with a (pre-hospital) GCS ≤ 8 were considered here, independent from the injury severity. A missing information about intubation was considered as 'no intubation', but an alternative airway counts as 'yes'.

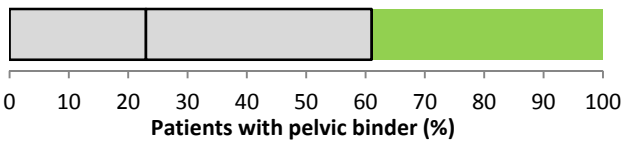
	intubated		unconscious	%I
Your hospital:	4 139	of	4 874	**85%**
TR-DGU:	4 139	of	4 874	86%



Pre-4 Pelvic binder in pelvic fractur

The early stabilization of an instable pelvic fracture, for example with a pelvic binder, could help to improve the hemo-dynamic situation of the patient. Only cases with a pelvic fractue (AIS severity 3 to 5) were considered here. The pelvic binder is documented in the standard form only (not part of the reduced QM dataset).

	pelv. binder		pelv. fracture	%
Your hospital:	360	of	1 238	**29%**
TR-DGU:	360	of	1 238	29%

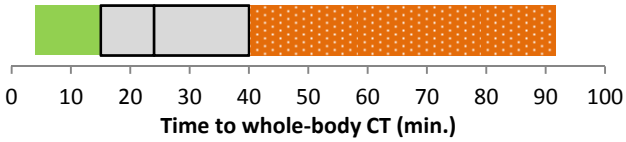


4.2 Times in the Emergency Room

ER-1 Time to whole-body CT

when a whole-body CT was indicated, it should be performed without delay, in order to initiate subsequent interventions without loss of time. All patientes who received a whole-body CT were considered here. Times > 2 hours were excluded.

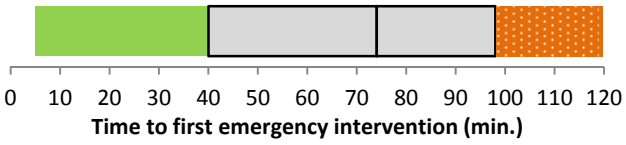
	patients	mean time	min-max
Your hospital:	23 130	**22 min.**	1-120
TR-DGU:	23 130	22 min.	1-120



ER-2 Time to first emergency surgery

Eight different emergency interventions were documented in TR-DGU (surgical liquor drain or brain decompression, laminectomy, thoracotomy, laparotomy, revascularisation, embolisation, and stabilisation of pelvis or extremities). All patients with at least one of these interventions were considered here. Times > 2 hours were excluded.

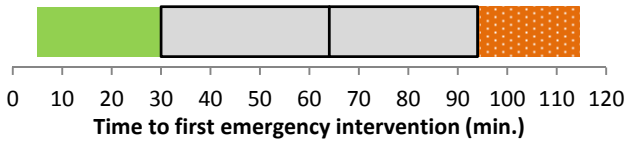
	patients	mean time	min-max
Your hospital:	4 823	**74 min.**	1-120
TR-DGU:	4 823	74 min.	1-120



ER-3 Time to surgery in penetrating trauma

Time to first surgical intervention (list of procedures, see ER-2 above) in patients with penetrating injuries (stabbing, gunshot, etc.). Times > 2 hours were excluded.

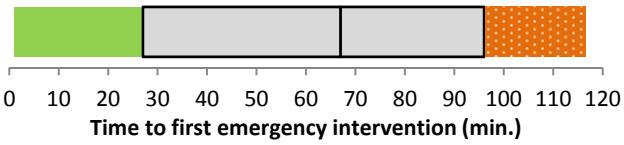
	penetrating	with surgery	mean time
Your hospital:	1 183	446	**64 min.**
TR-DGU:	1 183	446	64 min.



ER-4 Time to surgery in patients with shock

Time to first surgical intervention (list of procedures, see ER-2 above) in patients with shock, defined as systolic blod pressure ≤ 90 mmHg on admission. Times > 2 hours were excluded.

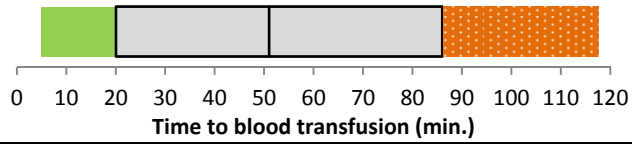
	shock	with surgery	mean time
Your hospital:	2 275	701	**67 min.**
TR-DGU:	2 275	701	67 min.



ER-5 Time to start of blood transfusion

If blood substitution is necessary this should be done as early as possible. All patiwents who received at least one unit of pRBC will be included here, if the time of first transfusion was documented. Times > 2 hours were excluded.

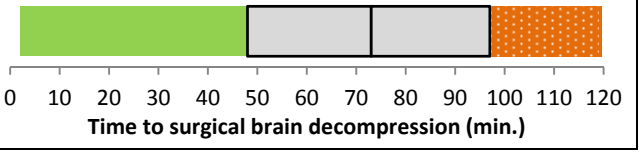
	transfused	with time	mean time
Your hospital:	2 241	1456	**51 min.**
TR-DGU:	2 241	1 456	67 min.



ER-6 Time to surgical brain decompression

In patients with intracranial bleeding after severe traumatic brain injury (TBI, AIS severity = 5) a surgical brain decompression is indicated. Only operated cases with a valid time to surgery (max. 2 hours) were considered here.

	severe TBI	time available	mean time
Your hospital:	3 676	768	**71 min.**
TR-DGU:	3 676	768	71 min.

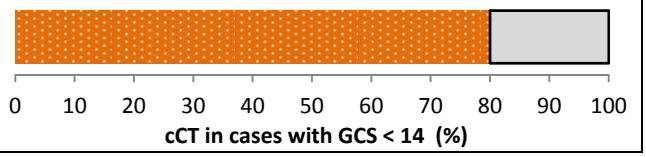


4.3 Diagnostics and Interventions in the ER

ER-7 CCT in patients with GCS < 14

A reduced consciousness could be indicative for a TBI and should be investigated with a cranial CT (cCT). All patients with a GCS < 14 will be included, either pre-hospital or on admission (if not intubated). Patients who died within the first 30 minutes were excluded. A missing value regarding the cCT was considered as ‚not performed'.

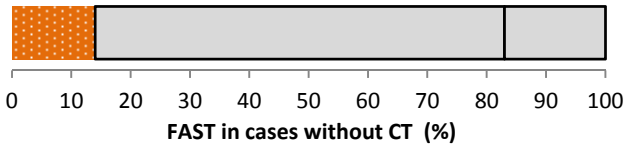
	GCS < 14	with cCT	%
Your hospital:	9 734	9333	**96%**
TR-DGU:	9 734	9 333	96%



ER-8 Sonography, if no CT

If no CT has been performed, abdominal sonography (FAST = Focused Assessment with Sonography for Trauma) should be part of the diagnostic work-up. All patients without a CT were included. Again, a missing value regarding the FAST was considered as ‚not performed'.

	no CT	FAST	%
Your hospital:	2 832	1986	**70%**
TR-DGU:	2 832	1 986	70%



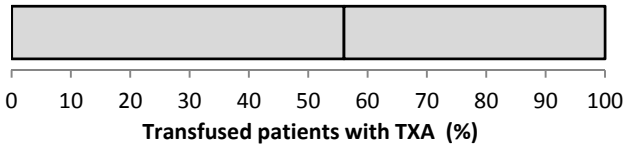
ER-9 Tranexamic acid in patients with blood transfusion

Based on a randomized trial, tranexamic acid (TXA) is assumed to reduce or even avoid the amount of blood transfusion. Therefore, patients who required a blood transfusion in the initial phase should have been given TXA in the ER.

Actually, tranexamic acid in the ER is recorded only in the standard dataset (not in the reduced QM dataset)

All patients who received at least one unit of packed red blood cells (pRBC) until ICU admission were included here. A missing value regarding TXA administration was considered as ‚no TXA given'.

	transfusion	TXA given	%
Your hospital:	1 555	929	**60%**
TR-DGU:	1 555	929	60%



4.4 Data Quality

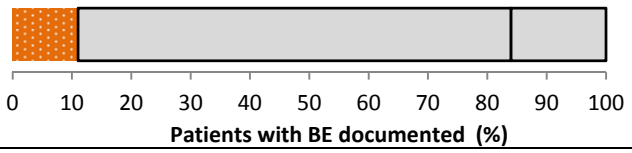
ER-10 Blood gas analysis performed / BE documented

A blood gas analysis provides important and timely information about the condition of a trauma patient. But often these measurements were not documented in the patient files. Specifically the base excess (BE, or base deficit) is an important outcome predictor. It is also used in the RISC II prognostic score.

Detailed results regarding the completeness of data are presented on page 9.1/9.2 in this report. As an example, the completeness of BE data is presented here in the same way as the process indicators above.

Among all primary admitted patients, the percentage of cases with a valid BE is calculated and presented.

	patients	with BE	%
Your hospital:	28 137	22 236	**79%**
TR-DGU:	28 137	22 236	79%



5. Individual Cases

5.1 Non-survivor with a low risk of death (< 15% acc. to RISC II)

Patients from the **basic patient subgroup** who died in hospital although their initial prognosis (based on the RISC II score) seemed to be rather low are listed here. In total, 617 such cases were observed in the whole registry in 2016.

A low risk of death does not mean that none of these patients would die; however, this does not happen very often. Therefore, a detailed analysis of such cases may lead to **relevant problems** during the acute care of these patients. But this could only be judged in a more detailed individual analysis of these cases.

Your hospital: Among the 28137 primary admitted cases, **23478 patients** had a risk of death < 15%. From these cases **617 patients died.** They are listed in the following table (LOS = length of stay).

ID in the registry*	RISC II	ISS	Age	Sex	Date of admission	LOS
D-XXXXX-A@2016-00001.n	10.2	14	73	M	02-MAY-2016	23

5.2 Survivor with a high risk of death (> 70% acc. to RISC II)

Patients who survived although their risk of death was rather high (>70%) could be indicative for a very well functioning **interdisciplinary approach** in acute care. Overall, 217 such cases were observed in the registry last year. Again, details could only be found after individual analysis of each case. Patients transferred into another hospital within the first two days were disregarded here, of course. Nevertheless, patients could have been transferred later and survival might not have been secured.

Your hospital: Among the 28137 primary admitted cases, **1573 patients** had a risk of death > 70%. The survivors among these patients (**n = 217**) are listed below.

