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No registry, no benchmark: a nationwide cross-sectional gap analysis of trauma care data in Poland against American College of Surgeons standards

Piotr Krzysztof Kowalewski

pietia.kowalewski@gmail.com

Military Institute of Medicine - National Research Institute

Łukasz Jacuniak

Military Institute of Medicine - National Research Institute

Krzysztof Kłos

Military Institute of Medicine - National Research Institute

Research Article

Keywords: Trauma registry, Trauma systems, Quality of health care, Injury Severity Score, Administrative data, Trauma centres, Benchmarking, Poland

Posted Date: November 25th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-11455696/v1

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Additional Declarations: No competing interests reported.

Abstract

Background

Poland has 17 designated adult trauma centres but no national trauma registry. This study assessed which trauma data elements required by the American College of Surgeons (ACS) are available in Polish public data sources and what these sources reveal about the care of injured patients.

Methods

In this cross-sectional gap analysis, 17 verifiable requirements from the ACS Trauma Systems Consultation Guide, the 2022 Resources for Optimal Care of the Injured Patient, the National Trauma Data Standard, the Trauma Quality Improvement Program and the Utstein template were mapped against Polish sources and graded on a five-level scale. Sources were National Health Fund portals and open hospital data (2017–2025), Police, Statistics Poland and air rescue reports. In-hospital mortality in injury-related diagnosis-related groups was analysed; trauma centres were compared using indirect standardisation and funnel plots. Five established trauma registries served as comparators.

Results

Of 17 requirements, one was fully available in public data; the gap was small for one, moderate for one, large for four and critical for nine; one was not applicable. No source contained Abbreviated Injury Scale codes, physiological parameters, process times or linked 30-day outcomes. In injury-related groups the share of patients aged ≥ 65 years rose from 31.3% (2017) to 47.8% (2025); they accounted for 75.7% of in-hospital deaths in 2025. Multiple-injury groups (1002–1466 stays per year) were billed by trauma centres in 99.1–99.8% of cases. Standardised mortality ratios of centres ranged from 0.49 to 2.10; six of 17 lay outside 95% control limits. In operative severe head injury, the observed-to-expected mortality ratio was 0.89 (95% CI 0.85–0.92) in trauma centres and 1.05 (1.03–1.07) in other hospitals, but trauma centres transferred more patients onward (17.8% vs 11.9%).

Conclusions

Polish public data describe volume, age structure and crude in-hospital outcomes of injured patients but cannot measure the quality of trauma care as defined by the ACS. Without injury severity, process times and linkage beyond discharge, differences between hospitals cannot be attributed to quality of care. A national trauma registry aligned with the Utstein template and the National Trauma Data Standard, with injury severity coding and data linkage, is a prerequisite for risk-adjusted benchmarking.

Introduction

Injury remains a leading cause of death and disability in working-age adults and an increasing burden in older people. In Poland, road traffic crashes alone killed 1660 people and seriously injured 7866 in 2025 [1]. Since the introduction of trauma centres under the State Emergency Medical Services Act, 17 hospitals have been designated to treat adults with multiple injuries [2]. However, the performance of this system has rarely been measured: in 2021 the Supreme Audit Office described the data available to the Minister of Health on the emergency medical system as unreliable and inconsistent [3], and recent nationwide analyses of injured patients in Poland had to rely on administrative records without any measure of injury severity [4].

The American College of Surgeons (ACS) Committee on Trauma defines the data needed to evaluate trauma care at two levels. At the system level, the Trauma Systems Consultation Guide ("White Book") requires a trauma system registry covering the whole continuum of care, integrated with vital statistics, law enforcement and rehabilitation data, and used for system-wide performance improvement, triage monitoring and public reporting [5]. At the centre level, the 2022 Resources for Optimal Care of the Injured Patient require a concurrent registry compliant with the National Trauma Data Standard (NTDS), injury coding with the Abbreviated Injury Scale (AIS) and participation in risk-adjusted benchmarking such as the Trauma Quality Improvement Program (TQIP) [6–8]. In Europe, the Utstein template defines 35 core variables for uniform reporting after major trauma [9], and national registries in Germany, Norway, Sweden and the United Kingdom use comparable data sets for benchmarking [10–13].

Poland has no national trauma registry. Its health system nevertheless produces large volumes of routinely collected data: the National Health Fund (Narodowy Fundusz Zdrowia, NFZ), the single public payer, publishes aggregated hospital data down to individual providers, and the Police publish annual statistics on road traffic crashes and other incidents. Whether these sources can substitute, even partially, for a trauma registry has not been examined.

The aim of this study was therefore (1) to identify Polish public data sources that record injured patients, (2) to map them against the data requirements of the ACS and the Utstein template, and (3) to describe what these data reveal about the care of injured patients, including the role of trauma centres.

Methods

Study design and reference framework

A cross-sectional document and data gap analysis was conducted, combined with a secondary analysis of publicly available, aggregated administrative data. All sources were accessed between 28 September and 1 October 2026. The reference framework was built from the ACS Trauma Systems Consultation Guide (effective September 2023; Elements 1, 5, 7, 8 and 9) [5], the 2022 Resources for Optimal Care of the Injured Patient (Standards 4.32–4.33, 6.1–6.3 and 7.4) [6], the NTDS Data Dictionary for 2026 admissions [7], TQIP [8] and the Utstein template [9]. From these documents, 17 requirements that can

be verified against data were extracted: six system-level requirements, three centre-level requirements and eight groups of patient-level data elements (Table 1; rationale in Additional file 1: Table S1).

