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REVIEW ARTICLE

Mapping publications using the Japan Trauma Data Bank: Scoping review of the international literature

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Abstract

The purpose of this study was to describe the characteristics of published international literature using the Japan Trauma Data Bank (JTDB). We undertook a scoping review of studies using data from JTDB. We carried out a systematic search of the following databases on November 21, 2022, using search terms that covers trauma registries in Japan: MEDLINE, Web of Science, CINAHL, and Cochrane Library. Two authors independently abstracted the data. We included all original articles written in English. We identified 166 studies from the 456 included articles. From 2010 to 2016, the annual number of published articles was less than 10. In 2017, there were 10 articles published (6.0%). This increased to 18 (10.8%) in 2018, 21 (12.7%) in 2019, 28 (16.9%) in 2020, 33 (19.9%) in 2021, and 37 (22.3%) in 2022. Most articles ($n = 138$, 83.1%) reported in-hospital mortality as the primary outcome. There were more articles on the adult population ($n = 86$, 51.8%) than those on the pediatric population ($n = 21$, 12.7%). Twenty-one articles (12.7%) specified a mechanism of injury for the study population, and three articles (1.8%) focused on burns. Most articles did not specify injury sites for the study population ($n = 108$, 65.1%) and the most common injury site described in publications was the head ($n = 21$, 12.7%), followed by the abdomen ($n = 13$, 7.8%). We observed an increase in international publications using the JTDB and highlighted the major topics and knowledge gaps. Our findings could encourage studies to explore less studied areas in research using the JTDB.

KEYWORDS
international publication, Japan Trauma Data Bank, trauma registry

INTRODUCTION

Trauma registries provide epidemiological information on trauma care to health-care providers, researchers, and policymakers, and are being established in many parts of the world to accumulate evidence on trauma care.[1,2] The research activity varies among trauma registries throughout the world.[3] According to a systematic review published in 2016, the most active registry among regional, national, and international trauma registries was the National Trauma Registry in the United States, followed by the TraumaRegister of the German Trauma Society in Germany, and the Victoria State Trauma Registry in Australia.[4]

The Japan Trauma Data Bank (JTDB) is a nationwide voluntary hospital-based trauma registry that was established in 2003 by the Japanese Association for Surgery and Trauma (Trauma Surgery Committee) and the Japanese Association for Acute Medicine (Committee for Clinical Care Evaluation).[5] As of March 2022, 303 major emergency medical institutions including more than 80% of tertiary-care hospitals across Japan participated in the JTDB registry.[6,7] Data are collected from participating institutions

through the internet. In most cases, physicians and medical assistants who have completed the Abbreviated Injury Scale (AIS) coding course register patient data. The JTDB captures core information in trauma cases, including age, sex, mechanism of injury, Injury Severity Score (ISS), comorbidity, and mortality at discharge, as well as details on mode of transport, prehospital management, AIS code, emergency procedures, angiography, operations, and complications.

The JTDB is comparable to foreign trauma registries, and various studies have been published using the JTDB.[4,8,9] However, it is unclear in which areas research papers using the JTDB, among the international community, are flourishing, and whether there are areas that have not received attention as targets. The purpose of this review was to systematically map published international literature using the JTDB and determine the current distribution of focused patient characteristics.

METHODS

Protocol

We undertook a scoping review and developed our protocol in accordance with the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Statement.[10]

Eligibility criteria

We included original articles that assessed patient characteristics and outcomes recorded in the JTDB, were written in English, and were published in peer-reviewed journals without a limit on publication date. We excluded review articles, conference abstracts, letters, and unavailable articles.

Information sources and search strategy

To identify potentially relevant documents, the following bibliographic databases were searched on November 21, 2022: MEDLINE, Web of Science, CINAHL, and Cochrane Library. There were no date or language restrictions placed on the search. The search strategies were developed using the following key words: "trauma registr*", "trauma database*", "trauma databank*", "trauma data bank*", and "Japan", modified with the method described by O'Reilly et al.[3] The search strategies for each database can be found in Table S1.