ID in the registry*	RISC II	ISS	Age	Sex	Date of admission	LOS

5.3 Non-survivor with minor injuries

The RISC II score is calculated for patients with ISS ≥ 4 points only. However, in 2015 there were 4647 cases with an ISS less than 4, i.e. the most severe injury had an AIS severity grade of one (max. AIS = 1). These patients were excluded from the **basic patient subgroup**. Although such patients usually survive, we observed 41 deaths is this subgroup (0.9%). These cases should be subject of a detailed internal revision, including the correctness and completeness of injury coding.

Your hospital: **4647 patients** had a max. AIS = 1; **41 of them died**:

ID in the registry*	ISS	Age	Sex	Date of admission	LOS

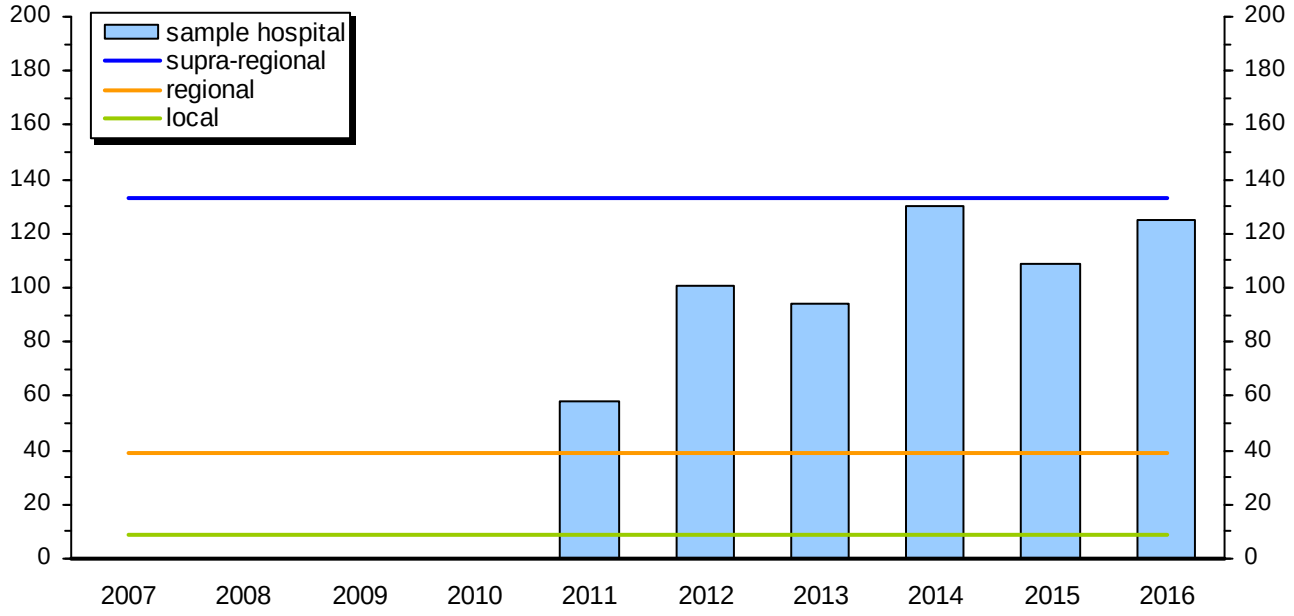
* The ID in the registry is composed of the hospital code, the year of trauma, and an individual patient code

6. Graphical Comparisons

6.1 Documented patients in the last 10 years

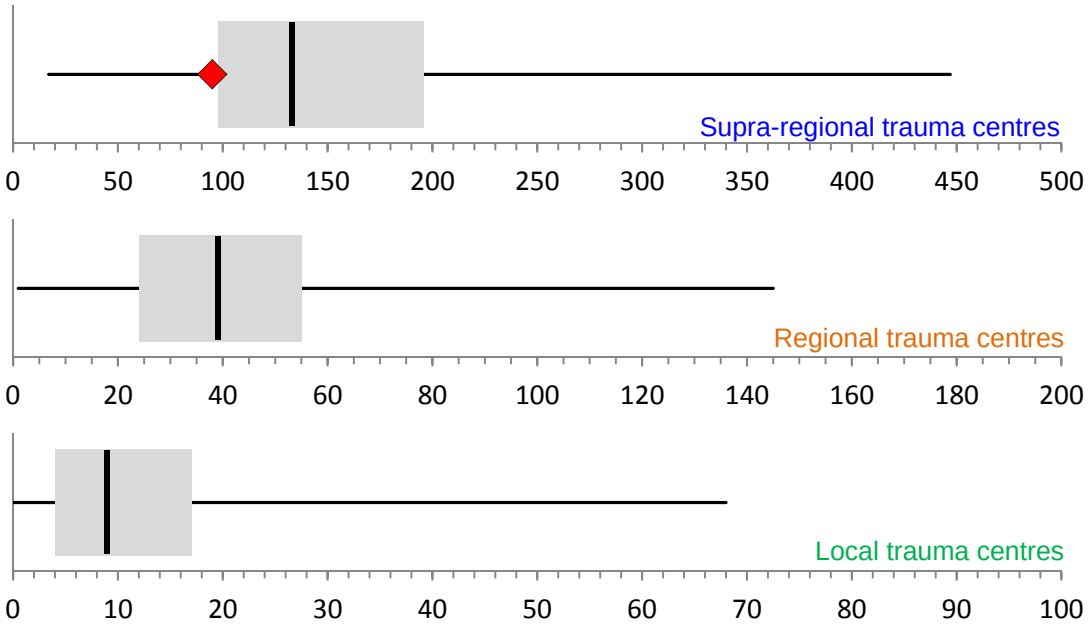
The following figure presents the number of documented trauma patients in the last ten years. Only cases from the **basic patient group** were considered here (see page 1 for definition). From your hospital **210478 patients** were documented in the last 10 years, among them **33374 patients from 2016**.

In order to better interpret your annual sample size the **median number of cases** per year and hospital is also given in the figure, for three levels of care: blue line for supra-regional trauma centers (n=133), and orange and green lines for regional (n=39) and local (n=9) trauma centers. Your hospital has been classified as a **supra-regional trauma center**. Hospitals without a certified level of care were classified at the best knowledge. Regard that about 70 certified local trauma centers without documented patients in 2016 were not included here.



6.2 Level of care and sample size

In 2016, your hospital documented **33374 patients** in the basic patient group. This value is marked with a **red diamond** (♦) below. The values in the graph represent the median (vertikal line), the inter-quartile range (grey box) and minimum / maximum of all hospitals in 2016.

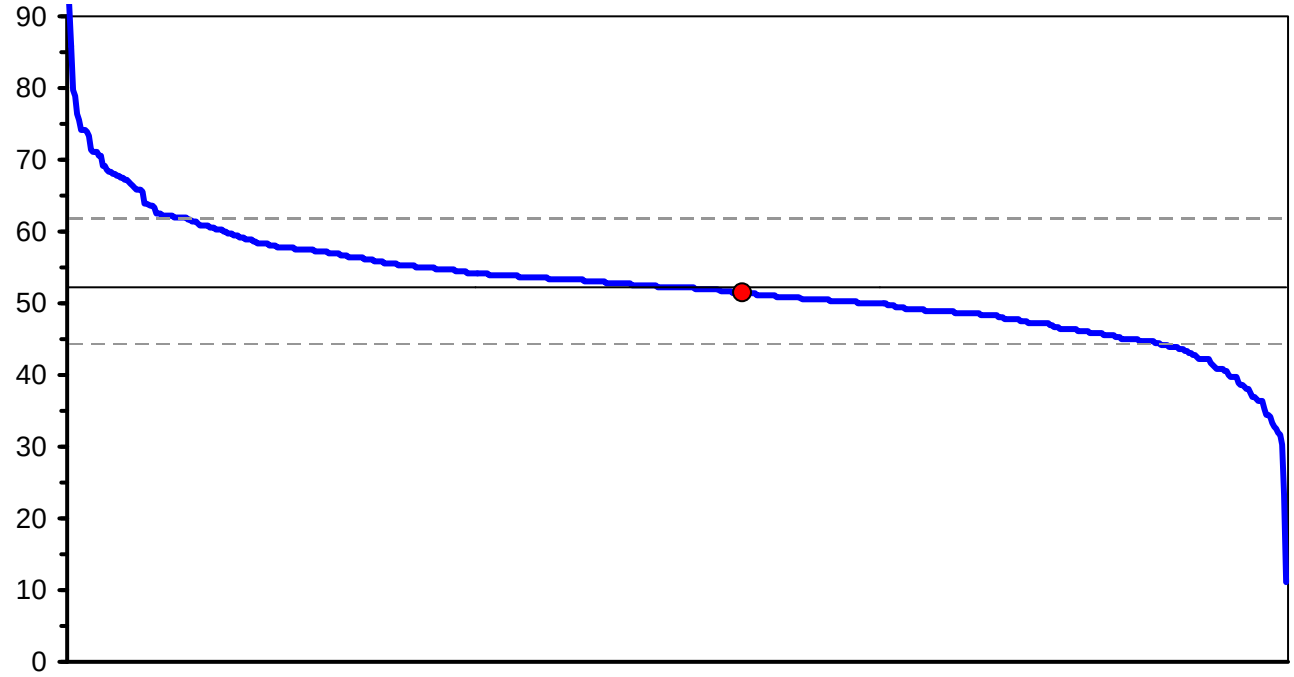


6.3 Graphical Comparisons with other Hospitals 2016

The following figures compare data of your hospital (from **2016**) with respective data from all other hospitals in the TraumaRegister DGU®. Only cases from the **basic patient subgroup** will be considered (see page 1). Your hospital's value is indicated as a **red dot** (●) if data from **at least 3 patients** were available. The horizontal line is the median value of all hospitals, and the broken lines are the 10% and 90% percentiles.

