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Rapid Short communications

Current status and future prospects of the Japanese orthopaedic association national registry (JOANR), Japan's first national registry of orthopaedic surgery

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ABSTRACT

The Japanese Orthopaedic Association National Registry (JOANR) is Japan's first national registry of orthopaedic surgery, which has been developed after having been selected for the Project for Developing a Database of Clinical Outcome approved by the Health Policy Bureau of the Ministry of Health, Labour and Welfare. Its architecture has two levels of registration, one being the basic items of surgical procedure, disease, information on surgeons, surgery-related information, and outcome, and the other being detailed items in the affiliated registries of partner medical associations. It has a number of features, including the facts that, because it handles medical data, which constitute special care-required personal information, data processing is conducted entirely in a cloud environment with the imposition of high-level data security measures; registration of the implant data required to assess implant performance has been automated via a bar code reader app; and the system structure enables flexible collaboration with the registries of partner associations. JOANR registration is a requirement for accreditation as a core institution or partner institution under the board certification system, and the total number of cases registered during the first year of operation (2020) was 899,421 registered by 2,247 institutions, providing real-world evidence concerning orthopaedic surgery.

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Evidence-based medicine is achieved by obtaining high-level evidence from randomized controlled trials (RCTs) and their meta-analyses, but this has the disadvantage that, when strict inclusion criteria are applied to the patients enrolled in RCTs, their results are not necessarily clinically applicable to diseases that affect patients from varying backgrounds. RCTs of surgical treatments are particularly difficult to implement because of numerous issues, including patients' reluctance about randomization, difficulties in blinding, and the need for long-term follow-up [1]. Data-driven database studies, which discover a variety of phenomena from so-called "real-world data" obtained by gathering massive amounts of comprehensive information and collating it in database format, are attracting attention because they may be able to compensate for these defects of RCTs [2]. There is an increasing movement toward the creation of large-scale databases by clinical medical settings in Japan, and the Ministry of Health, Labour and Welfare (MHLW) is encouraging the development of large-scale databases (national registries) that can contribute to improving the quality of medical care and the choice of good-quality treatment methods in light of their cost-effectiveness. The objectives of medical information database construction are: (1) large-scale medical research using clinical "big data"; (2) policy responses such as calculating health insurance reimbursement points for medical care, new medical device development, and postmarketing surveillance; and (3) use for board certification systems. Many medical associations are therefore pressing ahead with constructing registries [3–5]. In this paper, the process of development of the Japanese Orthopaedic Association National Registry (JOANR), its current status, and its future prospects, are explained.

1. Development process

Orthopaedic registries have a long history in Europe, particularly Northern Europe, and many high-quality clinical studies have been reported for procedures including arthroplasty and spinal surgery [6,7]. In Japan, the Japanese Orthopaedic Association (JOA) began work on developing an arthroplasty registry in 2003. Pilot registration in the Japan arthroplasty register, Japan's first national orthopaedic registry, started in 2006. From 2011, its operation was transferred to the Japanese Society for Replacement Arthroplasty, and over 200,000 cases have been registered [8,9]. The JOA's response to the national push for registry development was to embark in 2017 on the development of a national registry for the comprehensive registration of orthopaedic surgeries, undertaken by the Case Investigation and Study Committee (with Morio Matsumoto as the responsible director and Hiroshi Taneichi as the committee chair; now renamed the Case Registry Committee) under the leadership of JOA President Masashi Yamazaki [10]. The Case Registry Committee took around a year for its careful consideration of matters, including the basic structure of the database, how best to collaborate with other affiliated registries, deciding which procedures were to be registered by which institutions, and the choice of system architecture vendor. In FY2018 the JOA was selected as one of the organizations implementing the Project for Developing a Database of Clinical Outcome approved by the Health Policy Bureau of the Ministry of Health, Labor, and Welfare (MHLW), and started system development with this assistance. Pilot registration of cases from the institutions with which the Case Registry Committee members were affiliated was conducted from 2019, when the online registration system was ready, and after system malfunctions and other errors had been corrected, the JOANR (https://www.joanr.org) was fully launched on April 1, 2020 [11,12]. The JOANR was approved by Medical Ethics Committee of the Japanese Orthopaedic Association.

2. Architecture and affiliated registries

The JOANR database architecture has two levels, with the first dealing with basic items and the second the detailed items used in the specialist areas of partner medical associations. As of 2022, the vertically affiliated registries comprise: the Japan Arthroplasty Register (JAR, which is the forerunner of the JOANR) [9]; the Japan Orthopaedic Society of Knee Arthroscopy and Sports Medicine (JOSKAS) arthroscopic surgery registry (JOSKAS eNOTE) [13]; the Japanese Society for Spine Surgery and Related Research (JSSR) database (JSSR-DB); Ossification of the Spinal Ligament Case Registry operated by Ossification of the Spinal Ligament Research Team as a Research on Rare and Intractable Diseases funded by a Health and Labour Sciences Research Grant; and the Japanese Scoliosis Society Early-Onset Scoliosis Case Registry (this system is currently under development and its name has yet to be finalized). There is one horizontally affiliated registry, the Japanese Spinal Instrumentation Society (JSIS) Database (JSIS-DB) [14,15].

3. Registered surgical procedures

The surgical procedures to be registered are the 580 orthopaedic surgical procedures listed on the JOANR website (https://www.joanr.org/about/jyutsushiki/touroku), which are mainly those given in the Clause 2, Musculoskeletal, Limbs and Trunk section of the health insurance reimbursement points table. According to the latest 7th National Database (NDB) open data (receipts for fees for medical care provided between April 2020 and March 2021) [16] published by the MHLW, approximately 1.28 million surgeries eligible for JOANR registration were conducted yearly. This is not far behind the approximately 1.5 million cases registered in the National Clinical Database (NCD), Japan's largest national registry for surgical operations, in 2018 [3].