Selection of sources of evidence

The search results were imported into Covidence software (http://covidence.org) for duplicate removal and screening. Two reviewers (S.N., H.I.) systematically screened study titles and abstracts, followed by the full text, using the inclusion and exclusion criteria. Discrepancies between reviewers were discussed after each stage of screening and resolved together.

Data charting process and data items

Data extraction was carried out by one reviewer (S.N.) and verified by a second (H.I.). Extracted data included published year, target age group, target mechanism of injury, target injury region, target severity, primary outcome, affiliation of first author, gender of first author, affiliation of corresponding author, statistical methods to control for confounding, methods for handling missing data, use of machine learning techniques, statistical software, and journal title.

Synthesis of results

We summarized the characteristics of target populations including target age group, target mechanism of injury, target injury region, target severity, and primary outcome, along with the author information, statistical methods, and journal titles. Published year was categorized into four periods: from the first year of publication to 2013, from 2014 to 2016, from 2017 to 2019, and from 2020 to 2022. Target age group was classified as adults, children, or unspecified. Target severity was classified as ISS ≥16, ISS ≥9, or unspecified with ISS. We categorized affiliation of authors as university-affiliated hospital or community hospital.

RESULTS

Selection of sources of evidence

After removing duplicates, we identified a total of 222 articles from electronic databases. Based on the title and abstract, we excluded 44 articles, leaving 178 full-text articles to be assessed for eligibility. Of these, 12 were excluded for the following reasons: four were duplicates, seven were not original articles, one did not use patient information in the JTDB, and one was not written in English. The remaining 166 studies were considered eligible for this review (Figure 1).

Characteristics of sources of evidence

The distribution of patient characteristics of interest is described in Table 1. The first available study was published in 2010, and the number of published studies has increased since then. From 2010 to 2016, the annual number of published articles was less than 10. In 2017, there were 10 articles published (6.0%). This increased to 18 (10.8%) in 2018, 21 (12.7%) in 2019, 28 (16.9%) in 2020, 33 (19.9%) in 2021, and 37 (22.3%) in 2022. More than half of the articles focused on adult population, while 12.7% focused on children.

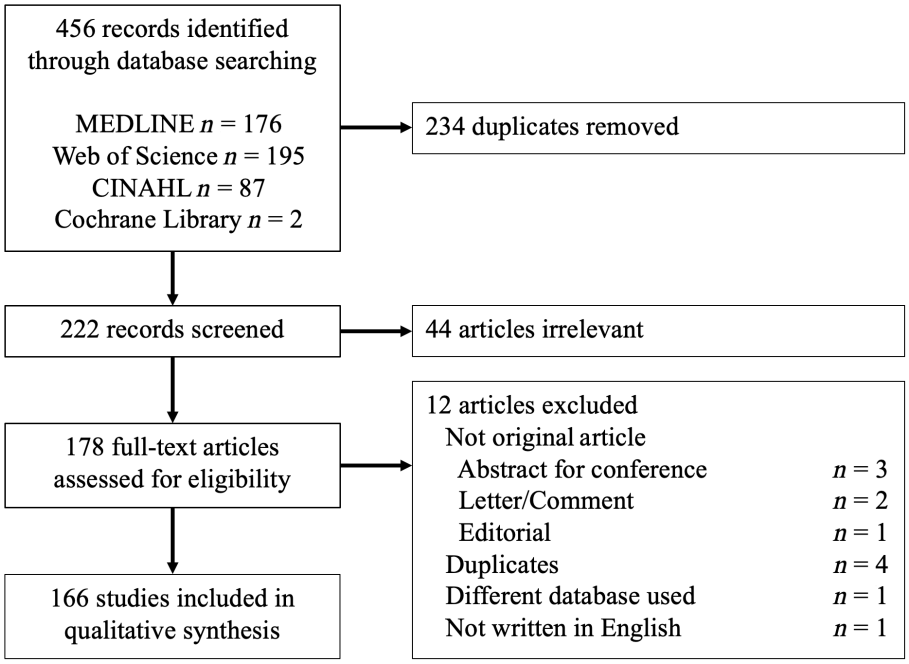

FIGURE 1 Flow diagram to summarize study selection of published articles that used the Japan Trauma Data Bank.