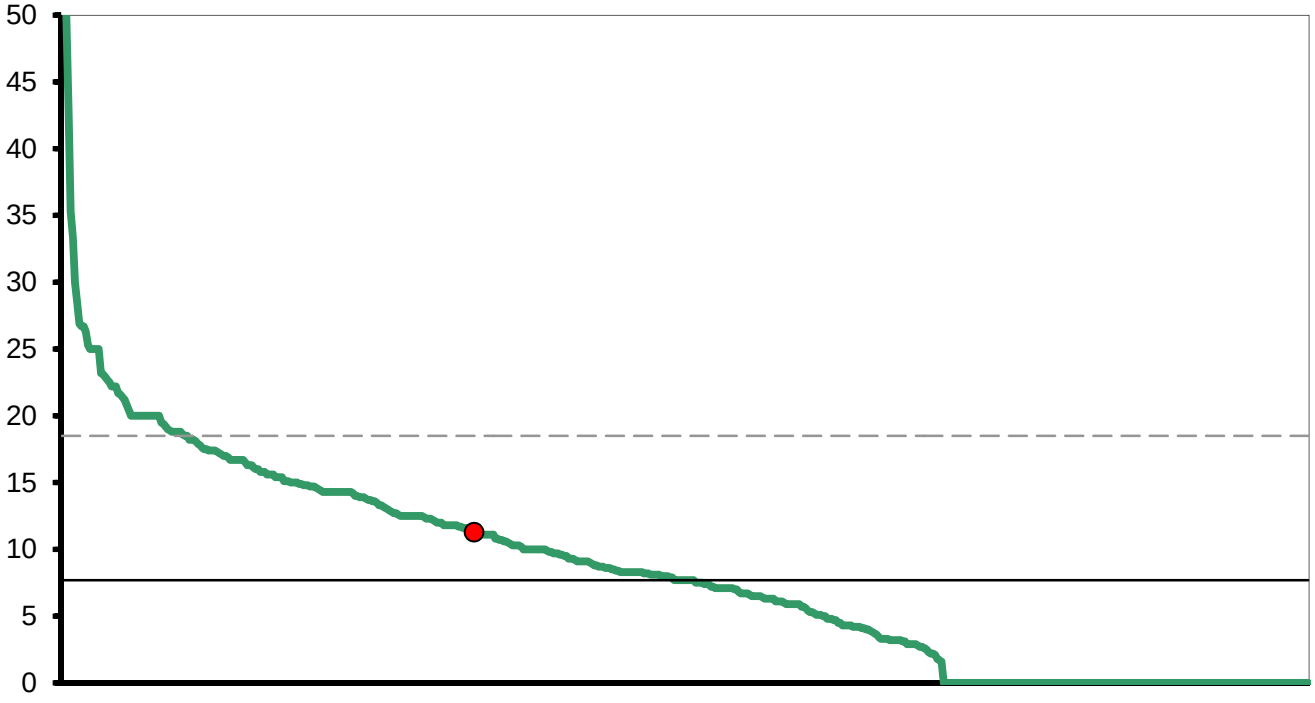
Mean Age (years) Your hospital: **51.4 years** (33 374 patients)

The median value of all 601 hospitals in 2016 (with at least 3 cases) was 52.2 years.



Hospital Mortality (%) Your hospital: **11.3%** (3 507 of 31 150 patients)

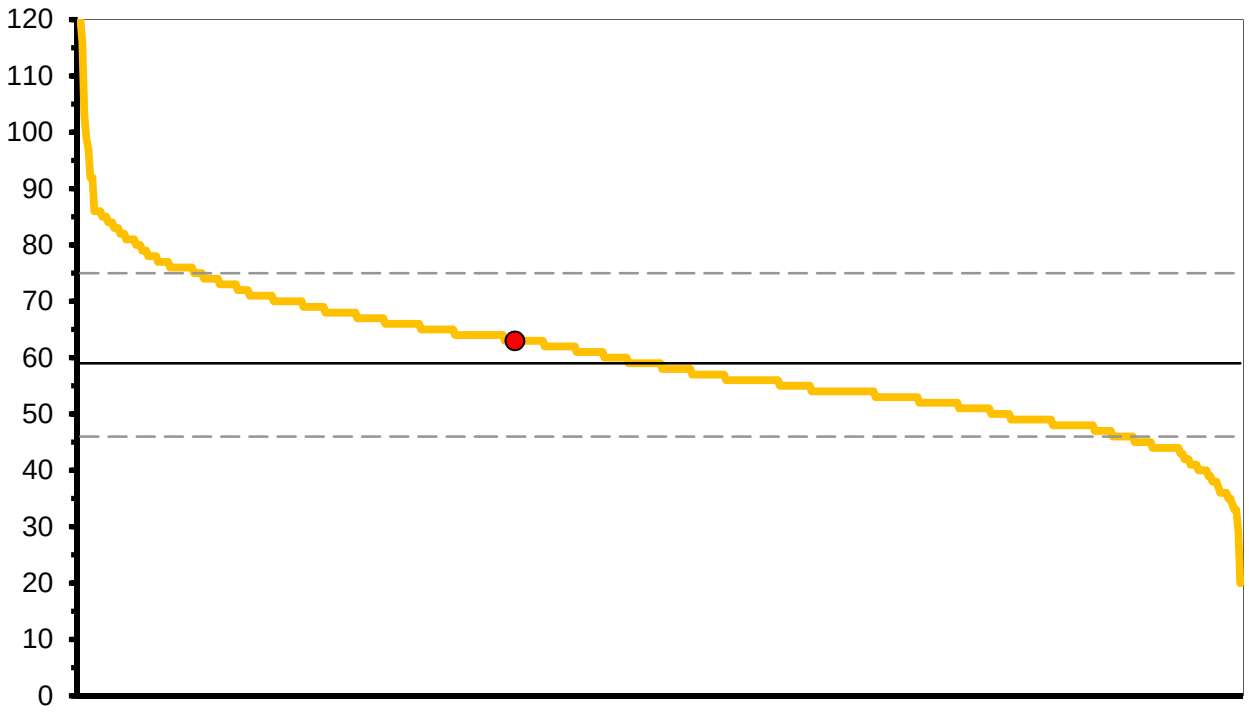
Only primary admitted patients and those transferred in were considered here. Early transfers out (within 48 h) were excluded. The median mortality rate of all 579 hospitals in 2016 (with at least 3 cases) was 7.7%.



Prehospital Time (mean time in min.)

Your hospital: **63 Min.** (23 135 patients)

Your hospital value is based on 23 135 of 30 361 **primary admitted patients** from the basic group with valid time points for both accident and hospital admission. Times below 5 minutes or above 4 hours were disregarded. The median value of all 583 hospitals (with 3 or more valid cases) in 2016 was 59 minutes. If there were less than 3 cases with valid data your hospital was not included in this figure.



5.4 Length of Stay and Injury Severity

This figure describes the association between length of stay (LOS) in hospital and injury severity (ISS). The mean value was calculated for survivors from the basic patient group. Patients transferred to another hospital (n=5 367) were excluded here.

Hospitals with **less than three valid cases** were **not** included in this figure.

■ Your hospital 2016:

Your hospital value is based on **24 500 patients.**

LOS: **17.4 days**

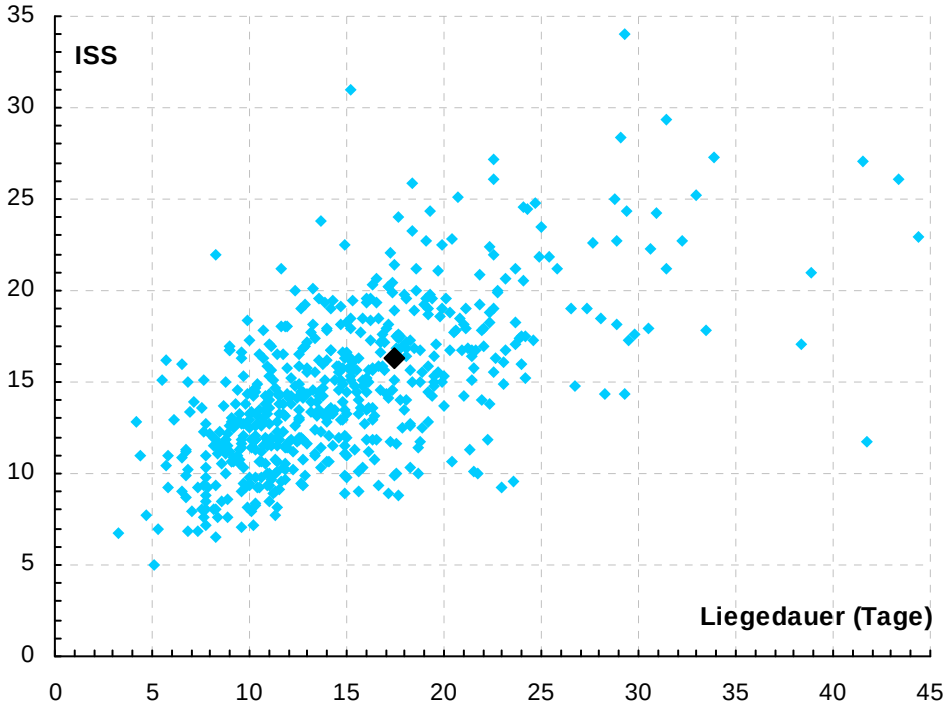
ISS: **16.3 points**

◆ TR-DGU 2016:

Patients: 24 500

LOS: 17.4 days

ISS: 16.3 points



7. Basic Data

The following three pages present basic data from five different areas: Demographics / Accident (S); Pre-hospital Phase (A); Emergency Room (B); Intensive Care (C), and Final Assessment / Discharge (D). Your hospital data refer to patients from the **basic patient group** (see page 1) documented in 2016. Comparative registry data are provided from the same year (**TR-DGU 2016**) and from the last 10 years 2007-2016 (**TR-DGU 10 years**).

	Your hospital 2016		TR-DGU 2016		TR-DGU 10 years	
Total no. of patients (basic patient group)	**33 374**		**33 374**		**210 478**	

(S) Demographics / Accident

Primary Admissions / Transfers	%	n	%	n	%	n
primary admitted	**91.0**	30 361	**91.0**	30 361	**90.0**	189 491
among these transferred out within 48h	***6.7***	*2 224*	***6.7***	*2 224*	***6.2***	*13 109*
transferred in within 24h after trauma	**8.2**	2 734	**8.2**	2 734	**8.9**	18 760
transferred in later	**0.8**	279	**0.8**	279	**1.1**	2 227
Patient Characteristics						
Age in years (M ± SD, n)	**51** ± 23	33 374	**51** ± 23	33 374	**49** ± 22	210 478
Children / adolescents (<16y.) (%, n)	**3.9**	1 312	**3.9**	1 312	**4.0**	8 500
Elderly patients (age 70+) (%, n)	**26.0**	8 690	**26.0**	8 690	**23.7**	49 819
Males (%, n)	**70.3**	23 462	**69.3**	23 462	**70.3**	147 910
ASA 3-4 prior to trauma (since 2009) (%, n)	**17.6**	5 402	**17.6**	5 402	**15.9**	27 009
Mechanism of Injury	%	n	%	n	%	n
blunt	**96.1**	30 616	**96.1**	30 616	**95.8**	191 499
penetrating	**3.9**	1 250	**3.9**	1 250	**4.2**	8 424
Type and Cause of Accident	%	n	%	n	%	n
Traffic – car	**20.9**	6 907	**20.9**	6 907	**21.9**	44 919
Traffic – motor bike	**12.0**	3 981	**12.0**	3 981	**12.6**	25 763
Traffic – bicycle	**9.3**	3 074	**9.3**	3 074	**8.8**	18 019
Traffic – pedestrian	**6.0**	1 991	**6.0**	1 991	**6.7**	13 654
High fall (>3m)	**15.2**	5 028	**15.2**	5 028	**16.1**	32 945
Low fall (<3m)	**26.0**	8 583	**26.0**	8 583	**22.5**	46 210
Suicide (suspected)	**4.4**	1 449	**4.4**	1.449	**4.6**	9 331
Assault (suspected)	**2.6**	848	**2.6**	848	**2.4**	4 938