Identification of Polish data sources

Publicly accessible sources recording injured persons at any stage of the care pathway were searched: the NFZ Zdrowe Dane portal [14], the NFZ statistics application programming interface (API) [15], the open data portal dane.gov.pl [16], publications of Statistics Poland (GUS) and of the National Institute of Public Health (NIZP PZH-PIB) [17], Police statistics [1, 18], Polish Medical Air Rescue reports [19] and Supreme Audit Office reports [3]; targeted searches covered a Polish trauma registry and participation in international registries. For each source, the data holder, unit of observation, level of aggregation, time span, injury-relevant variables, availability of International Classification of Diseases, 10th revision (ICD-10) diagnoses including external causes, and route of access were recorded.

NFZ statistics API

The API provides national aggregates for each diagnosis-related group (Jednorodne Grupy Pacjentów, JGP) and year, including admission and discharge mode, age, length of stay, ICD-10 diagnoses and ICD-9-CM procedures, but no hospital- or region-level breakdown. Discharge- and admission-mode tables for the adult multiple-injury groups (T01–T06, T08, T09) were retrieved for 2019 and 2024 to validate the hospital data set; each table was accepted only if its metadata confirmed product code and year.

Hospital data set

Hospital-level data came from the NFZ open data set on hospital stays settled under JGP, published under a CC0 licence [16]. Each record is the number of stays for a combination of year, month, NFZ regional branch, provider tax identification number (NIP), contract product, JGP code, admission mode, discharge mode, sex, age group (0–17, 18–44, 45–64, ≥ 65 years) and length-of-stay category. The data contain no diagnoses and no patient identifier; cells with fewer than five stays are masked (“<5”). Files for 2017–2025 were analysed (the archive distributed with the data set contained 2017–2021).

Injury-related groups were selected by JGP code: multiple injuries (T01–T06, T08, T09), conservative treatment of injuries (T07), intracranial surgery for major trauma (A01) and for trauma (A02), head injury treated conservatively with (A76) and without (A77) significant brain injury, and post-traumatic injuries other than brain injury (H85, H85E, H85F). In-hospital death was defined as discharge mode 9, transfer to another hospital as discharge mode 3, admission by an emergency medical service team as admission mode 2 and transfer from another hospital as admission mode 8.

Almost all cells in these groups were masked. Their value was estimated by comparison with national API totals. In groups T01–T09, 986 masked cells corresponded to 1093 stays in 2019 and 1169 cells to

1334 stays in 2024; cells with in-hospital death corresponded exactly to deaths in 2019 (178 vs 178) and almost exactly in 2024 (130 vs 132). The mean value of a masked cell was 0.99–1.23 stays depending on the group, 1.09 in A01 and 1.12 in T07. In the main analysis, masked cells in groups T01–T09 were assigned the group-specific mean of 2019 and 2024 (1.0 for death cells) and masked cells in other groups the value 1; counts in those groups are therefore conservative. In a sensitivity analysis of the 2022–2025 data, all masked cells were set to 4.

The 17 adult trauma centres were taken from the Ministry of Health list [2]. The NIP of each centre was obtained from two independent sources, validated with the NIP check-digit algorithm and confirmed by its presence in the data set with stays in the T groups. Because the NIP identifies the legal entity, results for one centre include its satellite hospital. Data were processed in Python 3 with pandas 2.3.3.

Gap assessment and comparison with registries

Each requirement was mapped against public data (open data, portals, reports) and individual-level data obtainable on request (NFZ claims; hospital morbidity records collected on form MZ/Szp-11 [17]). The gap was graded as none (available in public data in a usable form), small (public but aggregated only), moderate (only in individual-level data), large (only an indirect proxy) or critical (not recorded in any structured national source). The mapping and grading were performed by one author (PK), and the underlying data and sources were checked by a second author (ŁJ); the requirement text, the evidence found in Polish sources and the resulting grade are documented for each requirement in Additional file 1: Table S1 to allow verification. The Polish situation was compared with the TraumaRegister DGU [10], the Norwegian Trauma Registry [11], the Swedish Trauma Registry [12], the Trauma Audit and Research Network and its successor [13] and the ACS National Trauma Data Bank and TQIP [7, 8], using published descriptions and validation studies.

Statistical analysis

Data are presented as counts and percentages. Trauma centres were compared using indirect standardisation: the expected number of deaths was the sum over strata of JGP group and age group of the number of stays multiplied by the reference mortality. The reference was all 17 trauma centres for the comparison between centres (groups T01–T09) and all hospitals for the comparison of trauma centres with other hospitals (patients aged ≥ 18 years; groups A01, A02, A76 and T07, which are settled by both). Observed-to-expected ratios (O/E) are given with 95% confidence intervals based on Byar's approximation; centres were plotted on a funnel plot with 95% and 99.8% control limits around O/E = 1 [20]. Data for 2017–2025 were pooled. No formal hypothesis tests were performed.

Use of a large language model

An AI system (Claude, Anthropic) was used to search for and retrieve public data sources, write the data-processing scripts, perform the calculations and draft the manuscript. All sources, calculations and text were verified by the authors, who take full responsibility for the content.