4. Items registered

There is a trade-off between the registration rate and the number of items to be registered, with the former decreasing as the number of items increases and the content becomes more complicated [9,11,12]. To guarantee the completeness of registration, in order to reduce the burden on the person undertaking the registration, the basic items to be registered in the JOANR are limited to eight: surgical procedure, disease name, information on surgeons, operating time, anesthesia time, number of nurses, number of technicians, and postoperative outcome. In the pursuit of completeness, JOANR registration has also been made obligatory as a condition for the accreditation of core institutions and partner institutions under the new board certification system.

4.1. Basic items

The basic items comprise only a few selected items required (1) as evidence for health insurance reimbursement calculations and (2) as information for the list of surgical cases required to apply for or renew board-certified specialist status. These provide sufficient information to identify national trends in musculoskeletal surgery. A strength of the JOANR is that revision surgeries (long-term outcomes) are traceable by using hash values, as described below. The details of each registered item are as follows.

1. Surgical procedure: When the K code for the surgical procedure concerned from the list of surgeries (Fig. 1) is selected, both this K code and the Medical Treatment Code from the Medical Treatment Master for use in electronic processing systems for receipts for health insurance claims generated and managed by

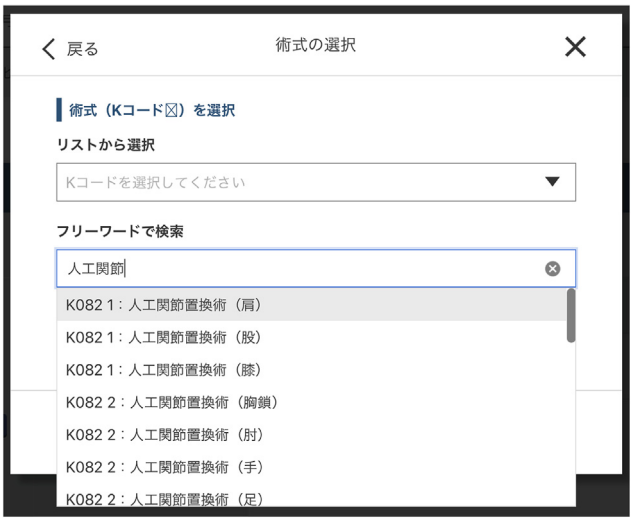


Fig. 1. Surgical procedure selection screen on JOANR web registration site (written in Japanese)
When part of the name of the surgical procedure is typed in, a list of the corresponding K codes is displayed. This list is linked to the Medical Treatment Master for use in electronic processing systems for receipts for health insurance claims generated and managed by the Health Insurance Claims Review and Reimbursement Services. Hence, just by clicking the appropriate surgical procedure from this pull-down list, both the K code and the Medical Treatment Code can be registered. This can simplify the step to specify the detailed surgical procedure among the multiple procedure names held by the same K code (ie., K082 1 is allocated to total arthroplasty, in which the shoulder, hip, and knee are involved.).

the Health Insurance Claims Review and Reimbursement Services are registered in the database. The use of Medical Treatment Codes overcomes the disadvantage of K codes whereby multiple different surgical procedures are allocated a single code.

2. Disease name: A user-friendly system has been adopted whereby when a disease name familiar to clinicians and data managers (such as health information managers) is input (even partially), a list of disease names created from the "Disease Descriptions" standard disease name table of the ICD-10-based Standard Disease Code Master produced by the Medical Information System Development Center (MEDIS-DC) is displayed, and the person carrying out the registration chooses the most appropriate disease name to register from the list. The ICD-10 code for the registered disease is also registered simultaneously, enabling international data comparisons.
3. Surgeon/Assistant: Because the JOANR is associated with the JOA membership management system, when registering the surgeon and assistant(s), a list of affiliated doctors is displayed for each medical institution as a pull-down menu, so that all that is necessary is to select from this. Because it is synchronized with the membership management system, the numbers of years of experience of the surgeon and assistant(s) are also automatically registered.
4. Other: The operating time, anesthesia time, numbers of nurses and technicians involved in the surgery, and simple outcome 30 days postoperatively, which are standard information for the health insurance reimbursement calculations, are also registered.

4.2. Detailed items

RCTs are unsuitable as studies for the clinical outcomes of surgical treatment because of the difficulties in standardizing the performance of surgical procedures, and when strict inclusion criteria are applied, their results are not necessarily clinically applicable to diseases that affect patients from varying backgrounds. Using real-world data from large-scale registries is thus highly advantageous for studies in this field [10]. The system architecture of the JOANR is scalable, with a view to enabling the provision of data for medical research in a wide range of fields, and the second-level registration data (detailed items) can be set as desired by each medical association operating a database. For example, the JAR has been designed with a focus on the registration of implant data, such as lot number and catalog number, with the goal of evaluating implant performance. In contrast, because the JSSR-DB deals with spinal surgery, in which permanent sequelae such as neurological complications are an issue, it has been designed with complications and how they are handled as its main focus. Where spinal ligament ossification (Ossification of the Spinal Ligament Case Registry) and early-onset scoliosis (the provisionally named EOS-DB) are concerned, it is the long-term outcomes that are important, and registration items covering short-term to long-term treatment outcomes and complications have therefore been added. The JOANR is thus an amalgamation of several different registries, offering the possibility of unfettered system design for a range of purposes. It will also be feasible to add designs to follow up clinical effectiveness and safety in detail with restrictions on time periods and eligible patients, such as for the postmarketing surveillance of new medical devices, though this feature has yet to be implemented.