(A) Pre-hospital Phase

Results only for **primary admitted** cases	30 361		30 361		189 491	
Vital Signs	**M** ± SD	n	**M** ± SD	n	**M** ± SD	n
Systolic Blood Pressure sBP [mm Hg]	**134** ± 33	26 394	**134** ± 33	26 394	**130** ± 34	165 502
Respiratory Rate RR [/min]	**16** ± 6	19 128	**16** ± 6	19 128	**16** ± 6	114 612
Glasgow Coma Scale (GCS)	**12.5** ± 4.0	28 149	**12.5** ± 4.0	28 149	**12.3** ± 4.1	176 228
Findings	%	n	%	n	%	n
Shock (sBP ≤ 90 mmHg)	**8.5**	2 253	**8.5**	2.253	**11.0**	18 162
Unconsciousness (GCS ≤ 8)	**17.3**	4 874	**17.3**	4 874	**19.1**	33 619
Therapy	%	n	%	n	%	n
Cardio-pulmonary Resuscitation (CPR)	**2.9**	862	**2.9**	862	**3.0**	5 517
Endotracheal Intubation	**21.9**	6 408	**21.9**	6 408	**26.9**	49 716
Alternative Airway * *NEW*	**2.1**	306	**2.1**	306	**1.2**	408
Analgo-sedation *	**60.1**	8 856	**60.1**	8 856	**64.2**	63 144
Chest Drain *	**3.3**	483	**3.3**	483	**3.3**	3 272
Catecholamines *	**8.2**	1 207	**8.2**	1 207	**7.9**	7 808
Pelvic Binder * *NEW*	**7.0**	1 020	**7.0**	1 020	**6.2**	1 152
Tranexamic Acid * *NEW*	**6.6**	965	**6.6**	965	**5.8**	1 089
Volume Administration		n		n		n
Patienten without volume (%)	**17%**	4 914	**17%**	4 914	**15%**	26 807
with volume (%)	**83%**	23 294	**83%**	23.294	**83%**	150 316
with colloids (%)	**4%**	1 090	**4%**	1 090	**13%**	23 467
Average amount of volume M ± SD	**653** ± 551	28 208	**653** ± 551	28 208	**753** ± 642	177 123
in all patients (ml) median	**500**		**500**		**500**	

* not available in the reduced QM dataset

	Your hospital 2016	TR-DGU 2016	TR-DGU 10 years
No. of patients	**33 374**	33 374	210 478

(B) Emergency Room

Results for **primary admitted** cases only		**n = 30 361**		**n = 30 361**		**n = 189 491**	
Transportation to hospital		**%**	n	**%**	n	**%**	n
with helicopter		**19.1%**	5 785	**19.1%**	5 785	**21.1%**	39 974
Glasgow Coma Scale (GCS)		**M** ± SD	n	**M** ± SD	n	**M** ± SD	n
if intubated on admission		**3.2** ± 1.4	3 786	**3.2** ± 1.4	3 786	**3.2** ± 1.3	29 751
if not intubated		**13.7** ± 2.6	10 280	**13.7** ± 2.6	10 280	**13.7** ± 2.5	61 585
Initial diagnostics		**%**	n	**%**	n	**%**	n
sonography (FAST)		**82.2%**	24 959	**82.2%**	24 959	**80.0%**	151 622
X-ray of the thorax		**33.2%**	10 070	**33.2%**	10 070	**40.8%**	77 271
cranial CT (isolated or whole-body CT)		**90.7%**	27 529	**90.7%**	27 529	**88.5%**	167 765
whole-body CT		**78.0%**	23 677	**78.0%**	23 677	**73.7%**	139 736
Time in the ER		**M** ± SD	n	**M** ± SD	n	**M** ± SD	n
sent to the opration room *NEW*	%	**24%**	6 921	**24%**	6 921	**25%**	8 785
time in the ER	[min]	**74** ± 59	6 065	**74** ± 59	6 065	**74** ± 59	7 567
transferred to the ICU *NEW*	%	**64%**	18 217	**64%**	18 217	**64%**	22 700
time in the ER	[min]	**82** ± 72	15 003	**82** ± 72	15 003	**82** ± 72	18 222
Bleeding and Transfusion		**%**	n	**%**	n	**%**	n
pre-existing coagulopathy *NEW*		**18%**	4 217	**18%**	4 217	**18%**	5 284
systolic blood pressure ≤ 90 mmHg		**8%**	2 275	**8%**	2 275	**9%**	15 553
hemostasis therapy *		**20%**	2 793	**20%**	2 793	**15%**	12 002
administration of tranexamic acid * *NEW*		**15%**	2 128	**15%**	2 128	**15%**	2 551
ROTEM / thrombelastography * *NEW*		**9%**	1 067	**9%**	1 067	**11%**	6 335
patients with blood transfusion		**7%**	2 242	**7%**	2 242	**10%**	18 648
pRBC, if transfused (mean units)		**5.1**		**5.1**		**6.0**	
FFP, if transfused (mean units)		**3.2**		**3.2**		**2.0**	
Treatment in the ER		**%**	n	**%**	n	**%**	n
cardio-pulmonary resuscitation (CPR) *		**2%**	363	**2%**	363	**3%**	2 903
chest drain *		**10%**	1 574	**10%**	1 574	**12%**	11 732
endotracheal intubation * *NEW*		**15%**	2 245	**15%**	2 245	**19%**	19 058
Initial laboratory values		**MW** ± SD	n	**MW** ± SD	n	**MW** ± SD	n
base excess [mmol/l]		**- 1.8** ± 4.5	23 746	**- 1.8** ± 4.5	23 746	**- 2.0** ± 4.7	128 753
hemoglobin [g/dl]		**13.2** ± 2.2	29 327	**13.2** ± 2.2	29 327	**13.0** ± 2.4	178 587
Int. Normalized Ratio, INR **		**1.20** ± 0.50	28 315	**1.20** ± 0.50	28 315	**1.20** ± 0.60	170 652
Quick's value [%]		**87** ± 21	27 554	**87** ± 21	27 554	**86** ± 22	167 481
temperature [°C] *		**36.1** ± 1.2	8 425	**36.1** ± 1.2	8 425	**36.1** ± 1.2	48 087

(C) Intensive Care Unit

Patients with **intensive care therapy**		**n = 29 275 (88%)**		**n = 29 275 (88%)**		**184 127 (88%)**	
Treatment *		**%**	n	**%**	n	**%**	n
hemostatic drugs *		**15.1%**	2 230	**15.1%**	2 230	**16.4%**	14 146
dialysis / hemofiltration *		**2.2%**	329	**2.2%**	329	**2.4%**	2 281
blood transfusion * within the first 48 h after admission		**19.3%**	3 119	**19.3%**	3 119	**20.7%**	21 691
mechan. ventilation / intubated		**38.7%**	11 322	**38.7%**	11 322	**45.5%**	83 713
Complications on ICU*		**%**	n	**%**	n	**%**	n
organ failure *		**33.7%**	5085 / 15073	**33.7%**	5 085	**37.0%**	35 979
multiple organ failure (MOF)*		**20.0%**	3020 / 15073	**20.0%**	3 020	**22.8%**	21 588
sepsis*		**6.7%**	991 / 14778	**6.7%**	991	**6.2%**	5 905
Length of stay and ventilation		**M** ± SD	n	**M** ± SD	n	**M** ± SD	n
length of intubation [days]		**2.9** ± 7.3 median **0**	29 135	**2.9** ± 7.3 median **0**	29 135	**3.5** ± 8.2 median **0**	182 834
LOS on ICU [days]		**6.5** ± 10.0 median **2**	29 275	**6.5** ± 10.0 median **2**	29 275	**7.2** ± 10.8 median **3**	184 111

* not available in the reduced QM dataset ** approximated from Quick's value (PT) if not documented

ICU = Intensiv Care Unit ER = Emergency Room LOS = Length of Stay CT = Computed Tomography M ± SD = mean and standard deviation

	Your hospital 2016	TR-DGU 2016	TR-DGU 10 years
No. of patients (basic group)	**33 374**	33 374	210 478