Results

Data sources and gaps

Eleven public sources recording injured persons were identified; they cover separate segments of the care pathway and share no common identifier (Fig. 1). NFZ data cover all hospitals but contain no diagnoses at hospital level, while the NFZ statistics API provides diagnoses only as national aggregates without a hospital breakdown. Police data describe incidents (in 2025: 20 925 road traffic crashes, 1660 deaths and 24 590 injured persons, 7866 of them seriously [1]; in 2024: 444 drowning deaths [18]) but contain no clinical information; firearm statistics report offences, not injured persons [18]. No source contained AIS codes, physiological parameters on arrival, process times or outcomes after discharge, and no Polish hospital participated in the TraumaRegister DGU [10].

Of the 17 requirements, one was fully available in public data (discharge disposition including in-hospital death), one had a small gap (data from all hospitals, aggregated), one a moderate gap (NTDS inclusion criteria, which require individual ICD-10 diagnoses), four a large gap and nine a critical gap; one (registry data-quality plan) was not applicable (Table 1; Additional file 1: Table S1). The comparison with established registries is summarised in Table 2.

Table 1
Requirements of the ACS and the Utstein template mapped against Polish data sources

Requirement	Source	Public data	Individual-level data	Gap
System trauma registry covering the whole continuum of care	White Book, Element 7	Absent	Absent	Critical
Data from all hospitals treating injured patients	White Book, Element 5	NFZ, all hospitals, aggregated	Available	Small
Integration with vital statistics, law enforcement, rehabilitation	White Book, Element 7	Absent	Death dates linkable by personal ID; no key to Police data	Large
NTDS inclusion criteria (S00–S99, T07, T14 plus admission, transfer or death)	NTDS 2026	No diagnoses in hospital-level data	ICD-10 main and secondary diagnoses	Moderate
AIS coding by certified coders; ISS/NISS	Standards 4.32–4.33; Utstein	Absent	Absent (approximation from ICD-10 only)	Critical
Physiology on arrival (SBP, pulse, RR, SpO_2, GCS)	NTDS; Utstein	Absent	Absent	Critical
Process times (call, EMS arrival, hospital arrival, CT, surgery)	NTDS; Utstein	Absent	Absent	Critical
Procedures with date and time	NTDS	ICD-9-CM codes without time	Codes and dates	Large
Hospital events (complications)	NTDS	JGP groups “with complications” only	Partly from secondary diagnoses	Large
Discharge disposition, in-hospital death, transfer	NTDS; Utstein	Available	Available	None
ICU and ventilator days	NTDS; Utstein	Absent	Partly (ICU stays)	Large
Over- and undertriage, interfacility transfer timeliness	White Book, Elements 5 and 9	Transfer counts without severity	No severity	Critical
TQIP process measures (VTE prophylaxis, transfusion, embolisation, time to craniotomy, withdrawal of care)	NTDS/TQIP	Absent	Absent	Critical

Requirement	Source	Public data	Individual-level data	Gap
Risk-adjusted benchmarking	Standard 7.4	Absent	Crude only (JGP group, age)	Critical
Registry data-quality plan; 80% of records within 60 days	Standards 6.1–6.2	Not applicable	Not applicable	–
Preventable death review and system performance improvement	White Book, Element 9	Absent	Absent	Critical
Annual public report on trauma system performance	White Book, Element 1	Absent	–	Critical

ACS, American College of Surgeons; AIS, Abbreviated Injury Scale; CT, computed tomography; EMS, emergency medical services; GCS, Glasgow Coma Scale; ICU, intensive care unit; ISS/NISS, (New) Injury Severity Score; JGP, Polish diagnosis-related groups; NFZ, National Health Fund; NTDS, National Trauma Data Standard; RR, respiratory rate; SBP, systolic blood pressure; TQIP, Trauma Quality Improvement Program; VTE, venous thromboembolism.

Table 2
Polish data compared with established trauma registries

Registry	Coverage	Inclusion	Severity and risk model	Reported measures
TraumaRegister DGU [10]	684 hospitals in 2024 (70 outside Germany, none in Poland); 30 754 patients in the basic group	MAIS ≥ 3, or MAIS 2 with death or ICU care	AIS; RISC III	Observed vs expected mortality per hospital; time to whole-body CT and to emergency surgery
Norwegian Trauma Registry [11]	Mandatory; all 38 trauma-receiving hospitals; ~9000 patients/year; completeness 92.2%	Trauma team activation or NISS > 12	AIS, NISS; 118 variables incl. 35 Utstein	Validated against patient records (AC1/ICC > 0.80)
SweTrau (Sweden) [12]	48 of 52 trauma-receiving hospitals (2018)	Trauma alert, NISS > 15, or secondary transfer within 7 days	AIS, NISS; Utstein	Validation: accuracy 85.8%; case completeness 100% for NISS > 15
TARN / National Major Trauma Registry (England and Wales) [13]	~ 400 000 patients 2007–2023	Stay ≥ 3 days, ICU, death or transfer, with qualifying injury	AIS, ISS; risk model	Risk-adjusted hospital outcomes
NTDB/TQIP (United States) [7, 8]	> 900 TQIP centres	NTDS criteria	AIS by certified coders; TQIP models	Risk-adjusted mortality, complications, processes of care
Poland	No registry; NFZ claims from all hospitals	No severity criterion; JGP groups	None	In-hospital death, transfers, length of stay; no risk adjustment

Injured patients in hospital data

In the injury-related groups, the conservative count of stays fell from 92 056 in 2017 to 60 818 in 2025, mainly in conservative treatment of injuries (T07) and minor head injury (A77), with a marked drop in 2020; the number of in-hospital deaths remained between 2915 and 3459 per year (Table 3). The proportion of patients aged ≥ 65 years increased steadily, both among stays and among in-hospital deaths (Fig. 2). In operative severe head injury (A01), the share of patients aged ≥ 65 years rose from 48.2% to 59.0% and in-hospital mortality was 23.4–28.4% in every year.