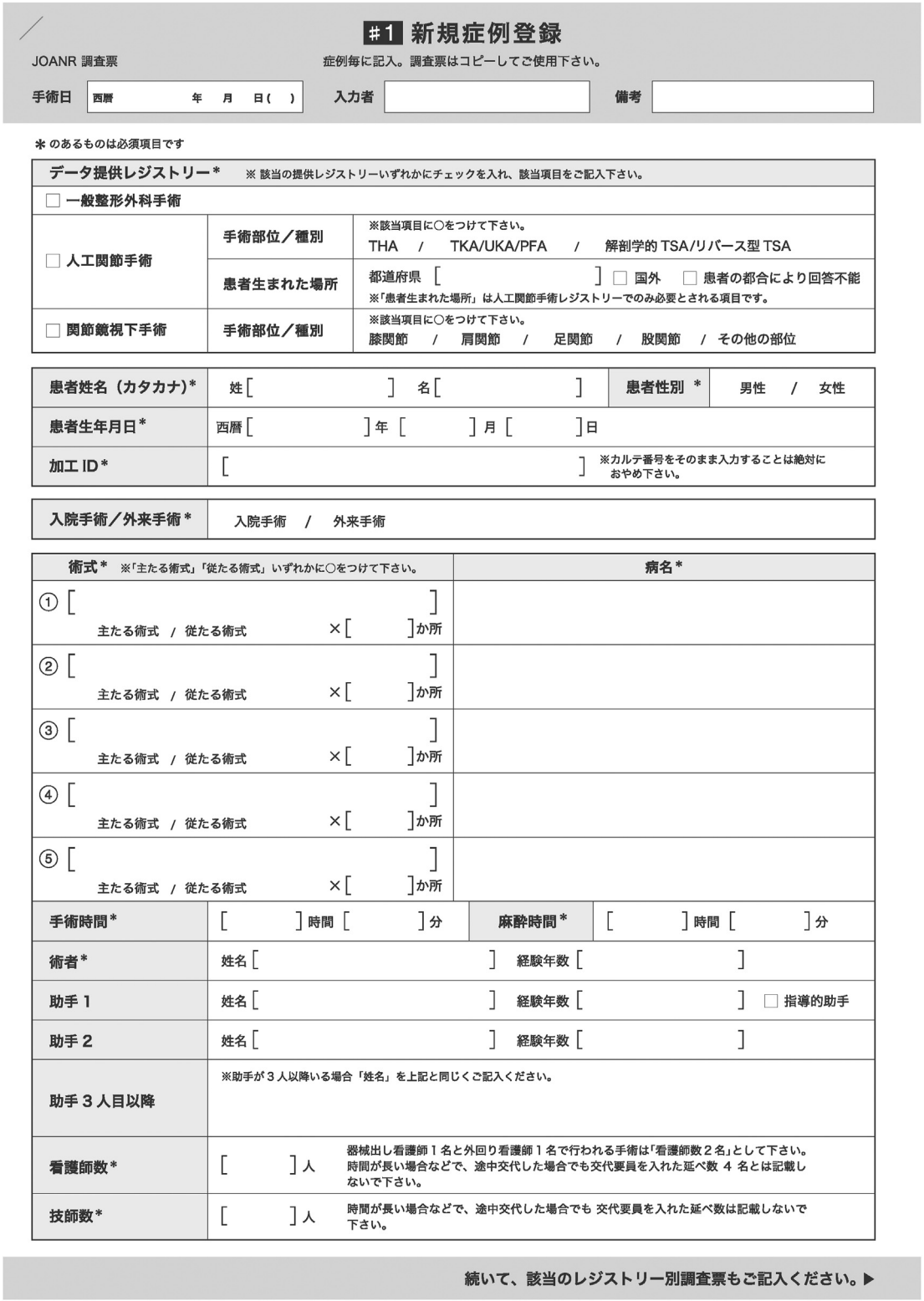
5. Registration procedure

Data registration takes places via a dedicated online registration site, and the practice in most large hospitals is for registration forms downloaded from the JOANR website (Fig. 2) to be filled out by surgeons (generally junior surgeons) in clinical settings, after which data managers carry out the registration based on the completed forms. The categories of people registering data in medical institutions are chief surgeons, full-time surgeons, part-time surgeons, and data managers, and they each have defined roles and privileges (Fig. 3). To assure the quality of the medical data collected from these information sources, approval by a chief surgeon or full-time surgeon is required for data finalization. Only a chief surgeon or full-time surgeon may change previously approved data.

6. Functions to guarantee database reliability

6.1. Information security

The JOANR does not store personal information that could identify individuals, such as names and medical record numbers, but does store information including date of surgery, age, sex, and medical institution code, which might enable an individual's identification when combined [11,12]. From the perspective of maintaining information security, the JOANR system does not permit data to be downloaded for analysis or data cleansing, with all these operations conducted in a cloud environment. Operations including management of login/logout to the cloud analysis environment, user scope/account settings/access privilege management, and network security management are subject to stringent security. Data analysis is conducted in the cloud analysis environment subject to strict security measures, and it is carried out by biological statisticians appointed by the JOA. Data cleansing is also conducted regularly by staff such as health information managers and healthcare information technologists appointed by the JOA, under a system in which the cleansing team is put together and supervised by several board-certified orthopaedic surgeons.