(D) Discharge and Outcome

Diagnoses		**M**	n	**M**	n	**M**	n
number of injuries per patient		**4.5**		**4.5**		**4,6**	
patients with only one injury	(%, n)	**9.5%**	3 180	**9.5**	3 180	**9,5%**	20 138
Operations		**%**	n	**%**	n	**%**	n
patients with surgery		**58.0%**	17 523	**58.0%**	17 523	**67,5%**	82 658
no. of procedures if operated *	[mean]	**3.4**		**3.4**		**3,5**	
Thrombo-embolic Events* (MI; pulmonary embolism; DVT; stroke; etc.)		**%**	n	**%**	n	**%**	n
patients with at least one event *		**2.7%**	437	**2.7%**	437	**2,8%**	2 845
Outcome (without early transfers out)		**%**	n	**%**	n	**%**	n
survivor		**88.7%**	27 643	**88.7%**	27 643	**88,3%**	174 309
hospital mortality		**11.3%**	3 507	**11.3%**	3 507	**11,7%**	23 060
died within 30 days		**10.8%**	3 357	**10.8%**	3 357	**11,2%**	22 110
died within 24 hours		**5.1%**	1 580	**5.1%**	1 580	**5,6%**	10 973
died in the ER (no ICU)		**1.4%**	449	**1.4%**	449	**1,7%**	3 434
Transfer / Discharge (all patients)		**%**	n	**%**	n	**%**	n
Survivor who were discharged and …		**100%**	29 867	**100%**	29 867	**100%**	187 352
transferred into another hospital		**18.0%**	5 367	**17.6%**	5 367	**17,2%**	32 446
among them early discharges (<48h)		**7.4%**	2 224	**7.6%**	2 224	**7,0%**	13 109
transferred into a rehabilitation center		**17.2%**	5 147	**17.7%**	5 147	**21,5%**	40 370
other destination		**3.4%**	1 014	**3.4%**	1 014	**3,4%**	6 366
sent home		**61.4%**	18 339	**61.2%**	18 339	**57,7%**	108 170
Condition at the time of discharge: Glasgow Outcome Scale (GOS) (without early transfers out)		**%**	n	**%**	n	**%**	n
Patients with valid GOS			30 835		30 835		189 394
Surviving patients		**100%**	27 328	**100%**	27 328	**100%**	166 334
– good recovery		**64.9%**	17 740	**67.3%**	17 740	**65,1%**	108 280
– moderate disability		**24.7%**	6 758	**23.1%**	6 758	**24,6%**	40 976
– severe disability		**8.9%**	2 435	**8.2%**	2 435	**8,7%**	14 426
– persistant vegetative state		**1.4%**	395	**1.4%**	395	**1,6%**	2 652
Length of stay in hospital (all patients)		**M** ± SD	n	**M** ± SD	n	**M** ± SD	n
All patients, mean		**15.2** ± 16.9	33 372	**15.2** ± 16.9	33 372	**16,8** ± 18,9	210 440
median		**11**		**11**		**12**	
Only non-survivors		**16.1** ± 17.2	29 865	**16.1** ± 17.2	29 865	**18,0** ± 19,2	187 383
Only survivors		**7.5** ± 12.2	3 507	**7.5** ± 12.2	3 507	**7,2** ± 12,4	23 057
median survivors / non-survivors		**11 / 3**		**11 / 3**		**13 / 3**	
Survivors transferred into a rehab. center		**28.7** ± 21.2	5 147	**28.7** ± 21.2	5 147	**30,4** ± 22,6	40 366
Survivors transferred into another hospital		**10.5** ± 14.4	5 367	**10.5** ± 14.4	5 367	**11,0** ± 15,5	32 442
Survivors sent home		**13.9** ± 14.2	18 337	**13.9** ± 14.2	18 337	**15,2** ± 16,3	108 146
Costs of treatment (without early transfers out; see footnote)		**€**	n	**€**	n	**€**	n
Average costs per patient							
… all patients		**14641**	31 012	**14 641**	31 012	**16 354**	196 314
… only non-survivor		**11164**	3 478	**11 164**	3 478	**11 283**	22 837
… only survivor		**15080**	27 534	**15 080**	27 534	**17 021**	173 477
… only patients with ISS ≥ 16		**19382**	16 909	**19 382**	16 909	**21 135**	112 026
Sum of all costs		454 045 115 €		454 045 115 €		3 210 478 905 €	
Sum of all days in hospital		507 789 days		507 789 days		3 531 195 days	
Average costs per day		**894.16 €**		**894.16 €**		**909.18 €**	

* not available in the reduced QM dataset M = mean

Treatment costs: The estimated treatment costs are based on data from 1002 German TR-DGU patients treated in 2007/08. For these patients a detailed cost analysis was available (Lefering et al. *Unfallchirurg*; online first). Assuming a cost increase of 2% per year the costs today would be 19% higher.

8. Subgroup Analyses

Summary results might not be helpful when looking for potential causes. Therfore, subgroup results of your hospital are presented on this page. Besides descriptive data about the patients and the process of care also hospital outcome and prognosis are presented here for each subgroup.

In order to reduce the statistical uncertainty involved in subgroup analyses, patients from the **last three years** (2014-2016) were pooled together. Again, only patients from the **basic patient group** (see page 1) were considered here.

8.1 Subgroups within your hospital

All results in the following table refer to **primary** admitted cases from the basic patient group. Patients transferred in as well as those transferred out early (within 48h) are not considered here.

There were a total of **82648 patients** from your hospital in the last three years.

		Primary patients 3 years	Subgroups					
			No TBI	Combined trauma	Isolated TBI	Shock	Severe injuries	Elderly
Defionition of subgroup		Basic group	AIS head ≤ 1	head and body AIS ≥ 2	AIS head ≥ 3 and AIS elsew. ≤ 1	syst. BP ≤ 90 on admission	ISS ≥ 16 & at least one problem*	age 70 years or more
No. of patients (basic group)	n	82 648	40 983	31 014	10 651	6 146	25 160	20 971
	%	100%	50%	38%	13%	7%	30%	25%
Patients								
Age	[years]	50,9	48,3	51,4	59,5	51,0	59,3	79,8
Males	%	70%	71%	69%	65%	69%	66%	55%
ASA 3-4	%	16%	13%	17%	29%	20%	27%	46%
Injuries								
ISS	[points]	18,1	14,5	22,7	18,2	30,2	28,7	18,8
Head injury (AIS≥3)	%	34%	---	56%	100%	47%	65%	46%
Thoracic injury (AIS≥3)	%	38%	43%	43%	---	57%	51%	34%
Abdominal injury (AIS≥3)	%	9%	13%	8%	---	23%	23%	5%
Pre-hospital care								
Pre-hospital time	min.	63	61	63	64	69	67	64
Intubation	%	23%	12%	33%	34%	64%	50%	22%
Volume given	[ml]	661	664	706	514	1032	802	549
Emergency room								
Blood transfusion	%	8%	8%	10%	3%	35%	18%	7%
Whole-body CT	%	90%	83%	96%	96%	85%	93%	88%
CPR	%	1%	1%	2%	1%	8%	4%	1%
Physiological problems*								
Age ≥ 70	%	25%	19%	27%	44%	27%	47%	100%
Shock (sBP ≤ 90)	%	25%	11%	15%	10%	100%	31%	12%
Acidosis (BE<-6)	%	9%	7%	12%	9%	36%	24%	9%
Coagulopathy	%	11%	9%	14%	15%	32%	26%	21%
Unconsciousness (GCS 3-8)	%	16%	4%	25%	34%	45%	44%	18%
Length of stay								
Treated on ICU	n	74 132	35 565	28 929	9 638	5 259	22 925	18 428
- Intubation (ICU)	[days]	2,9	1,3	4,0	3,5	7,1	6,5	3,2
- Days on ICU	[days]	6,5	4,2	7,7	6,5	11,9	11,4	7,0
Days in hospital	[days]	16,0	16,0	16,7	13,6	19,9	20,0	15,8
Outcome and prognosis								
Non-survivor	n	9 128	1 920	4 425	2 783	2 289	7 646	5 064
Hospital mortality	%	11,0%	4,7%	14,3%	26,1%	37,2%	30,4%	24,1%
RISC II prognosis	%	10,6%	4,4%	14,2%	23,8%	38,4%	29,3%	22,5%

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

8.2 Hospital level of care

The following table allows a comparison of your hospital with hospitals of the same level of care. There are three levels of care (local, regional, and supra-regional trauma centers); non-certified hospitals were grouped according to patient volume and ressources. The column with comparative data for your hospital **(supra-regional trauma center)** is marked with a triangle ▼. The results of the whole registry (TR-DGU) are presented as well.

Again only cases from the **basic patient group** were considered here. In order to reduce the statistical uncertainty, all patients from the **last three years** were pooled together (available from your hospital: 3 years).

		Your hospital	Trauma Center			
			local	regional	supra-regional	TR-DGU
Level of care / trauma center		**supra-regional**			▼	
Number of hospitals			285	224	136	645
Percentage of patients in TR-DGU			10.9%	29.0%	60.1%	100%
Patients per year	n	**53** /year	**13** /year	**43** /year	**149** /year	**53** / year
All patients (3 years)		n=98 200	n=10 729	n=28 448	n=59 023	n=98 200
primary admitted and treated	n,%	8 2648 84%	76%	85%	86%	84%
primary admitted; early transferred out	n,%	6 571 7%	23%	12%	1%	7%
transferred in from other hospital	n,%	8 981 9%	2%	4%	13%	9%
Patients						
average age	[years]	51.2	54.0	52.3	50.2	51.2
elderly patients aged 70+ years	%	26%	30%	27%	25%	26%
males	%	70%	67%	69%	71%	70%
ASA 3-4	%	17%	20%	19%	16%	17%
Injuries						
Injury Severity Score, ISS	[points]	18.4	14.7	16.9	19.8	18.4
ISS ≥ 16	%	54%	39%	49%	60%	54%
polytrauma*	%	15%	8%	12%	18%	15%
pat. with head injury (AIS≥3)	%	37%	23%	29%	44%	37%
pat. with thoracic injury (AIS≥3)	%	37%	34%	37%	37%	37%
pat. with abdominal injury (AIS≥3)	%	9%	8%	9%	10%	9%
Pre-hospital Care (primary admissions only)		n=89 219	n=10 547	n=27 367	n=51 305	n=89 219
time (from accident to hospital)	[min]	62	55	58	66	62
volume administration	[ml]	656	525	608	710	656
intubation	%	22%	6%	13%	30%	22%
unconsciousness (GCS 3-8)	%	16%	6%	10%	21%	16%
Emergency Room (primary admissions only)						
blood transfusionen	%	8%	4%	5%	10%	8%
whole-body CT scan	%	90%	78%	89%	92%	90%
CPR	%	1%	0%	0%	2%	1%
shock / hypotension	%	12%	8%	10%	14%	12%
coagulopathy	%	11%	9%	9%	13%	11%
Length of stay (without early transfers out)						
length of intubation on ICU	[days]	2.7	0.7	1.7	3.5	2.7
LOS on ICU	[days]	6.0	3.1	4.7	7.0	6.0
LOS in hospital	[days]	16.3	12.0	14.2	17.8	16.3
Outcome and Prognosis (without transfers in and early transfers out)						
Patients	n	82 648	8 111	24 061	50 476	82 648
Non-survivor	n	9 128	540	2 061	6 527	9 128
Hospital mortality	%	11.0%	6.7%	8.6%	12.9%	11.0%
RISC II prognosis	%	10.6%	6.5%	8.2%	12.4%	10.6%

ICU = Intensive Care Unit GCS = Glasgow Coma Scale AIS = Abbreviated Injury Scale ISS = Injury Severity Score, LOS = Length of Stay CPR = cardio-pulmonary resuscitation CT = computed tomography

* Polytrauma: see Berlin definition of Pape et al. (*J Trauma* 2014)

9. Data Quality and Completeness

9.1 Completeness of selected variables

Registries and audit reports could only be as good as the data they are based on. If a lot of patients have missing data in important variables then these patients have to be excluded from analysis, and results might be biased or even wrong. The following table describes the **completeness rates (%)** of several important variables, together with the **number of patients with missing data (∅)**. The list of variables specifically contains the prognostic variables needed for the RISC II. As on the previous pages only cases from the **basic patient group** were considered here.

Good completeness rates are indicated in green color (96% or better), variables with moderate completeness are marked in yellow (90-95%), and insufficient completeness (below 90%) is indicated in red. The categories for completeness are thresholds defined by experts; they were not derived from the data.

The completeness rates of your hospital **in 2016** are compared with your hospital's data from the previous years (**since 2007**) and with actual overall data from the whole registry (**TR-DGU 2016**). Besides the rates also the number of patients with missing data is given, marked with the ∅ sign. including also cases with implausible data.