Table 3
Hospital stays and in-hospital deaths in injury-related JGP groups, 2017–2025

Year	Stays, all injury-related groups[a]	In-hospital deaths[a]	Mortality	Stays in multiple-injury groups T01–T09[b]	Share billed by trauma centres	Mortality in T01–T09
2017	92 056	3292	3.6%	1002	99.1%	15.6%
2018	82 656	3423	4.1%	1199	99.4%	12.8%
2019	73 024	3445	4.7%	1145	99.4%	15.5%
2020	55 235	3373	6.1%	1289	99.2%	13.3%
2021	53 984	3459	6.4%	1333	99.3%	11.8%
2022	57 533	3250	5.6%	1411	99.5%	10.8%
2023	60 681	3112	5.1%	1319	99.3%	8.9%
2024	61 786	3022	4.9%	1466	99.6%	8.9%
2025	60 818	2915	4.8%	1404	99.8%	9.3%

[a] Groups T01–T09, T07, A01, A02, A76, A77, H85; masked cells counted as 1 (conservative). [b] Masked cells calibrated against national API totals.

Multiple injuries and trauma centres

The multiple-injury groups T01–T09 comprised 1002–1466 stays per year and were billed almost exclusively by the 17 trauma centres (99.1–99.8%); two to six other hospitals billed a few stays each year. Mortality in these groups fell from 15.6% in 2017 to 9.3% in 2025, consistent with the API (15.6% in 2019, 8.9% in 2024).

In 2017–2025, trauma centres recorded 11 500 stays and 1336 deaths (11.6%) in these groups. Volume ranged from 10.6 to 299.5 stays per year of activity, and crude mortality from 4.6% to 31.8% (Additional file 2: Table S2). After standardisation for JGP group and age, O/E ranged from 0.49 (95% CI 0.38–0.61) to 2.10 (1.37–3.08); six centres lay outside the 95% and three outside the 99.8% control limits (Fig. 3). The two centres below the lower control limit had the lowest shares of craniotomy (1.6% and 1.9% of stays) and of onward transfers (1.0% and 1.8%).

Trauma centres and other hospitals

In adults, trauma centres treated 30.7% of stays with operative severe head injury (A01), 35.6% of operative head injury (A02), 10.2% of conservatively treated head injury with brain damage (A76) and 6.9% of conservatively treated injuries (T07); other stays were spread across 521 hospitals. In A01, mortality was 22.4% in trauma centres and 26.6% in other hospitals (O/E 0.89, 95% CI 0.85–0.92 vs 1.05,

1.03–1.07), but trauma centres transferred more patients onward (17.8% vs 11.9%). There was no difference in A76, whereas in T07 trauma centres had higher than expected mortality (Fig. 4). In the 2022–2025 sensitivity analysis, setting masked cells to 4 did not change O/E ratios materially.

Discussion

This study shows that Polish public data cover only one of the 17 data requirements set by the ACS without a gap, and that the elements on which trauma quality improvement rests – injury severity, physiology on arrival, process times and outcomes beyond discharge – are not recorded in any structured national source. At the same time, the data that do exist reveal three findings relevant to policy: injured patients in Polish hospitals are rapidly ageing, the multiple-injury groups of the payer's classification are in practice a trauma-centre product, and outcomes of trauma centres vary widely.

The gap is structural rather than technical. The White Book expects a trauma system registry spanning the whole pathway and integrated with vital statistics and law enforcement data [5], and European registries operationalise this through the Utstein data set [9]. In Norway and Sweden, participation is national and data quality has been validated against patient records [11, 12]; in Germany, a single registry covers more than 600 hospitals and reports risk-adjusted outcomes and process times to each of them [10]. Poland has the opposite configuration: complete coverage of hospitals through claims data, but no clinical content suitable for risk adjustment. Large sets of quality indicators for trauma care have been described [21]; with the current data, almost none can be calculated beyond crude in-hospital mortality and transfer rates.

The age shift is the most robust finding, because it does not depend on severity adjustment. Patients aged ≥ 65 years now account for almost half of injury-related stays and three quarters of in-hospital deaths, and more than half of patients undergoing intracranial surgery for major trauma. Trauma systems designed for young victims of road traffic crashes need pathways for older patients with low-energy injuries, and a future registry should capture comorbidity and frailty.

The finding that multiple-injury groups are billed almost exclusively by trauma centres means that these groups describe the activity of trauma centres rather than the epidemiology of major trauma. Their annual volume (about 1000–1500 stays) is far below the number of seriously injured road users alone [1]; most severely injured patients are therefore classified under other groups, typically by the dominant procedure, and cannot be identified in claims data without an injury severity score [22]. The variation between centres must be interpreted in this light. The centres with the lowest standardised mortality also had the lowest proportions of craniotomy and of onward transfers, which suggests that they include less severely injured patients in these groups; without AIS-based severity, differences in coding and case-mix cannot be separated from differences in quality.