#1 新規症例登録

JOANR 調査票　　症例毎に記入。調査票はコピーしてご使用下さい。

手術日 西暦　　年　月　日(　)　入力者　　備考

＊のあるものは必須項目です

データ提供レジストリー＊ ※該当の提供レジストリーいずれかにチェックを入れ、該当項目をご記入下さい。		
□ 一般整形外科手術		
□ 人工関節手術	手術部位／種別	※該当項目に○をつけて下さい。 THA / TKA/UKA/PFA / 解剖学的 TSA/リバース型 TSA
	患者生まれた場所	都道府県 [　] □ 国外 □ 患者の都合により回答不能 ※「患者生まれた場所」は人工関節手術レジストリーでのみ必要とされる項目です。
□ 関節鏡視下手術	手術部位／種別	※該当項目に○をつけて下さい。 膝関節 / 肩関節 / 足関節 / 股関節 / その他の部位

患者姓名（カタカナ）＊	姓[　] 名[　]	患者性別 ＊	男性 / 女性
患者生年月日＊	西暦[　]年[　]月[　]日		
加工 ID＊	[　] ※カルテ番号をそのまま入力することは絶対におやめ下さい。		

入院手術／外来手術＊	入院手術 / 外来手術

術式＊ ※「主たる術式」「従たる術式」いずれかに○をつけて下さい。	病名＊
①[　] 主たる術式 / 従たる術式 ×[　]か所	
②[　] 主たる術式 / 従たる術式 ×[　]か所	
③[　] 主たる術式 / 従たる術式 ×[　]か所	
④[　] 主たる術式 / 従たる術式 ×[　]か所	
⑤[　] 主たる術式 / 従たる術式 ×[　]か所	

手術時間＊	[　]時間[　]分	麻酔時間＊	[　]時間[　]分
術者＊	姓名[　] 経験年数[　]		
助手 1	姓名[　] 経験年数[　] □ 指導的助手		
助手 2	姓名[　] 経験年数[　]		
助手 3 人目以降	※助手が 3 人以降いる場合「姓名」を上記と同じくご記入ください。		
看護師数＊	[　]人	器械出し看護師 1 名と外回り看護師 1 名で行われる手術は「看護師数 2 名」として下さい。時間が長い場合などで、途中交代した場合でも交代要員を入れた延べ数 4 名とは記載しないで下さい。	
技師数＊	[　]人	時間が長い場合などで、途中交代した場合でも 交代要員を入れた延べ数は記載しないで下さい。	

続いて、該当のレジストリー別調査票もご記入ください。▶

Fig. 2. Forms to be filled out by hand (written in Japanese).
Users can download forms to be filled out by hand from the JOANR website. In clinical settings, it is common for surgeons to complete the required items on the form in the operating room or elsewhere, and for data managers to carry out online registration while referring to the form.

procedure category	detailed procedures	JOA member			JOA non-member
		chief surgeons	full-time surgeons	part-time surgeons	data manager
member management	reference of member list	✓	✓	✓	✓
	member approval	✓			
	data manager invitation	✓	✓		
	member deletion	✓			
case management	reference of case list	✓	✓	✓	✓
	case registration	✓	✓	✓	✓
	modification of processing ID	✓	✓		✓
	temporary storage of cases	✓	✓	✓	✓
	completion of case registration	✓	✓	✓	✓
	case approval	✓	✓		
	modification of approved case	✓	✓		
	temporary deletion of cases	✓	✓	✓	✓
	complete deletion of cases	✓			
institution management	reference of institution information	✓	✓	✓	✓
	editing institution information	✓			
profie management	browsing profile	✓	✓	✓	✓
	editing profile				✓
	application of 2nd or more institution	✓	✓	✓	

Fig. 3. User categories and privileges on web registration site.
The user categories and privileges at individual medical institutions can be viewed on the JOANR website. The data approval process is very important for the quality management of registered data. Data will not be registered in the database unless a chief surgeon or full-time surgeon confirms and approves the data on their own responsibility.

6.2. Quality management of medical data

In terms of the quality management of medical data, the system incorporates encoding and data cleansing in accordance with the MHLW notification on the reliability required of database operators [17].

(1) An adequate surgical procedure is selected from the K code list linked to Medical Treatment Codes and stored;
(2) An adequate disease name is selected from the ICD 10-based Standard Disease Code Master and stored;
(3) Information on surgeon and assistant(s) are selected from the list connected to JOA membership management system via application programming interface (API) and stored;
(4) Operating time is selected from the operating time list and stored. System alert issued when values outside the minimum and maximum permitted operating times specified by the JOA and partner medical associations are input;
(5) Numbers of nurses and technicians is selected from the number list and stored. Appropriate number should be selected according to designated rules for registration;
(6) Implant information: Registration of the Global Trade Item Number (GTIN) that is product identification code via a bar code reader (described below); and
(7) Data cleansing is regularly conducted. Cleansing of the JOANR basic items is conducted by several health information managers contracted by the JOA, who check appropriateness of combination of the disease name and surgical procedure, and healthcare information technologists, who check the other information and provide feedback to the registering institutions. The second-level data are also encoded and cleansed by the partner medical associations responsible, following the same procedure.

7. Functions to Improve the user convenience

7.1. Automated registration system (bar code information)

The JAR registers the type of arthroplasty (hip, knee, or shoulder) and implant information (including catalog number, manufacturer name, product name, and lot number). This is one of the most time-consuming operations of the JOANR, and the JOA has therefore developed an automated registration system to reduce the burden on users and improve data quality management via a bar code reader app (the JOANR Bar Code Reader) for use on smartphones (iOS or Android) [11,12]. This development was carried out with the assistance of the FY2020 Project for Developing a Database of Clinical Outcomes approved by the Health Policy Bureau of the MHLW. The implant bar code can be scanned with a smartphone in advance, whether in the operating room or elsewhere, and the saved bar code information (GTIN) can then be sent to the database during case registration. Details of how to download the app can be found on the JOANR website.

7.2. Surgical case list creation function for board certification application/renewal

Since FY2021, cases registered in the JOANR can be used to create the surgical case lists required for orthopaedic surgeons to apply for board certification. Surgical cases registered in the JOANR are imported into the JOA Board Certification Management System via API connection, and orthopaedic surgeons can easily create a case list table for their application by selecting the necessary cases from this case list (Fig. 4). In terms of its actual use, in FY2021, 215 of the 500 residents who took the board certification examinations used the JOANR to create a case list for their application, a 43% use rate. This function will be expanded in future to include surgical case registration for board certification renewal.