Variable	Importance	Category (%)			Your hospital 2016	Your hospital 2007-2015	TR-DGU 2016
Pre-hospital data (A)							
				only primary admitted cases	n=30 361	n=159 130	n=30 361
GCS	RISC II requires the motor component; quality indicators use the GCS for the definition of cases	96+	90-95	<90	**93%** ∅ 2212	**93%** ∅ 11149	**93%** ∅ 2212
Blood pressure	Initial blood pressure is important for validating the volume therapy and for the definition of shock	96+	90-95	<90	**87%** ∅ 3967	**87%** ∅ 20112	**87%** ∅ 3967
Pupils*	Pupil size and reactivity are relevant for prognosis (RISC II); will be required for all patients in future	96+	90-95	<90	**87%** ∅ 3952	**91%** ∅ 8360	**87%** ∅ 3952
CPR	Cardio-pulmonary resuscitation is seldom (3-4%) but highly predictive for outcome; required for RISC II	96+	90-95	<90	**91%** ∅ 2786	**93%** ∅ 11647	**91%** ∅ 2768
Emergency room (B)							
				only primary admitted cases	n=30 361	n=159 130	n=30 361
Time of admission	Required to calculate the time until diagnostics were performed	96+	90-95	<90	**99%** ∅ 226	**99%** ∅ 2375	**99%** ∅ 226
Blood pressure	BP on admission is used by RISC II as a prognostic variable; also needed for definition of shock	96+	90-95	<90	**94%** ∅ 1753	**91%** ∅ 14506	**94%** ∅ 1753
Base excess	Base excess is part of the RISC II and an independent prognostic factor	96+	90-95	<90	**78%** ∅ 6631	**66%** ∅ 54227	**78%** ∅ 6631
Coagulation	The INR (or Quick's value) is needed for the RISC II as coagulation marker	96+	90-95	<90	**93%** ∅ 2046	**89%** ∅ 16793	**93%** ∅ 2046
Hemoglobin	Is part of the RISC II score as an indirect sign of relevant bleeding	96+	90-95	<90	**97%** ∅ 1034	**94%** ∅ 9870	**97%** ∅ 1034
Patients and Outcome							
				alle Patienten	n=33 374	n=177 104	n=33 374
ASA	Prior diseases are relevant for outcome prediction (RISC II); doc. since 2009	96+	90-95	<90	**92%** ∅ 2649	**79%** ∅ 37873	**92%** ∅ 2649
Surgical treatment*	A low rate of surgical patients could be based on incomplete documentation	70+	50-69	<50	**54%**	**62%**	**54%**
GOS	The Glasgow Outcome Scale (GOS) describes the patient's condition at discharge or transfer	96+	90-95	<90	**98%** ∅ 623	**94%** ∅ 11293	**98%** ∅ 623
Prozessdaten							
				all patients	n=33 374	n=177 104	n=33 374
Time point	A timely documentation of cases is able to improve data quality			months from accident to start of documentation	**3.7** mon.	**4.5** mon.	**3.7** mon.
	Months from discharge until completion of documentation	<3	3-4	5+	**4.7**	**5.5**	**4.7**

* the actual dataset revision includes pupil size / reactivity and surgical treatnment for all cases.

9.2 Comparison of data quality among hospitals

Detailed completeness rates for different variables were presented on the previous page 9.1. In order to compare data quality among hospitals, a combined **quality score** has to be considered.

This score was calculated from the following 10 variables: from the pre-hospital phase GCS, blood pressure, and CPR; from the emergency room phase the time of admission, blood pressure, base excess, hemoglobine, and coagulation (Quick's value or INR); finally the patient's prior health status (pre-injury ASA) and the GOS (Glasgow Outcome Scale) as outcome measure. All these variables were part of both the standard and the reduced QM dataset.

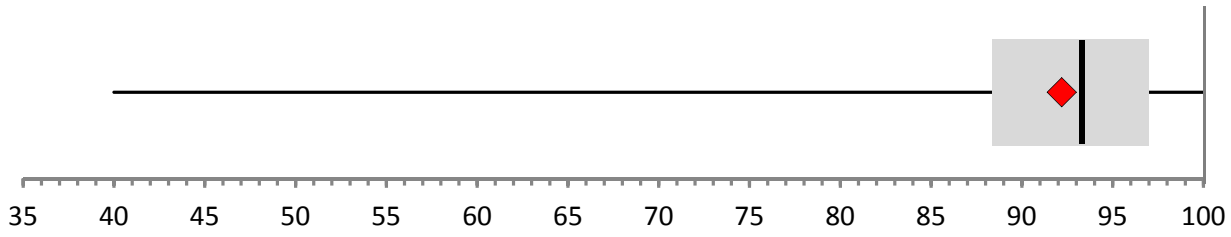
The number of missing data points from all **primary admitted trauma patients in the basic patient group** were then added and compared to the theoretical maximum. This leads to an average completeness rate based on 10 different variables.

Data Completeness	**Your hospital 2016**	**Your hospital 2007-2015**	**TR-DGU 2016**
Primary admitted patienten in the basic group	n=30 361	159 130	30 361
Theoretical sum of all values	303 610	1 591 300	303 610
Sum of missing values	∅ 23 655	∅ 185 107	∅ 23 655
Average data completeness rate (%) based on 10 different measurements	**92.2%**	**88.4%**	**92.2%**

Graphical comparison with other hospitals

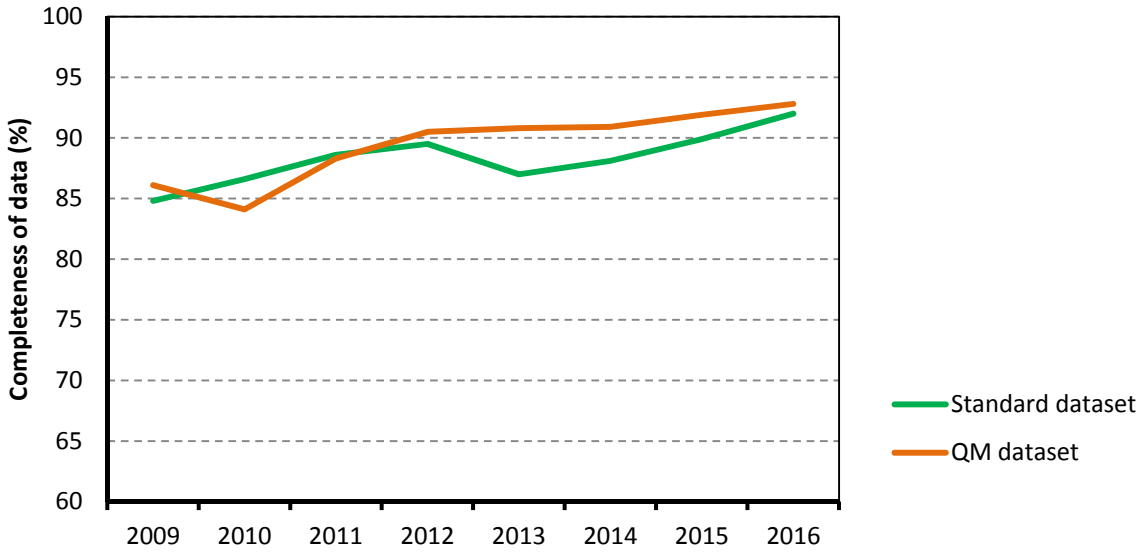
The following figure summarizes the completeness data from all 645 hospitals who submitted cases in 2016. The value of your hospital is presented as a **red diamond**.

The figure follows the idea of a box plot where the grey box ranging from 88.4 to 97.0 covers half of all hospital values. The vertical line within the box is the median hospital value (93.3%).



Development over time

The following figure shows the development of data completeness in the last 8 years since 2009. The completeness rates were pooled separately for hospitals using the standard dataset and the reduced QM dataset.

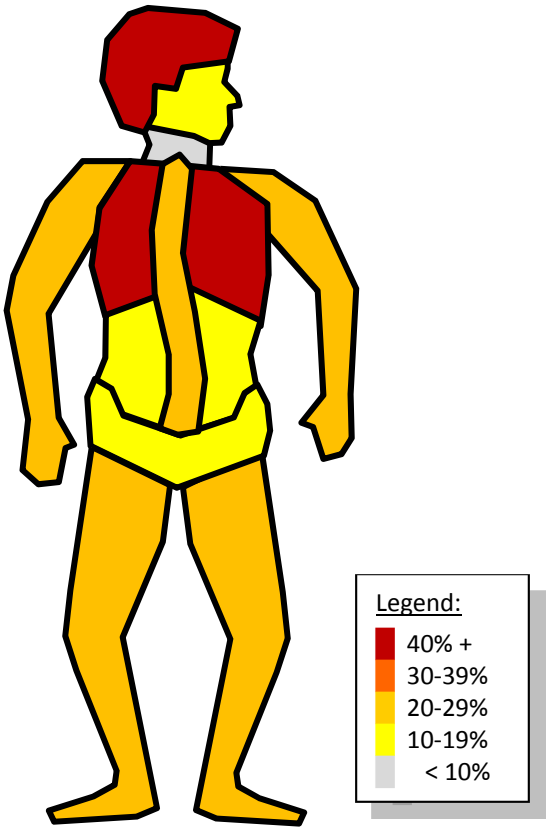


10. Pattern of Injury

The figure below shows the average injury pattern of your patients compared with the TraumaRegister DGU®. For these data all cases from the **basic patient group** were considered. In order to reduce the statistical uncertainty, all patients from the last three years **(2014-2016)** were pooled. In these three years, a total of **98 200 patients** from your hospital have been documented in the registry (TR-DGU: 98 200).

Data are presented for each of the nine body regions according to the **Abbreviated Injury Scale (AIS).** The rates refer to injuries with an injury severity of **at least two points** (including, for example, radius fractures, spine fractures, lung contusions, etc.). The colour-coded figure refers to injury distribution from the whole registry.