The comparison with other hospitals is similarly ambiguous. Lower mortality of trauma centres in operative severe head injury coincided with more onward transfers, and their higher mortality in conservatively treated injuries is compatible with more severely injured patients managed without

surgery – which is why the ACS requires risk adjustment based on severity and physiology before hospitals are compared [6, 8].

Pending a registry, partial solutions exist. ICD-10-based severity measures, such as the ICD-derived Injury Severity Score with internationally comparable survival risk ratios, or mapping of ICD codes to AIS, can be calculated from individual-level claims data [23–25], although their agreement with registry-based scores is imperfect [26]. The NFZ already links its data with dates of death to report postoperative mortality for selected procedures [14], so 30-day mortality after injury could be produced with existing infrastructure. Mandatory coding of external causes would also make it possible to monitor specific mechanisms such as firearm injuries, which are currently visible only as offences in Police statistics [18].

Limitations

The study relied on aggregated public data in which almost all cells were masked; masked values were estimated and validated against national totals for two years, with close agreement for deaths, but hospital-level counts remain approximate. The JGP classification changed during the study period, and part of the fall in injury-related stays, including the abrupt changes in some groups and the drop in 2020, probably reflects coding rules and the COVID-19 pandemic rather than epidemiology. Only in-hospital deaths were available, and the unit of analysis was the hospital stay, so transferred patients were counted more than once. The NIP identifies the legal entity, which for one trauma centre includes a satellite hospital. The gap grading involved judgement, performed by one author; this was mitigated by verification of the underlying sources by a second author, explicit grade definitions and by documenting the evidence for every grade (Additional file 1: Table S1). Finally, the analysis reflects sources available in autumn 2026; individual-level data held by the NFZ or by trauma centres may contain more information than is publicly visible.

Conclusions

Polish public data can describe the volume, age structure and crude in-hospital outcomes of injured patients, and they show an ageing trauma population and wide variation between trauma centres. They cannot, however, measure the quality of trauma care as defined by the ACS, because injury severity, physiology, process times and post-discharge outcomes are not recorded. A national trauma registry based on the Utstein template and the NTDS, with AIS coding, linkage with mortality and pre-hospital data and an annual public report, is a prerequisite for risk-adjusted benchmarking of Polish trauma centres.

Abbreviations

ACS
American College of Surgeons
AIS

Abbreviated Injury Scale
API
application programming interface
CI
confidence interval
CT
computed tomography
ED
emergency department
EMS
emergency medical services
GCS
Glasgow Coma Scale
GUS
Statistics Poland
ICD-10
International Classification of Diseases, 10th revision
ICU
intensive care unit
ISS
Injury Severity Score
JGP
Jednorodne Grupy Pacjentów (Polish diagnosis-related groups)
LPR
Polish Medical Air Rescue
MAIS
maximum AIS
NFZ
Narodowy Fundusz Zdrowia (National Health Fund)
NIP
tax identification number
NISS
New Injury Severity Score
NIZP PZH-PIB
National Institute of Public Health – National Research Institute
NTDS
National Trauma Data Standard
O/E
observed-to-expected ratio
TARN

Trauma Audit and Research Network
TQIP
Trauma Quality Improvement Program
TR-DGU
TraumaRegister DGU.

Declarations

Ethics approval and consent to participate

The study protocol (registration no. KB/56/26) was submitted to the Bioethics Committee of the Military Institute of Medicine - National Research Institute, Warsaw, Poland. By Resolution No. 66/26 of 21 October 2026, the Committee determined that the study is not subject to review by the Bioethics Committee. The study used only publicly available, aggregated and anonymised data and published documents; no individual patient data were accessed, and consent to participate was therefore not applicable.

Clinical trial number

Clinical trial number: not applicable.

Consent for publication

Not applicable.

Availability of data and materials

All data analysed during this study are publicly available from the sources cited in the reference list [1, 14–16, 18]. Derived tables are included in this article and its additional files; the data-processing scripts are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Authors’ contributions

PK conceived and designed the study, collected and analysed the data, interpreted the results and wrote the manuscript. ŁJ verified the data and sources and contributed to the interpretation of the results. KK supervised the study, contributed to the interpretation of the results and critically revised the manuscript. All authors read and approved the final manuscript.

Acknowledgements

Not applicable.