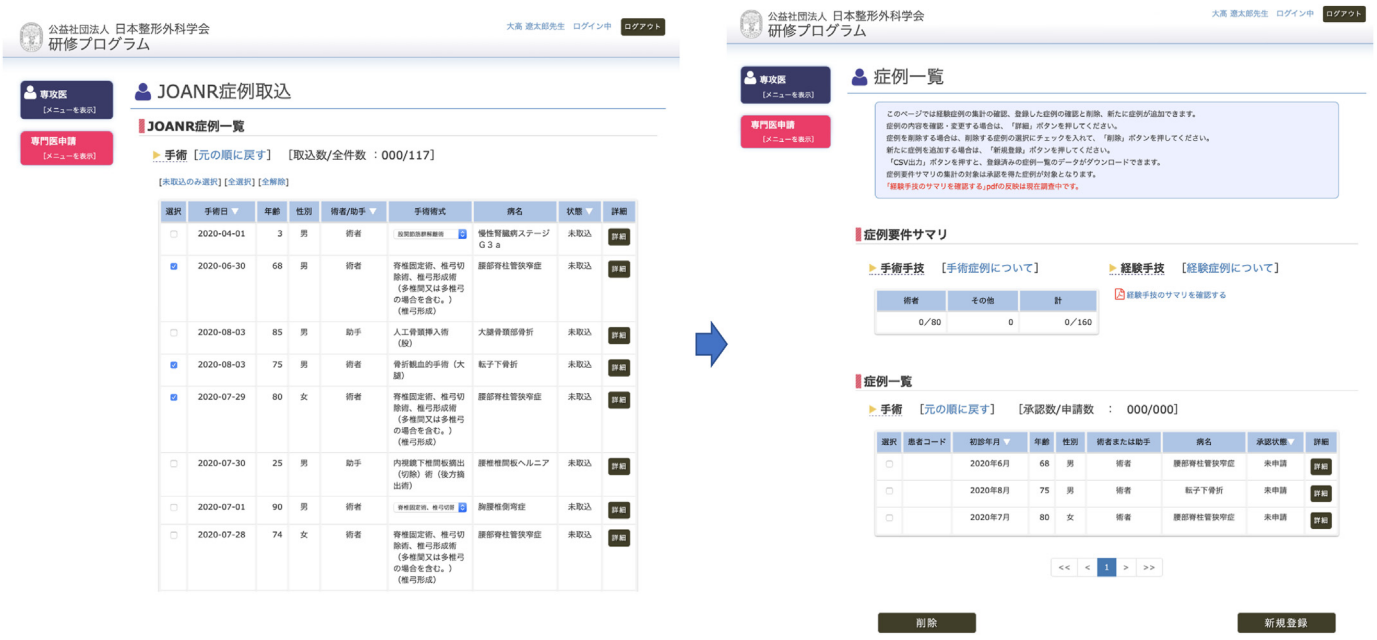


Fig. 4. Screen for "Surgical case list creation function for board certification application/renewal" (written in Japanese).
Orthopaedic surgeons can view a list of operations registered with the JOANR for which they were the surgeon or an assistant on their personal page on the JOA website. By clicking the surgical cases required for application and clicking the Import from JOANR button, a list of the cases required for application is automatically created on the board certification registration site. It must be noted that orthopaedic surgeons who started their training since FY2020 may only use cases registered with JOANR in their application.

7.3. Hospital-registered data download function

Since 2022, it has been possible for hospitals to download their own registered data. Users with Chief Surgeon privileges may now download data registered by their own institution, after completing two-factor authentication with a registered mobile phone. These data are in Comma Separated Values (CSV) file format and can be downloaded to cover specified periods for each registry. The use of data downloaded by multiple users for the same study is prohibited. Because joint studies using JOANR registered data must submit an official research application to the JOA and the medical association operating the registry and obtain their approval, caution is required when using this function.

8. Traceability of registered patients

Although every national arthroplasty registry specifies the simple, clear endpoint of revision surgery as an outcome, any large-scale database that does not register personal information for identifying individuals, such as name or medical record number, must have some special mechanism for tracing patients. The mechanism used for matching specific individuals in databases that do not include personal information is "hash values" [11,12]. In the JOANR, a 12-digit hash value generated from the patient's name (phonetic Japanese character reading), date of birth, and sex is stored in the database [11,12]. The names and dates of birth of patients input on the JOANR registration site are used solely for hash value generation and are not stored in the database. Once generated, the hash value is irreversible data, meaning that it cannot be decoded to reveal personal data such as name or date of birth.

Because the 12-digit hash values assigned to individuals with the same name, date of birth, and sex are the identical, individuals in a single database with the same 12-digit hash value are very likely to be the same person. This means that if individuals with the same hash value have undergone multiple surgeries, the probability that the second or subsequent operations are revision surgeries is extremely high. The way in which the hash value is calculated means that even if an individual's family name changes for a reason such as marriage, the final 7 digits of the 12 are still the same, so that people with the same final 7 digits are considered to be those with the same first name, sex, and date of birth. If it is suspected that an individual's family name alone may have changed due to marriage or divorce, this can be traced by confirming with the institution that provided the data. However, the facts that there may be some variation in name readings and that there will always be a certain number of typographical errors make 100% traceability impossible to guarantee. It will be helpful if other identifiers such as the Japanese government social security and tax number (known as "My Number") could be used in case registration in future.

9. Japanese and overseas orthopaedic registries

The orthopaedic-related registries that preceded the JOANR include: the Japanese Arthroplasty Registration System [9], the forerunner of the JOANR; the JOSKAS arthroscopic surgery registry (JOSKAS eNOTE) [13]; the JSIS Database (JSIS-DB) [14,15]; and the JSSR new medical device registry [18].