Head	Your hospital	**48.1%**	(n = 47 276)
	TR-DGU	48.1%	(n = 47 276)
Face	Your hospital	**11.1%**	(n = 10 908)
	TR-DGU	11.1%	(n = 10 908)
Neck	Your hospital	**1.4%**	(n = 1 369)
	TR-DGU	1.4%	(n = 1 369)
Thorax	Your hospital	**44.8%**	(n = 44 021)
	TR-DGU	44.8%	(n = 44 021)
Abdomen	Your hospital	**14.2%**	(n = 13 961)
	TR-DGU	14.2%	(n = 13 961)
Spine	Your hospital	**28.8%**	(n = 28 284)
	TR-DGU	28.8%	(n = 28 284)
Arms	Your hospital	**28.4%**	(n = 27 899)
	TR-DGU	28.4%	(n = 27 899)
Pelvis	Your hospital	**15.3%**	(n = 15 022)
	TR-DGU	15.3%	(n = 15 022)
Legs	Your hospital	**24.2%**	(n = 23 800)
	TR-DGU	24.2%	(n = 23 800)



Serious Injuries (AIS 3+)

Injuries with a severity of 3 points or more (AIS) are considered as ‘serious‘. The prevalence of serious injuries in four different body regions (head; thorax; abdomen; extremities) is given below. The body regions considered here refer to the respective regions of the *Injury Severity Score.*

In contrast to the figure above only patients with **at least one relevant injury** (MAIS 3+; see also page 1) are considered here. In the last three years there were **79753** such **patients** from your hospital. They constitute **81%** within the **basic patient group** (TR-DGU: 81%).

Serious injury (AIS ≥ 3)	**Your hospital** n = 79 753	**TR-DGU** n = 79 753
… of the **head**	**46.0%** (n=36 655)	46.0% (n=36 655)
… of the **thorax**	**45.5%** (n=36 321)	45.5% (n=36 321)
… of the **abdomen**	**11.6%** (n= 9 235)	11.6% (n= 9 235)
… of the **extremities**	**28.8%** (n=22 974)	28.8% (n=22 974)
Patients with **more than one** seriously injured body region	**30.2%** (n=24 102)	30.2% (n=24 102)

11. General Results

Some results from the actual analysis of 2016 data from the TraumaRegister DGU® are of general interest. They will be presented here without reference to individual hospitals' results.

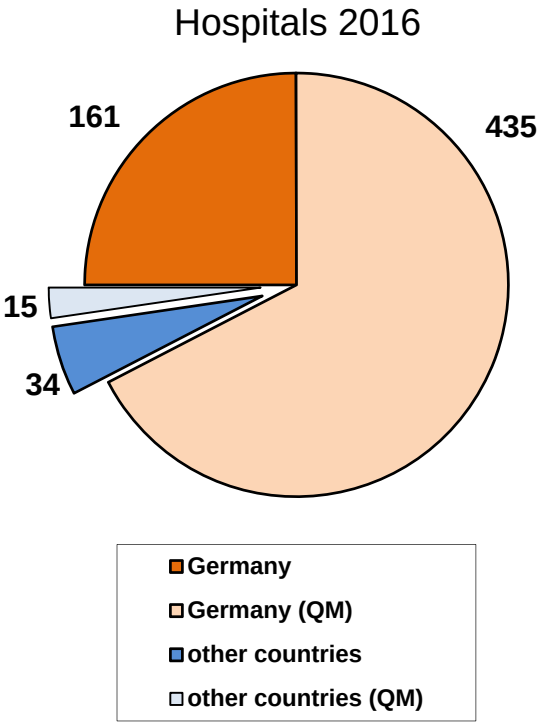
11.1 Hospitals and Patients

Hospitals

In 2016, **40 836 patients** from 645 hospitals were documented in the TraumaRegister DGU®. The total number of cases documented since 1993 thus increased to 281 174 patients. However, not all of these cases were severely injured. The **basic patient group** where this report is based on consisted of **33 374 patients** last year. Details of the definition of the basic patient group are given on pages 1 and 11.2 (next page). Already **51.081 patients**, and nearly all cases from 2016, have been documented with the recently updated dataset introduced in January 2016.

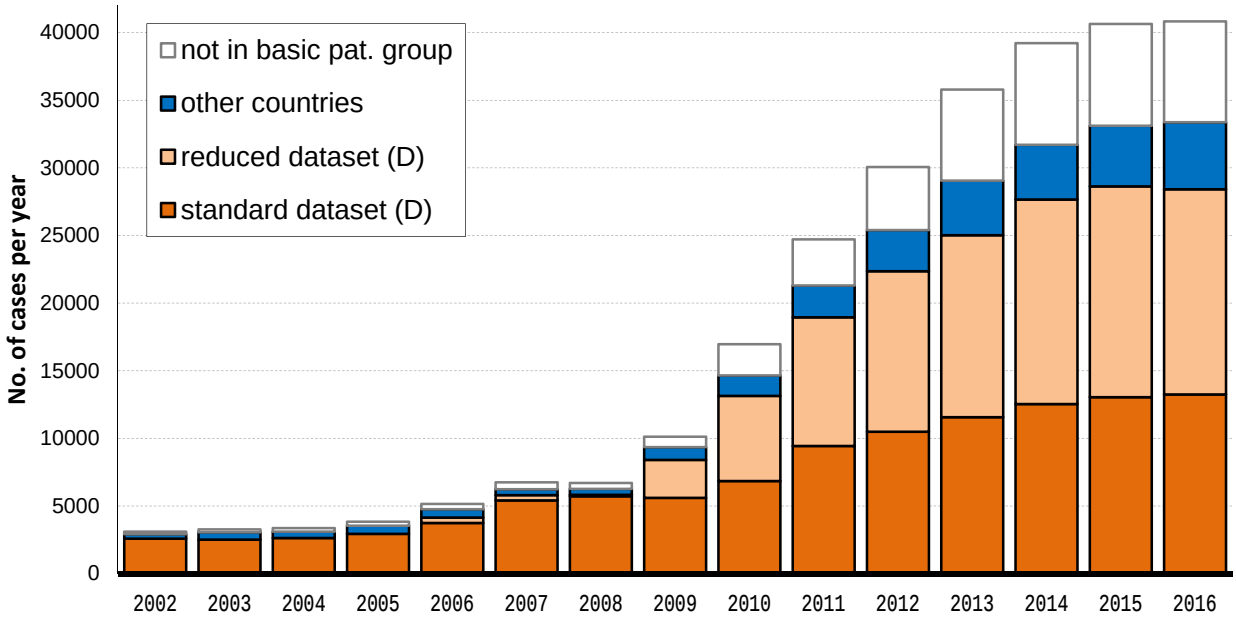
Among the total number of **645 actively participating hospitals** there were 49 hospitals from outside Germany (7.7%): Austria 23, Switzerland 7, Belgium 6, Luxembourg 4, The Netherlands 3, Finland, 3 Slovenia 2, and the United Arab Emirates 1. The number of active German hospitals was 596 last year.

The figure on the right shows the distribution of hospitals regarding their location (German vs. non-German) and the use of the standard dataset or the reduced QM dataset, respectively. The reduced version of the dataset is mainly used in Germany by local (87%) and regional (73%) trauma centers. The majority of level one trauma centers used the standard dataset (72%).



Patients

The figure below demonstrates the continuous increase of registered patients over time since 2002. In 2016, the portion of non-German patients was 13.6%. Only 3.9% of patients have been documented on paper forms before 2002. Last year, about half of all patients (49%) were documented with the standard dataset.



11.2 Severity of injuries

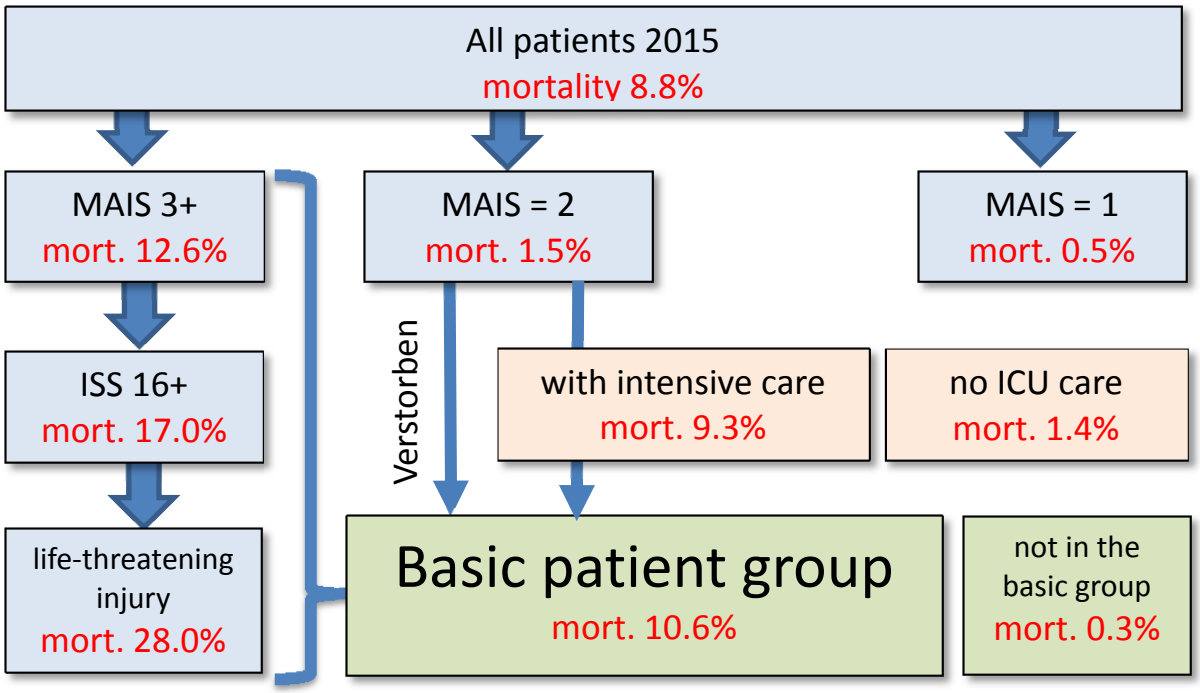
The TraumaRegister DGU® is designed to document and analyze **severely injured patients**. These patients are specifically suitable for the evaluation of interdisciplinary cooperation in trauma care within a hospital. It also reduces the workload for documentation considerably if not all but only severely injured patients are registered.

However, there are different approaches to define 'severe injuries'. The TR-DGU uses need for intensive care as a pragmatic and easy to determine inclusion criterion. But in 2016, only 77% of all documented patients were treated on ICU. And this is not due to early deaths in the emergency room (only 465 patients; 1.1%) who did not reach the ICU.

Definitions of 'severe' injury consider either anatomical (like ISS, MAIS) and/or physiological findings. Based on these definitions, the mortality rates obviously vary. The figure below shows mortality rates in different subgroups of trauma patients, based on TR-DGU data from 2015. Polytrauma patients (Berlin definition) have the same mortality rate (28%) as cases with life-threatening injuries.

