# Annual Registry Report 2024

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**Abstract**

The outcomes captured, completeness and validation processes are presented for the JointCare Arthroplasty Registry from South Africa, with the aim of facilitating research collaboration. The target audiences for this document are other arthroplasty registries, and all other researchers involved in studies aiming to improve the outcomes for individuals receiving joint replacement surgery worldwide.

## Contents



## 1 Revision Definition

A revision is defined as any operation where one or more components are added to, removed from or modified in a joint replacement, or if a Debridement And Implant Retention (DAIR) with or without modular exchange is performed[1].

# 2 Data Captured

Primary hip and knee arthroplasties and the associated revisions are captured.

The patient demographic data and operative parameters captured by the JointCare Registry are similar to that of several registries that are members of the International Society of Arthroplasty Registries (ISAR). Additionally, the JointCare Registry captures radiographic measurements from pre- and post-operative radiographs. These radiographic parameters are used for Jointcare's Peer Review Program. Patient outcome measures are captured pre- and post-operatively in the form of the Hip disability and Osteoarthritis Outcome Score (HOOS) and Knee injury and Osteoarthritis Outcome Score (KOOS) for hips and knees respectively.

Only the first revision procedures for the primary arthroplasties done through the JointCare Network are captured. Operative data pertaining to the revision surgery itself is not captured with the exception of the revision date and the indication.

## 2.1 Primary Arthroplasty Survivorship

Survivorship data is obtained by

1. Patient follow-up: Done for every primary. Patients and/or family members contacted via email, text messages and phone calls. Follow-up done at 1, 2, 3, 5, and 7 years. At each interval, follow-up ends for that primary if, the patient can not be contacted, requests not to be contacted, does not respond if year 2 or greater, is deceased, or required a revision. Therefore revision-required, death, and no-revision-required events are captured. Patient are also asked if a complication occurred after completing their patient reported outcome measures (PROMs) questionnaire *(Added in 2024)*.
2. The JointCare Peer Review Program, either via post-operative complication reports completed by the surgeon or by follow-up x-rays, both at around 6 weeks. Every primary is peer reviewed.
3. Cross-validation with revision claims made, although done historically, does not currently take place.

The completeness of the revision survivorship follow-up for arthroplasties done before 2024 is

| | Completeness (values available) | | |
|---|---|---|---|
| Primary | 1 year | 3 year | 5 year |
| Total Hip | 91% (3 668) | 81% (1 752) | 72% (824) |
| Total Knee | 92% (3 634) | 81% (1 345) | 72% (538) |
| Uni Knee | 91% (427) | 82% (146) | 79% (50) |

Short-term complication reports also record if a revision was required, and if other events such a pulmonary embolism or deep vein thrombosis occurred. Complication reports are completed by the surgeon at their follow-up examinations, which happen at various follow-up intervals, with normally the 6 week follow-up being captured. The completeness for complications reports from the start of 2019 to the end of 2024 is

| | Completeness (values available) | | | |
|---|---|---|---|---|
| | 2 weeks | 4 weeks | 6 weeks | 8 weeks |
| Complication data up to | 93% (6 627) | 75% (5 348) | 51% (3 675) | 17% (1 250) |

## 2.2 Patient Demographics

| Parameter | Description |
|---|---|
| Gender | Patient sex (source surgeon[1]) |
| Age | Patient age (source surgeon) |
| Mass | Patient mass at time of surgery (source anaesthetist[2]) |
| Height | Patient height (source anaesthetist) |
| Comorbidity Codes | ICD-10 codes. Before 2022 a checklist of comorbid categories was used. (source anaesthetist) |
| ASA grade | ASA Physical Status Classification. Introduced 2022. (source anaesthetist) |

[1] Either by the surgeon or their practice
[2] Entered by anaesthetist, their practice, or their billings service

| | Completeness (values available) | | |
|---|---|---|---|
| Parameter | 2015 or later | 2019 to 2024 | only 2024 |
| Gender | 100% (15 828) | 100% (13 933) | 100% (3 840) |
| Age | 100% (15 830) | 100% (13 933) | 100% (3 840) |
| Mass | 97% (15 390) | 100% (13 933) | 100% (3 840) |
| Height | 97% (15 390) | 100% (13 933) | 100% (3 840) |
| Comorbidity Codes | 66% (10 492) | 75% (10 492) | 100% (3 840) |
| ASA grade | 66% (10 492) | 75% (10 492) | 100% (3 840) |