The first overseas orthopaedic-related registry was the Swedish national knee arthroplasty registry, begun in 1975, and since then the idea has spread worldwide. A cooperative framework has been built to enable international comparisons between individual country data [9]. The British National Hip Fracture Database is a national registry covering 95% of all cases in the country, which has contributed to greatly reducing the risk of mortality from hip fracture [19]. Spine Tango (https://www.eurospine.org/spine-tango.htm), a large-scale spinal surgery registry, which has registered over 750,000 cases from 17 countries, registers patient-reported outcomes at a certain time postoperatively, but has the issues that registration is time-consuming, and the follow-up rate is low [20]. A systematic review of spine registry studies found that

Table 1
Annual Report of FY2020.
This table shows the numbers of patients who underwent the top 30 surgical procedures registered in the database as the primary procedure-1 by K code. It gives the K code, the name of the procedure, the numbers of each procedure conducted (total, men, and women), their age-group breakdowns (%), and frequency ranking of the underlying disease (1st–5th).

Rank	K code	Surgical procedure	Number of procedures conducted			Age-group breakdown, y (%)										Frequency ranking of underlying disease (1st–5th)				
			Total	Men	Women	0–9	10–19	20–29	30–39	40–49	50–59	60–69	70–79	80–89	≥90	1st	2nd	3rd	4th	5th
1	K046 1	Open surgery of fracture (femur)	1,02,072	24,486	77,586	0	1	0	1	1	3	6	16	42	30	Trochanteric fracture	Femoral neck fracture	Femoral shaft fracture	Subtrochanteric fracture	Femoral supracondylar fracture
2	K082 1	Total arthroplasty (knee)	71,232	16,274	54,958	0	0	0	0	0	4	18	50	27	1	Osteoarthritis of the knee	Bilateral osteoarthritis of the knee	Unilateral osteoarthritis of the knee	Unilateral primary arthropathy of the knee	Bilateral primary arthropathy of the knee
3	K082 1	Total arthroplasty (hip)	58,420	11,185	47,235	0	0	0	1	4	16	30	34	14	1	Osteoarthritis of the hip	Femoral neck fracture	Osteoarthritis resulting from hip dysplasia	Unilateral primary osteoarthritis of the hip	Primary osteoarthritis of the hip
4	K081 1	Femoral head replacement	56,182	14,117	42,065	0	0	0	0	0	1	7	25	46	21	Femoral neck fracture	Medial femoral neck fracture	Trochanteric fracture	Basicervical femoral neck fracture	Osteonecrosis of the femoral head
5	K046 2	Open surgery of fracture (forearm)	47,710	13,885	33,825	2	6	3	3	6	12	19	27	19	3	Distal radius fracture	Olecranon fracture	Distal radius and ulna fracture	Radial shaft fracture	Distal radius intra-articular fracture
6	K142 6	Spinal fusion, laminectomy, laminoplasty (including multiple levels or multiple arches) (laminoplasty)	31,917	21,009	10,908	0	0	1	1	5	11	22	39	20	1	Lumbar spinal stenosis	Cervical spondylotic myelopathy	Cervical posterior longitudinal ligament ossification	Cervical myelopathy	Lumbar disc herniation
7	K046 2	Open surgery of fracture (lower leg)	29,520	16,254	13,266	0	8	6	8	14	17	18	18	9	2	Lateral malleolar fracture	Fracture-dislocation of the ankle	Tibial shaft fracture	Distal fibula fracture	Medial malleolar fracture
8	K142 3	Spinal fusion, laminectomy, laminoplasty (including multiple levels or multiple arches) (posterior interbody fusion)	26,046	13,176	12,870	0	0	1	1	5	12	24	40	17	0	Lumbar spinal stenosis	Lumbar degenerative spondylolisthesis	Lumbar spondylolisthesis	Lumbar disc herniation	Lumbar spondylolytic spondylolisthesis
9	K046 1	Open surgery of fracture (upper arm)	25,174	8698	16,476	8	5	2	2	4	9	14	25	25	6	Proximal humerus fracture	Humeral shaft fracture	Humeral neck fracture	Humeral supracondylar fracture	Surgical neck fracture of the humerus
10	K142 2	Spinal fusion, laminectomy, laminoplasty (including multiple levels or multiple arches) (posterior or posterolateral fusion)	19,628	10,988	8640	0	1	2	2	6	10	19	36	22	2	Lumbar spinal stenosis	Lumbar burst fracture	Cervical spondylotic myelopathy	Thoracic burst fracture	Lumbar vertebral fracture

(*continued on next page*)

Table 1 (*continued*)