Although traffic injury was the most frequently studied mechanism of injury, most of the articles did not specify the mechanism. The head was the most frequently studied injury region, followed by the abdomen. None of the articles focused on neck injury, although cervical spine injury was categorized under spine. Most articles did not specify the severity of the target population using ISS. While most of the articles considered mortality as the primary outcome, other articles focused on intervention, diagnosis of injury, severity, complications, patient destination, length of time, patient volume, and documentation.

The information on authors' characteristics and statistical methods is presented in Table 2. The majority (80.1%) of the first authors belonged to university-affiliated hospitals, and 88.6% of the first authors were male. The most common statistical method used to control for confounding was logistic regression analysis, followed by the propensity score method. The most common method for handling missing data was deletion, followed by imputation. Machine learning techniques were used in two articles. The most popular statistical software was SPSS, followed by R.

The journal titles where the searched articles were published are listed in Table 3. The most popular journals for publication were *Acute Medicine & Surgery* and *European Journal of Trauma and Emergency Surgery*. Among 23 journal titles that had at least two articles, 12 were open access journals.

DISCUSSION

This structured literature review provides an international perspective on the contribution of the JTDB to building evidence on trauma care. We presented the distribution of the targeted population in international literature that used the JTDB, along with author information and journal titles for publications. Although a scoping review published in 2012 identified only one publication from the trauma registry in Japan, we identified 166 articles using the JTDB as of November 2022, indicating an increasing trend over time.[3] The increasing participation of emergency medical institutions in the JTDB, with coverage of more than 80% of tertiary-care hospitals across Japan, might have contributed to the increased utilization of the JTDB in research. Additionally, the growing prevalence of evidence-based medicine in trauma care in Japan might also account for this result.

While the number of publications utilizing the JTDB has been increasing, the value of the database might not be fully recognized in areas where there are relatively few publications. We observed a lower number of publications focused on the pediatric population, which may be understandable given that pediatric trauma patients account for less than 10% of the total patients registered according to annual reports of the JTDB.[7,11] We found that most of the eligible articles did not focus on a specific category of mechanism of injury. Therefore, there may be more room for analysis in the population that focuses on mechanism of injury. We found only one publication on injuries to the face and none on injuries to the neck, in the target injury region. However, according to annual reports on the JTDB, neck injuries were the least common injury recorded, while injuries to the face were more common than abdominal injuries.[7,11] These findings suggest that further research may be needed. While mortality was the primary outcome in most of the literature we reviewed, we observed that a variety of outcomes were

TABLE 1 Characteristics of target populations in published articles that used the Japan Trauma Data Bank.

Characteristic	Total $n = 166$
Published year	
2010–2013	9 (5.4)
2014–2016	10 (6.0)
2017–2019	49 (29.5)
2020–2022	98 (59.0)
Target age group	
Adults	86 (51.8)
Children	21 (12.7)
Unspecified	59 (35.5)
Target mechanism of injury	
Traffic injury	11 (6.6)
Falls	3 (1.8)
Sports-related injury	1 (0.6)
Injury by a falling/flying object	1 (0.6)
Penetrating injury	2 (1.2)
Burn	3 (1.8)
Unspecified	145 (87.3)
Target injury region	
Head	21 (12.7)
Face	1 (0.6)
Neck	0 (0.0)
Thorax	3 (1.8)
Abdomen	13 (7.8)
Spine	3 (1.8)
Pelvis/Lower extremity	2 (1.2)
Upper extremity	7 (4.2)
Multiple regions	8 (4.8)
Unspecified	108 (65.1)
Target severity	
ISS ≥ 16	21 (12.7)
ISS ≥ 9	22 (13.3)
Unspecified with ISS	123 (74.1)
Primary outcome	
Mortality	138 (83.1)
Specific intervention	9 (5.4)
Diagnosis of injury	4 (2.4)
Severity	2 (1.2)
Complications	6 (3.6)
Patient destination	2 (1.2)
Length of time	6 (3.6)
Patient volume	1 (0.6)
Documentation	1 (0.6)

Note: Data are shown as *n* (%).
Abbreviation: ISS, Injury Severity Score.

TABLE 2 Characteristics of authors' information and statistical methods applied in published articles that used the Japan Trauma Data Bank.