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Figures

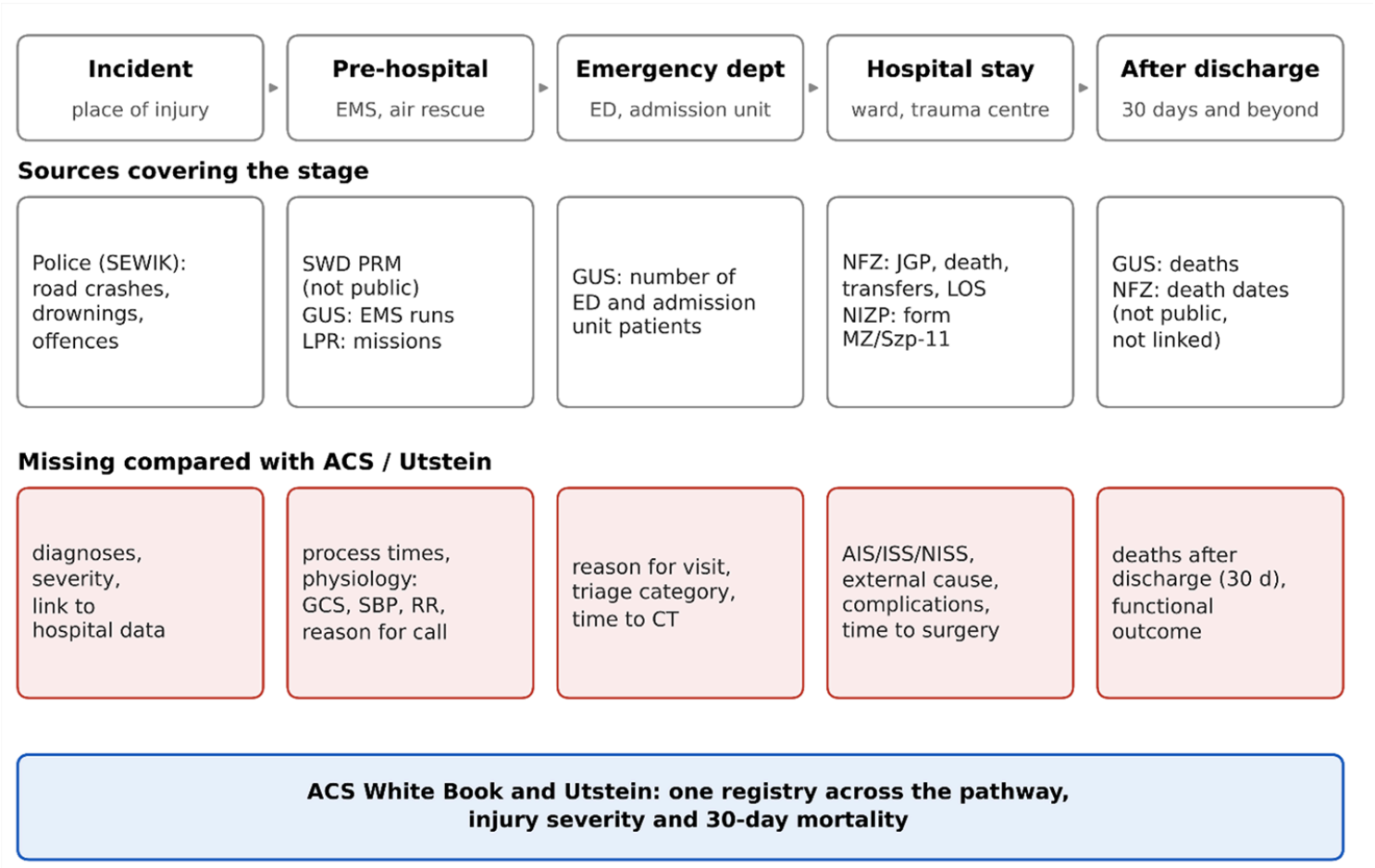

Figure 1

Polish data sources along the care pathway of an injured patient. For each stage of the care pathway, the upper row lists the Polish sources that record injured persons and the lower row the data elements that are missing compared with the ACS and Utstein requirements. ED, emergency department; EMS, emergency medical services; GUS, Statistics Poland; LPR, Polish Medical Air Rescue; LOS, length of stay; NIZP, National Institute of Public Health; SEWIK, Police road crash database; SWD PRM, EMS command support system; other abbreviations as in Table 1.