Rank	K code	Surgical procedure	Number of procedures conducted			Age-group breakdown, y (%)										Frequency ranking of underlying disease (1st–5th)				
			Total	Men	Women	0–9	10–19	20–29	30–39	40–49	50–59	60–69	70–79	80–89	≥90	1st	2nd	3rd	4th	5th
11	K093	Carpal tunnel release	17,599	6310	11,289	0	0	0	2	5	14	20	36	21	2	Carpal tunnel syndrome	Median nerve palsy	de Quervain's tenosynovitis	Trigger finger, middle finger	Distal radius fracture
12	K142 5	Spinal fusion, laminectomy, laminoplasty (including multiple levels or multiple arches) (laminectomy)	16,728	10,558	6170	0	0	0	1	4	9	21	41	23	1	Lumbar spinal stenosis	Cervical spondylotic myelopathy	Lumbar disc herniation	Cervical spondylotic radiculopathy	Lumbar degenerative spondylolisthesis
13	K046 3	Open surgery of fracture (clavicle)	15,283	11,543	3740	0	8	7	9	17	21	17	14	6	1	Clavicle fracture	Clavicular shaft fracture	Distal clavicle fracture	Comminuted clavicle fracture	Acromioclavicular dislocation
14	K080-4 1	Arthroscopic rotator cuff repair (simple)	13,939	8165	5774	0	0	0	1	8	20	34	32	5	0	Rotator cuff tear	Rotator cuff injury	Incomplete rotator cuff tear	Complete rotator cuff tear	Calcific tendinitis of the shoulder
15	K068-2	Arthroscopic meniscectomy	13,285	6992	6293	0	9	5	7	16	21	23	16	3	0	Medial meniscus injury	Lateral meniscus injury	Medial meniscus tear	Meniscus injury	Discoid lateral meniscus
16	K134 2	Intervertebral discectomy (posterior decompression)	12,712	8383	4329	0	2	8	15	20	16	17	17	5	0	Lumbar disc herniation	Lumbar spinal stenosis	Radiculopathy due to lumbar disc herniation	Level 4/5 lumbar disc herniation	Cervical disc herniation
17	K079-2 1	Arthroscopic ligament reconstruction (cruciate ligament)	11,249	6110	5139	0	36	23	17	16	7	1	0	0	0	Anterior cruciate ligament injury	Anterior cruciate ligament tear	Old anterior cruciate ligament injury	Posterior cruciate ligament injury	Posterior cruciate ligament tear
18	K134-2 2	Endoscopic intervertebral discectomy (posterior decompression)	10,167	6528	3639	0	4	9	16	22	17	15	13	4	0	Lumbar disc herniation	Lumbar spinal stenosis	Level 4/5 lumbar disc herniation	Radiculopathy due to lumbar disc herniation	Cervical disc herniation
19	K045 3	Fixation of fracture with percutaneous pinning (digit (finger, toe))	10,136	6588	3548	4	25	9	10	16	13	11	9	3	0	Fracture of the proximal phalanx of the little finger	Bony mallet finger of the ring finger	Bony mallet finger of the middle finger	Fracture of the proximal phalanx of the ring finger	Bony mallet finger of the little finger
20	K073 2	Open surgery of intra-articular fracture (hand)	9792	2763	7029	0	2	3	4	7	14	23	28	17	2	Distal radius fracture	Distal radius intra-articular fracture	Comminuted distal radius fracture	Intra-articular fracture of the wrist	Distal radius and ulna fracture
21	K069-3	Arthroscopic meniscus repair	9770	4945	4825	1	22	12	12	17	17	12	6	1	0	Medial meniscus injury	Lateral meniscus injury	Medial meniscus tear	Lateral meniscus tear	Meniscus injury
22	K066-2 1	Arthroscopic synovectomy (knee)	8453	4051	4402	0	14	10	8	13	17	17	14	6	1	Synovitis of the knee	Pyogenic arthritis of the knee	Symptomatic synovial plica of the knee	Osteoarthritis of the knee	Anterior cruciate ligament injury
23	K142-4	Percutaneous vertebroplasty	8075	2278	5797	0	0	0	0	0	2	7	33	49	9	Lumbar compression fracture	Thoracic compression fracture	Lumbar vertebral fracture	Thoracic vertebral fracture	Lumbar pseudarthrosis
24	K046 3	Open surgery of fracture (patella)	7949	3191	4758	0	2	2	3	8	15	23	28	17	2	Patella fracture	Comminuted patella fracture	Open patella fracture	Open comminuted patella fracture	Bipartite patella

25	K073 1	Open surgery of intra-articular fracture (elbow)	7067	3232	3835	9	6	5	6	9	12	15	20	15	3	Olecranon fracture	Radial head fracture	Distal humerus fracture	Lateral condylar fracture of the humerus	Fracture-dislocation of the elbow
26	K046 3	Open surgery of fracture (foot)	6997	4282	2782	0	7	6	8	16	18	21	17	6	1	Calcaneus fracture	Metatarsal fracture	Fracture-dislocation of the Lisfranc joint	Talus fracture	Metatarsal stress fracture
27	K054 2	Osteotomy (lower leg)	6695	3043	3652	0	1	0	1	10	30	39	17	2	0	Osteoarthritis of the knee	Unilateral osteoarthritis of the knee	Bilateral osteoarthritis of the knee	Unilateral primary arthropathy of the knee	Primary arthropathy of the knee
28	K046-3	Temporary external fixation of fracture	6687	3751	2936	1	3	6	8	14	17	18	19	12	2	Fracture-dislocation of the ankle	Distal radius fracture	Pelvis fracture	Open distal radius fracture	Distal tibia and fibula fracture
29	K037-2	Achilles tendon repair	6351	4591	1760	0	4	11	19	25	15	13	10	3	0	Achilles tendon tear	Old Achilles tendon tear	Partial Achilles tendon tear	Achilles myotendinous junction tear	Achilles tendon cut
30	K073 2	Open surgery of intra-articular fracture (foot)	6103	3641	2462	0	6	7	8	15	18	20	17	8	1	Lateral malleolar fracture	Calcaneus fracture	Fracture-dislocation of the ankle	Medial malleolar fracture	Ankle fracture

their impact on treatment is lower than that of arthroplasty registries and recommended improvements, including the standardization of design, the clarification of diagnoses and surgical indications, and the importance of audits [1].

10. FY2020 Annual Report

Subjects: A total of 2247 institutions registered cases with the JOANR in FY2020. By board certification training institution category, they comprised 203 core institutions, 1720 partner institutions, 90 community healthcare training institutions, and 502 institutions other than training institutions (some institutions fell into more than one category). The total number of core institutions and partner institutions, for which JOANR registration is a requirement for accreditation as a training institution, was 1736. The number of confirmed cases in FY2020 that were approved (data fixed on January 24, 2022) was 899,431. These comprised 675,614 orthopaedic surgeries for which only basic items (first-level data) were registered, and 138,259 arthroplasties (hip, knee, or shoulder), 76,576 arthroscopic surgeries, and 8982 spinal instrumentation surgeries for which detailed items (second-level data) were registered. There were 556 surgical procedures registered as the primary surgical procedure-1.