Name	Definition	Remark
severe injury	treated at least 24 h in a hospital	national road traffic statistics in Germany
serious injury	maximum AIS = 3 or more (MAIS 3+)	new severity level for European road traffic statistics
severe injury	ISS ≥ 16 (or > 15)	most widely used in international trauma literature
polytrauma *(Tscherne)*	multiple injuries, one of them, or their combination, is life-threatening	definition based on Tscherne; widely used in Germany, but no exact definition available
polytrauma *(Balogh)*	AIS ≥ 3 in at least two body regions	definition suggested by Balogh based on anatomical severity
polytrauma *(Berlin)*	AIS ≥ 3 in at least two body regions plus physiological problems*	international consensus definition; adds the pysiological component to anatomy
life-threatening injury	ISS ≥ 16 plus physiological problems*	similar approach but includes severe isolated trauma as well
basic patient group	MAIS3+/ Intensive care/ died	Basis for the annual quality reports of TR-DGU

* unconsciousness, shock, acidosis, coagulopathy, and high age; for exact definitions see Pape et al. [J Trauma, 2014] or Paffrath et al. [Injury, 2014]



The **basic patient group** first introduced and defined in the 2015 annual report of TR-DGU excludes all MAIS 1 patients (i.e. where the worst injury had AIS severity level 1). MAIS 2 patients are only included if intensive care was required, or if they died. But all MAIS 3+ patients are included, even those without intensive care. Finally, a valid age is required in order to calculate the RISC II prognostic score. In 2016, the basic patient group included 82% of all documented cases.

11.3 Quality Indicators

Since its founding the TraumaRegister DGU® reported about **quality indicators (QI)**. QI are measurements which were assumed to be associated with a good quality of care. In the past 20 years, the QI used in the quality reports of TR-DGU had only marginally changed. Only the intubation in patients with thoracic trauma has been deleted, and the time to whole-body CT has been newly introduced.

Now, these QI were extensively **evaluated**, and additional candidate QIs were identified from different sources, like the national guideline for polytrauma care, the ATLS handbook, reports from other registries, and a literature search. this finally produced a list of 170 different (but often similar) QI.

The initiative for this evaluation came from a similar approach in the AKTIN research project where QI in the emergency room (not limited to trauma) were evaluated; the results are already published (Kulla et al: Bewertung von Qualitätsindikatoren in der Notaufnahme. *Notfall- und Rettungsmedizin* 2016, doi: 10.1007/s10049-016-0236-8).

We used the new **QUALIFY** instrument to evaluate the trauma QI (Reiter et al.: QUALIFY: ein Instrument zur Bewertung von Qualitätsindikatoren. *ZaeFQ* 2008, 101: 683-8). This tool consists of 20 different dimensions, of which some were rated by experts, and others needed data for statistical analysis, and again other criteria refer to the data collection (which were not considered here since the data are already available in the registry).

Qualitätsindikator: TR14 **3,6**

Präklin. Intubation bei bewusstlosen Patienten (GSC≤8)

R1 Relevanz	4,0	
R2 Nutzen	3,7	
R3 Risiken/Nebenwirkungen	3,2	
W2 Klarheit der Definition	3,8	
P1 Verständlichkeit Patient	3,2	
P2 Verständlichkeit Arzt/Pflege	4,0	
P3 Beeinflussbarkeit	2,0	
P4 Datenverfügbarkeit/Aufwand	3,8	
P6 Implementationsbarrieren	3,4	

Qualitätsindikator: TR86 **2,7**

Intubation bei AF < 6 oder alternative Atemwegssicherung

R1 Relevanz	2,7	
R2 Nutzen	2,6	
R3 Risiken/Nebenwirkungen	2,7	
W2 Klarheit der Definition	3,3	
P1 Verständlichkeit Patient	2,6	
P2 Verständlichkeit Arzt/Pflege	3,4	
P3 Beeinflussbarkeit	1,8	
P4 Datenverfügbarkeit/Aufwand	3,2	
P6 Implementationsbarrieren	3,6	

There were many similar QI among the 170 identified indicators so that they could easily be grouped. Furthermore, some QI could not be calculated with the present TR-DGU dataset; they were thus set aside. A final list of 35 different QI (among them, of course, all previously used QI) was then evaluated by a group of 13 experts from multiple disciplines, using 9 of the 20 QUALIFY criteria.

In May 2017, the results of this evaluation has been presented to and intensively discussed with the TraumaRegister working group. This group finally decided to use a new set of 14 QI with a good rating in future quality reports. You find these new indicators on pages 4.1-4.3

In order to get an impression of how the evaluation of the QI has been performed, you find two examples on this page, one of a „good“ QI, and one of a „bad“ QI. The results of the expert ratings are given in colour coding. The criteria were as follows: R1 relevance; R2 benefit; R3 risks and side effects; W2 clearness of definition; P1/P2 understandability for patients / professionals; P3 behaviorability; P4 availability of data; P6 barriers for implementation. A detailed report about the evaluation of all QI will soon be published.

Furthermore, the presentation of QI has now been grouped into (1.) **pre-hospital measures** with only very limited influence by a hospital, (2.) **time measurements** in the emergency room, and (3.) the performance of acute diagnostic and/or therapeutic **interventions** in selected patient groups.

However, the evaluation process of QI has not yet been finished. The indicators used in the annual report will be tested and validated with real TR-DGU data. Other QI which are not yet documented in the registry will be considered as well; this evaluation has a potential effect on the next dataset revision planned in 2020.

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Financial Disclosure:

The **TraumaRegister DGU®** receives fees from the participating hospitals collected by the **AUC GmbH**. The AUC GmbH, a 100% affiliate of the DGU (Deutsche Gesellschaft für Unfallchirurgie), also hosts the registry and is owner of the database. Hospitals certified as members of a German trauma network (TraumaNetzwerk DGU®) are obliged to participate in the TraumaRegister DGU®, all other hospitals participate voluntary.

In the past 10 years the registry received financial or other support from the following organizations and companies:

- Private University Witten/Herdecke gGmbH and Cologne-Merheim Medical Centre (2005-2016)
- Novo Nordisk A/S, Bagsværd, Denmark (2003-2009)
- Sanofi Aventis Deutschland GmbH (2008)

Publications from the TraumaRegister DGU®

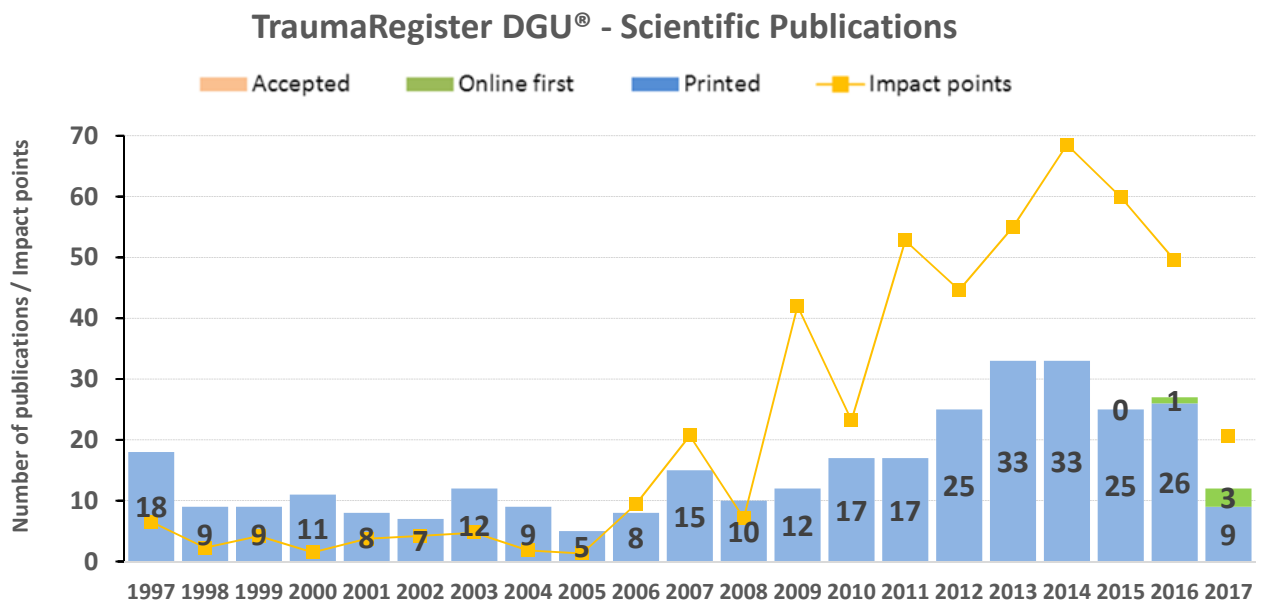
Publications from the last three years (2015-2017), no abstracts; last update: August 2016

An extended list of publications from the TraumaRegister DGU® including also papers published previously is available on **www.traumaregister-dgu.de**.

[PDF] / [PDFprov] = this paper is available in PDF format / provisional PDF format.

The articles indicated with **[PDF]** could be provided to interested users on request if there is no direct access to the respective journal. In this case, please send an email to: support-tr@auc-online.de .

The following figure presents the **number** of publications from the TraumaRegister DGU® since 1997 as well as the sum of **impact points** reached with these papers.



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List of abbreviations used in the report

Abbreviations

AIS	Abbreviated Injury Scale
ASA	American Society of Anaesthesiologists
AUC	AUC – Academy of Trauma Surgery (Akademie der Unfallchirurgie GmbH)
BE	Base Excess
CT	Computed tomography
CCT	Cranial computed tomography
DGU	German Trauma Society (Deutsche Gesellschaft für Unfallchirurgie)
FFP	Fresh Frozen Plasma
GCS	Glasgow Coma Scale
GOS	Glasgow Outcome Scale
h	Hour
Hb	Hemoglobine (or Haemoglobine)
ICU	Intensive Care Unit
INR	International Normalized Ratio
ISS	Injury Severity Score
M	Mean value
MAIS	Maximum AIS severity score
min	Minute
ml	Milliliter
MOF	Multiple Organ Failure
NACA	National Advisory Committee for Aeronautics
NIS	Committee on Emergency Medicine, Intensive Care and Trauma Management of the German Trauma Society (Sektion NIS of DGU)
NISS	New Injury Severity Score
OP	Operation
OF	Organ Failure
PDF	Portable Document Format
pRBC	Packed red blood cells
PTT	Partial thromboplastin time (in sec)
QI	Quality indicator
QM	Quality management
RISC	Revised Injury Severity Score (prognostic score)
RISC II	Revised Injury Severity Score, version II
SAPS	Simplified Acute Physiology Score
sBP	Systolic blood pressure
sec	Seconds
SD	Standard deviation
SMR	Standardized Mortality Ratio
SOFA	Sequential Organ Failure Assessment
TBI	Traumatic brain injury
TPZ	Thromboplastin timet; Quick's value
TR-DGU	TraumaRegister DGU®
TRISS	Trauma and Injury Severity Score (prognostic score)