Characteristic	Total $n = 166$
Affiliation of first author	
University-affiliated hospital	133 (80.1)
Community hospital	33 (19.9)
Gender of first author	
Male	147 (88.6)
Female	19 (11.4)
Affiliation of corresponding author	
University-affiliated hospital	134 (80.7)
Community hospital	32 (19.3)
Statistical methods to control for confounding	
Logistic regression analysis	126 (75.9)
Cox regression analysis	10 (6.0)
Linear regression analysis	3 (1.8)
Propensity score method	40 (24.1)
Other method	18 (10.8)
No adjustment	23 (13.9)
Methods for handling missing data	
Deletion	118 (71.1)
Imputation	30 (18.1)
Not reported	18 (10.8)
Use of machine learning techniques	
Yes	2 (1.2)
No	164 (98.8)
Statistical software	
SPSS	59 (35.5)
STATA	32 (19.3)
SAS	6 (3.6)
JMP	24 (14.5)
R	39 (23.5)
EZR	19 (11.4)
Others	3 (1.8)
Not reported	3 (1.8)

Note: Data are shown as *n* (%).

selected depending on the research question. Although we did not evaluate the secondary outcomes in this review, our finding suggests that the JTDB has provided decent information on patient outcomes.

Regarding the author affiliation, most papers utilizing the JTDB were published by university-affiliated hospitals, which might suggest that these institutions have more research resources. However, this also suggests that community hospitals are capable of publishing literature in internationally recognized journals and making

TABLE 3 Distribution of the number of articles published that used the Japan Trauma Data Bank, by journal title.

Journal title	Society or region	Open access	*n* (%)
Acute Medicine & Surgery	Japanese Association for Acute Medicine	Since 2017	13 (7.8)
European Journal of Trauma and Emergency Surgery	European Society for Trauma and Emergency Surgery	Hybrid	13 (7.8)
World Neurosurgery	World Federation of Neurosurgical Societies	Hybrid	9 (5.4)
Critical Care	England	Since 1998	8 (4.8)
Journal of Trauma and Acute Care Surgery	American Association for the Surgery of Trauma	Hybrid	8 (4.8)
Scientific Reports	England	Since 2011	8 (4.8)
Injury	British Trauma Society, Australasian Trauma Society, Saudi Orthopedic Association in Trauma	Hybrid	7 (4.2)
Scandinavian Journal of Trauma Resuscitation & Emergency Medicine	Norwegian Air Ambulance Foundation	Since 2008	7 (4.2)
American Journal of Emergency Medicine	United States	Hybrid	6 (3.6)
BMC Emergency Medicine	England	Since 2001	6 (3.6)
BMJ Open	England	Since 2011	6 (3.6)
Journal of Clinical Medicine	Switzerland	Since 2012	6 (3.6)
World Journal of Surgery	International Society of Surgery	Hybrid	6 (3.6)
Medicine (Baltimore)	United States	Since 2014	5 (3.0)
PLoS ONE	United States	Since 2006	5 (3.0)
Trauma Surgery & Acute Care Open	England	Since 2016	4 (2.4)
Journal of the American College of Surgeons	American College of Surgeons	Hybrid	3 (1.8)
Journal of Orthopedic Science	Japanese Orthopedic Association	Hybrid	3 (1.8)
Journal of Pediatric Surgery	Section on Surgery of the American Academy of Pediatrics, British Association of Pediatric Surgeons, the American Pediatric Surgical Association, Canadian Association of Pediatric Surgeons, Pacific Association of Pediatric Surgeons	Hybrid	3 (1.8)
World Journal of Emergency Surgery	World Society of Emergency Surgery	Since 2006	3 (1.8)
Air Medical Journal	Association of Air Medical Services, Air Medical Physician Association, Air & Surface Transport Nurses Association, National EMS Pilots Association, International College of Advanced Practice Paramedics	Hybrid	2 (1.2)
Emergency Medicine Journal	Royal College of Emergency Medicine	Hybrid	2 (1.2)
World Journal of Pediatric Surgery	Children's Hospital, Zhejiang University School of Medicine	Since 2018	2 (1.2)