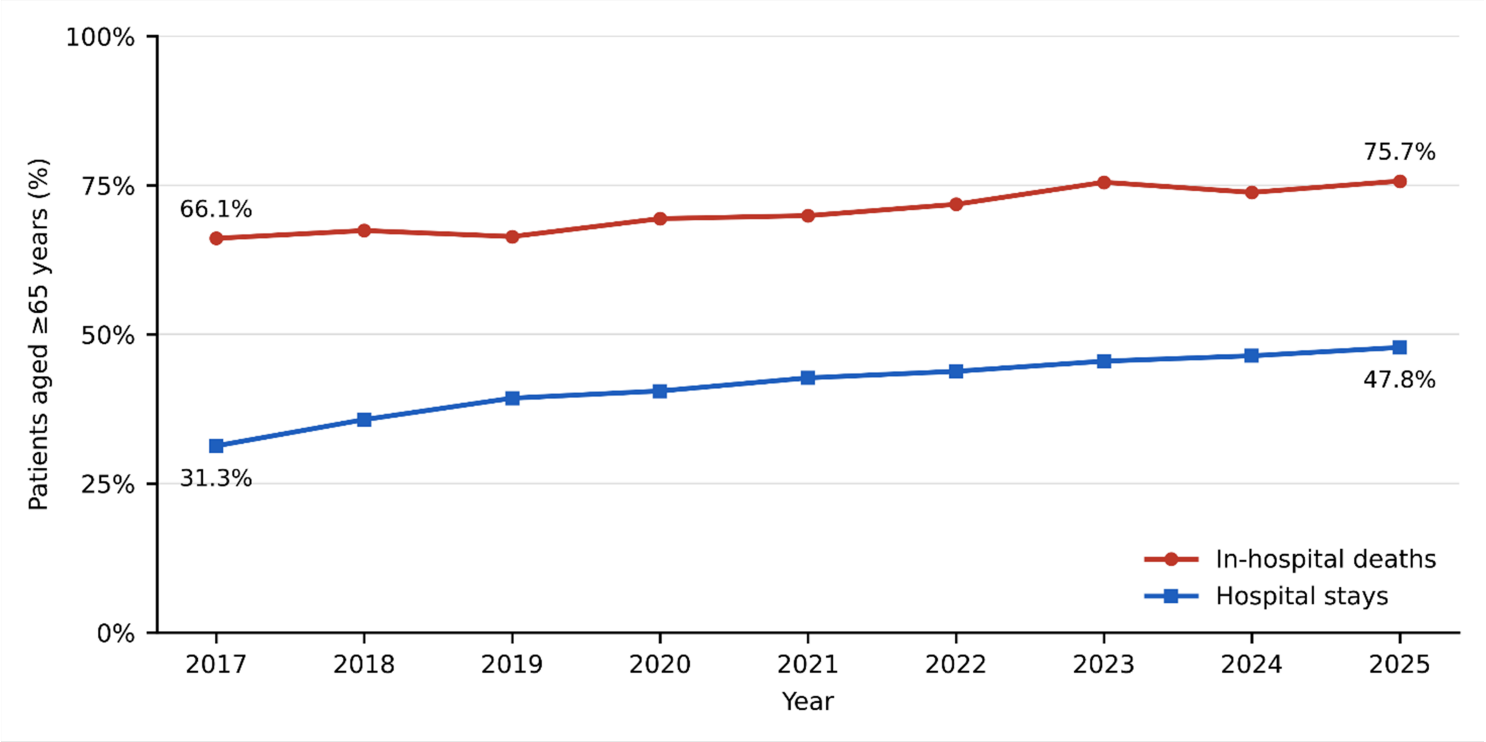

Figure 2

Patients aged ≥65 years among injury-related hospital stays and in-hospital deaths. Share of patients aged ≥65 years among hospital stays and in-hospital deaths in injury-related JGP groups (T01–T09, T07, A01, A02, A76, A77, H85), Poland, 2017–2025. Source: NFZ open hospital data (dane.gov.pl); masked cells counted as 1.