Methods: For each of the surgical procedures registered as the primary surgical procedure-1 (described as the K code linked to the Medical Treatment Code), the number of procedures conducted, the patients' ages, and the underlying disease were analyzed. This analysis was conducted under the cloud environment for data analysis described above, using SAS® 9.4 statistical software (SAS Institute Inc., Cary, NC, USA).

Results: By K code, Table 1 shows the top 30 surgical procedures conducted, the numbers of each surgical procedure conducted (total and for men/women), their age-group breakdowns (%), and frequency ranking of the underlying disease (1st–5th). The number of top 30 surgical procedures was 672,938, accounting for 74.8% of the total number of procedures conducted. The Annual Report is available on the JOA website (https://www.joa.or.jp/member/committee/registry/files/annual_report_2020.pdf).

The Annual Report (FY2020) identified the current national trends in orthopaedic surgery in Japan. It is hoped that the outcomes of this large-scale database of orthopaedic surgery will be used in the future as a primary resource for health insurance reimbursement calculations, as well as for the analysis of risk and surgical effectiveness, and that the increased amount of real-world evidence generated as a result will act as an incentive for registration, increasing the number of participating institutions. Reducing the work involved in registration, by means such as automatic registration through a linkage between electronic medical records and the registry system, is an important strategy that must be followed in future.

11. Conclusions

In this paper, the JOANR system and its features were explained, and the FY2020 Annual Report and its future prospects were described. This marks the birth of the first comprehensive large-scale orthopaedic surgery database in Japan, which registered almost 900,000 cases in its first year of operation (FY2020). The authors look forward to its further development in future with the addition of more registries by medical associations and other organizations in related fields, and the accumulation of real-world evidence that will contribute to the development of both medical research and government policy.

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References

[1] Van Hoof ML, Jacobs WC, Willems PC, Wouters MWJM, de Kleuver M, Peul WC, et al. Evidence and practice in spine registries. Systematic review, and recommendations for future design of registries. Acta Orthop 2015 Jul;86(5):534–44.
[2] Sherman RE, Anderson SA, Dal Pan GJ, Gray GW, Gross T, Hunter NL, et al. Real-world evidence - what is it and what can it tell us? N Engl J Med 2016 Dec;375(23):2293–7.
[3] National Clinical Database (NCD)
[4] Japan Stroke Data Bank (JSDB) https://strokedatabank.ncvc.go.jp.
[5] Japan Diabetes compREhensive database project based on an Advanced electronic Medical record System (J-DREAMS) (http://jdreams.jp).
[6] Engesaeter IØ, Lie SA, Lehmann TG, Furnes O, Vollset SE, Engesaeter LB. Neonatal hip instability and risk of total hip replacement in young adulthood: follow-up of 2,218,596 newborns from the Medical Birth Registry of Norway in the Norwegian Arthroplasty Register. Acta Orthop 2008 Jun;79(3):321–6.
[7] Becker HJ, Nauer S, Porchet F, Kleinstück FS, Haschtmann D, Fekete TF, et al. A novel use of the Spine Tango registry to evaluate selection bias in patient recruitment into clinical studies: an analysis of patients participating in the Lumbar Spinal Stenosis Outcome Study (LSOS). Eur Spine J 2017 Feb;26(2):441–9.
[8] Hoshino A. Arthroplasty registry in Japan; its development and current status. Orthop Surg Traumatol 2018 Apr;61(4):375–80 (in Japanese).
[9] Akiyama H. The Japan arthroplasty register. Bone Joint Nerve 2018 Jul;8(3):325–31 (in Japanese).
[10] Matsumoto M. Perspective of registry system in orthopedic surgery. Bone Joint Nerve 2018 Jul;8(3):295–8 (in Japanese).
[11] Taneichi H. Outline of Japanese orthopaedic association national registry. Orthop Surg Traumatol 2021 Nov;64(12):1487–96 (in Japanese).
[12] Taneichi H. Current status and prospects of Japanese orthopaedic association national registry. MB Orthop 2022 Jun;35(6):9–13 (in Japanese).
[13] Nakata K, Nakamae A, Sasaki E, Maeda A, Mae T. Registry of JOSKAS (Japanese orthopaedic society of knee arthroscopy and Sports medicine). Bone Joint Nerve 2018 Jul;8(3):333–45 (in Japanese).
[14] Arima H, Taneichi H, Kanemura T, Koda M, Yagi M, Yamada K, et al. Development of Japanese spinal instrumentation society database. Bone Joint Nerve 2018 Jul;8(3):315–23 (in Japanese).
[15] Ueda H, Arima H, Kanemura T, Koda M, Yagi M, Yamada K, et al. The Development of a nationwide, multicenter electronic database for spinal instrumentation surgery in Japan: Japanese Spinal Instrumentation Society Database (JSIS-DB). Healthcare 2021 Dec;10(1):78. https://doi.org/10.3390/healthcare10010078.
[16] 7th NDB open data (receipts for fees for medical care provided between April 2020 and March 2021) (in Japanese) https://www.mhlw.go.jp/stf/seisakunitsuite/bunya/0000177221_00011.html.
[17] In terms of the quality management of medical data, the system incorporates encoding and data cleansing in accordance with the MHLW notification on the reliability required of database operators. https://www.pmda.go.jp/files/000223003.pdf (in Japanese).
[18] Taneichi H. State and prospect of the registry for newly development medical devices by the Japanese society for spine surgery and related research. Bone Joint Nerve 2018;8:307–14 (in Japanese).
[19] The National Hip Fracture Database. (http://www.nhfd.co.uk/).
[20] Spine Tango Annual Report 2018–2019. (https://www.eurospine.org/cm_data/Spine_Tango_Report_International_2018-2019.pdf).