Note: The following journals had one article in each: *American Journal of Surgery*, *Anesthesia*, *Annals of Emergency Medicine*, *Annals of Plastic Surgery*, *BMC Neurology*, *Bone and Joint Journal*, *Burns*, *Chest*, *Children (Basel)*, *Cureus*, *Frontiers in Immunology*, *Healthcare (Basel)*, *International Journal of Injury Control and Safety Promotion*, *International Journal for Quality in Health Care*, *Journal of the American College of Emergency Physicians Open*, *Journal of Burn Care & Research*, *Journal of Emergencies, Trauma, and Shock*, *Journal of Hand Surgery Asian-Pacific volume*, *Journal of Neurosurgery*, *Journal of Neurotrauma*, *Journal of Nippon Medical School*, *Journal of Orthopedic Surgery and Research*, *Journal of Rural Medicine*, *Journal of Vascular and Interventional Radiology*, *Pediatric Critical Care Medicine*, *Prehospital and Disaster Medicine*, *Psychiatry Research*, *Public Health*, *Spine*, *and Surgery Today*.

valuable contributions to research on trauma care. We found a gender disparity in the first authorship of the eligible literature. Previous literature published from Japan in 2018 showed a gender gap in authorship for Japanese cardiovascular journals, and the representation of women was low.[12] Although this result could be attributed to a limited number of female researchers, it is essential for our community to overcome all possible obstacles and promote women's involvement in all facets of scientific production.[13–15]

We also observed that the most common statistical methods to control for confounding was logistic regression analysis, followed by propensity score methods. Propensity score methods can be a suitable option to address imbalances when there are seven or fewer events per confounder, whereas logistic regression may be preferred when the number of events per confounder is eight or higher.[16] A recent article suggests that logistic regression analysis could often be a preferable choice in terms of simplicity and performance for large observational studies using nationwide registries.[17] Missing data is one of the major disadvantages of research using registry data, which is common to all large databases.[18] Research teams should carefully choose the statistical methods for analysis depending on their research objectives. Although we found only two articles using machine learning methods, data science can have a significant impact on

registry research[19–21] Clinicians also need to have a deeper understanding of it and collaboration between clinicians, statisticians, and data scientists may be crucial for effective data analysis.[22] Publications using the JTDB were seen in a variety of internationally recognized journals. As many publications were in open access journals, securing research funding might be a consideration.

A scoping review utilizing a single registry, such as this study, could enhance our understanding of the characteristics of that registry, identify areas that may not have been fully analyzed by researchers, and contribute to more effective utilization of the registry. Undertaking similar studies not only in trauma registries but also in nontrauma registries could be valuable.

This study examined articles utilizing the JTDB, which differs from other nationwide trauma registries in several aspects. A previous study that reported an international comparison of trauma registries discussed differences in trauma systems, distribution of mechanism of injury, and population distribution. These characteristics of the JTDB as a nationwide database might influence researchers' interest and utilization of the data.

Limitations

There are several limitations in this review. First, it is possible that the search strategy might not be sufficient due to the lack of advice from a librarian, and some articles may have been missed. However, the number of obtained articles were greater than the number of articles listed in the JTDB bibliography as of December 2022.[23] Therefore, it can be considered sufficiently comprehensive. Second, as the publication of articles using the JTDB is increasing rapidly, we could have missed articles that had already been published but were not indexed in the databases searched on the date of the search. Finally, as we did not assess the appropriateness of the methodology in each study, the distribution of the methodology was not represented by the appropriate analyses.

CONCLUSIONS

We observed an increase in international publications using the JTDB and highlighted the major topics and knowledge gaps. Our findings could encourage further research using the JTDB to improve trauma care. The JTDB still has many areas of research and unexplored analytical methods and will continue to be a valuable resource for clinicians, researchers, and policymakers, contributing to the advancement of trauma care.

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CONFLICT OF INTEREST STATEMENT

Authors declare no conflict of interest for this article.

DATA AVAILABILITY STATEMENT

The database we created to record characteristics of the 166 articles analyzed is available from the corresponding author, SN, upon reasonable request.

ETHICS STATEMENTS

Approval of the research protocol: N/A.

Informed consent: N/A.

Registry and registration no. of the study/trial: This study was not registered.

Animal studies: N/A.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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