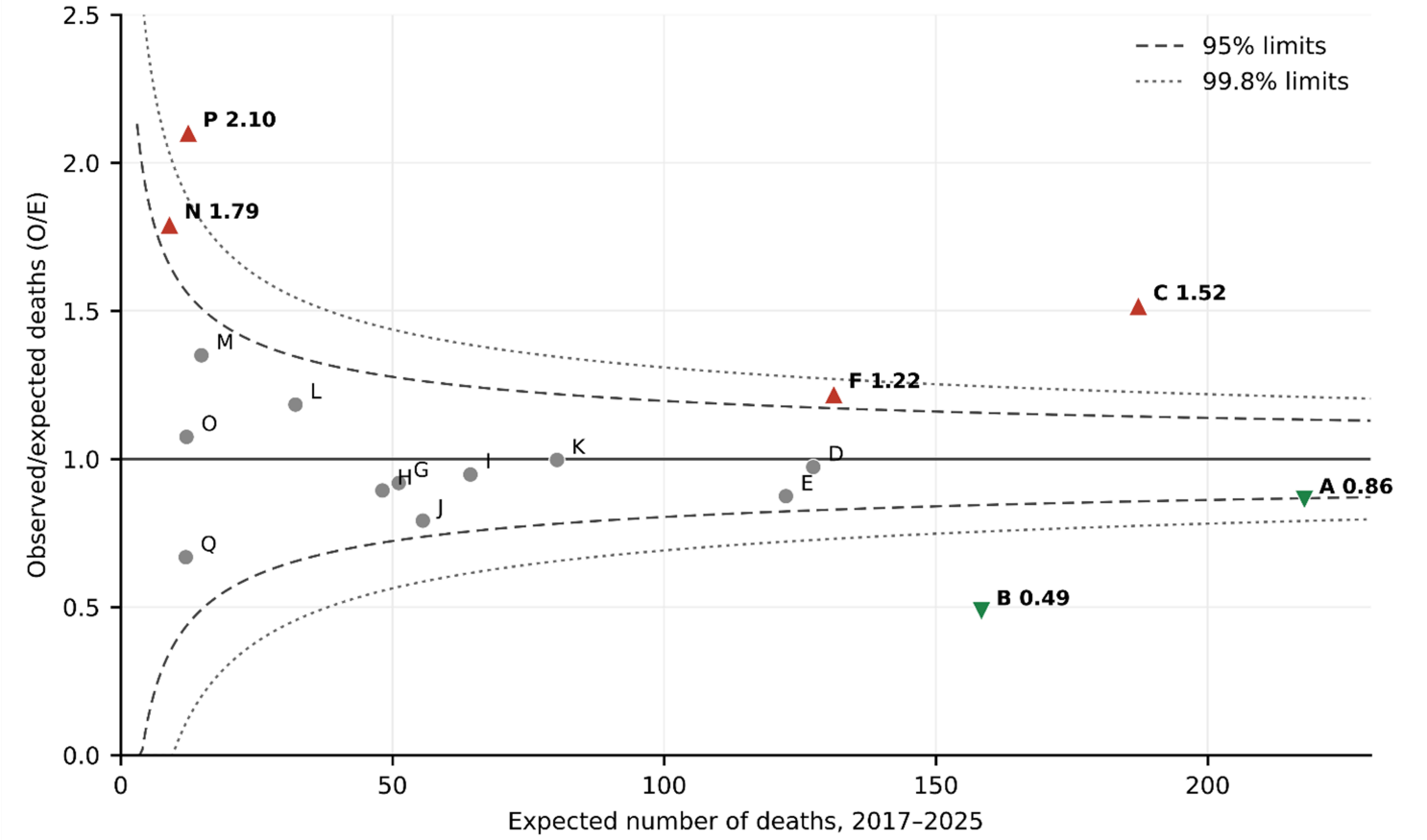

Figure 3

Funnel plot of standardised in-hospital mortality in the 17 adult trauma centres. Observed-to-expected deaths (O/E) in multiple-injury groups T01–T09, 2017–2025, standardised for JGP group and age against all trauma centres, plotted against the expected number of deaths. Dashed and dotted lines show 95% and 99.8% control limits around O/E = 1 (normal approximation to the Poisson distribution). Centres are labelled A–Q in order of decreasing volume; triangles mark centres above (red) and below (green) the 95% control limits. Masked cells were calibrated against national API totals.

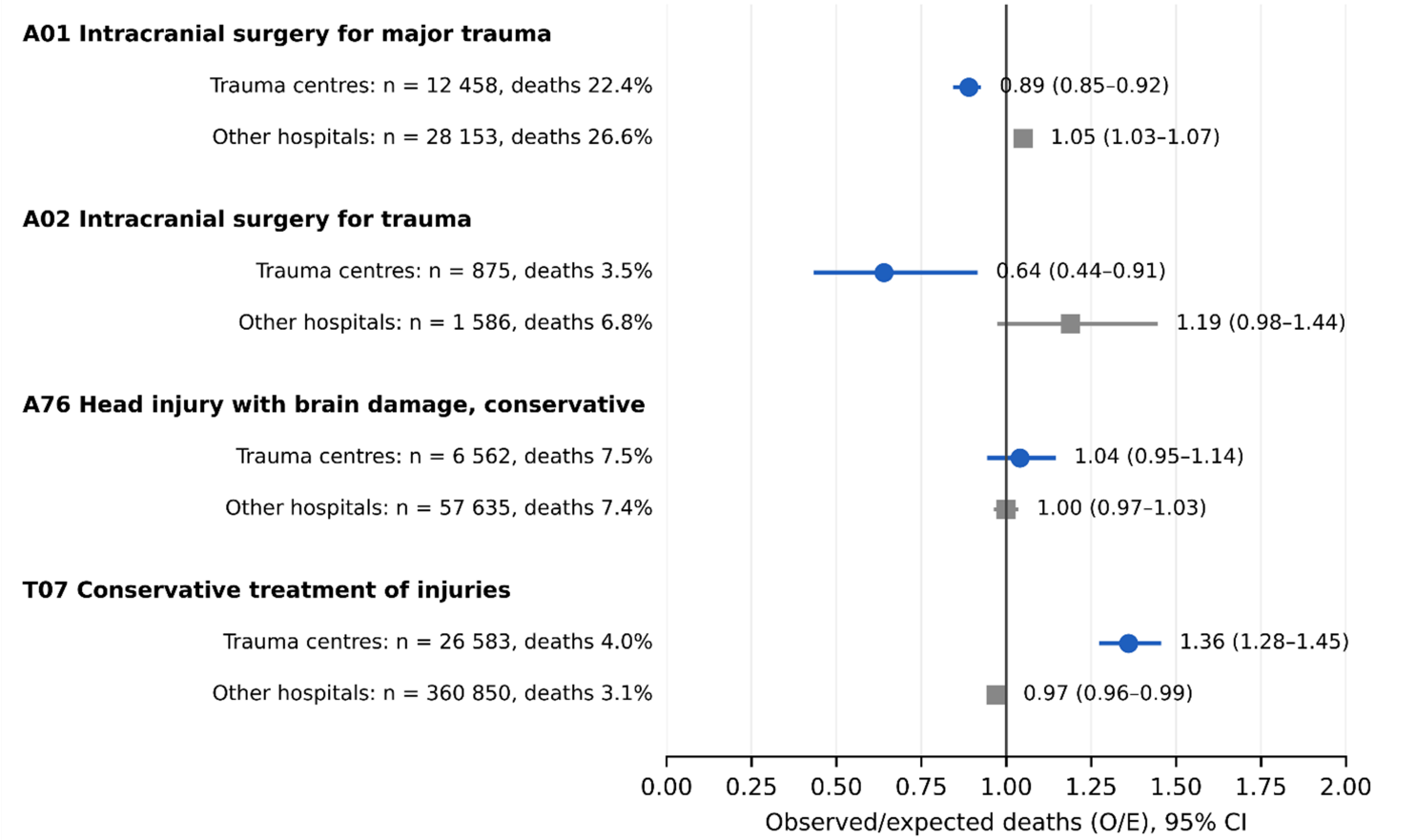

Figure 4

Standardised in-hospital mortality in trauma centres and other hospitals, adults. Observed-to-expected deaths (O/E) with 95% confidence intervals in injury-related JGP groups settled by both trauma centres (17) and other hospitals (521), patients aged ≥18 years, 2017–2025; standardised for JGP group and age against all hospitals. Source: NFZ open hospital data; masked cells counted as 1.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Additionalfile1TableS1.docx
- Additionalfile2TableS2.docx