## 2.3 Operative - General

The general operative parameters captured for primary hip and knee arthroplasties are as follows

| Parameter | Description |
|---|---|
| Surgery Date | Date of surgery (source surgeon) |
| Side | Operative side (source surgeon) |
| Diagnostic Code | Primary ICD-10 code (source surgeon) |
| Hospital Codes | Primary ICD-10 code (source hospital bill) |
| Prosthesis components | manufacturer codes and descriptions for the implant components (source implant invoice) |
| Prosthesis component lot numbers | lot or batch numbers for implant components (source implant invoice) |
| Cement | cement used in implant fixation. Lot number not captured. (source hospital bill or implant invoice) |
| Antibiotic | Antibiotic name, brand & dosage (source hospital bill) |

| | Completeness (values available) | | |
|---|---|---|---|
| Parameter | 2015 or later | 2019 to 2024 | only 2024 |
| Surgery Date | 100% (15 830) | 100% (13 933) | 100% (3 840) |
| Side | 100% (15 830) | 100% (13 933) | 100% (3 840) |
| Diagnostic Code | 100% (15 830) | 100% (13 933) | 100% (3 840) |
| Hospital Codes | 97% (15 324) | 100% (13 933) | 100% (3 840) |
| Prosthesis components | 97% (15 324) | 100% (13 933) | 100% (3 840) |
| Prosthesis component lot numbers | 97% (15 324) | 100% (13 933) | 100% (3 840) |
| Cement | 96% (7 922) | 95% (7 267) | 95% (2 066) |
| Antibiotic | 97% (15 324) | 100% (13 933) | 100% (3 840) |

## 2.4 Hip Arthroplasties

Two different PROM questionnaires have been used. From March 2017 up until the end of 2021 the pain and functionally questions from the 42 question HOOS was used (HOOS-pf). Thereafter the HOOS-12 PROM questionnaire was used. The completeness and number of data points are as follows

| | | Completeness (values available) | |
|---|---|---|---|
| PROM | time point | 2017 to 2021 | 2022 to 2024 |
| HOOS-pf | pre-op | 53% (1 212) | |
| | 6 month | 32% (735) | |
| | 1 year | 22% (510) | |
| | 2 year | 16% (368) | |
| HOOS-12 | pre-op | | 66% (2 598) |
| | 6 month | | 38% (1 484) |
| | 1 year | | 29% (915) |
| | 2 year | | 20% (387) |

Pre- and post-op x-rays are captured with the following measurements recorded

| Parameter | Description |
|---|---|
| $\text{LLD}_{post}$ | Leg-length discrepancy after surgery |
| $\text{LLD}_{pre}$ | Leg-length discrepancy before surgery |
| $\text{medialisation}_{post}$ | Medialisation after surgery. Difference of femoral-head-pelvis-centre distance between operative and non-operative sides along the transverse axis. |
| $\text{medialisation}_{pre}$ | Medialisation before surgery. |
| $\text{proximalisation}_{post}$ | Proximalisation after surgery. Difference of femoral-head-pelvis-centre distance between operative and non-operative sides along the longitudinal axis. |
| $\text{proximalisation}_{pre}$ | Proximalisation before surgery. |
| cup inclination | Radiographic inclination: angle between the face of the cup and the transverse axis. |
| anteversion | Radiographic anteversion: calculated from the ratio of the major & minor diameters of the ellipse formed by the rim of the cup as projected onto the coronal plane |
| penetration of ilioischial line | Whether or not ilioischial line was penetrated by arthroplasty |

| | Completeness (values available) | | |
|---|---|---|---|
| Parameter | 2015 or later | 2019 to 2024 | only 2024 |
| $\text{LLD}_{post}$ | 88% (5 840) | 99% (5 497) | 99% (1 337) |
| $\text{LLD}_{pre}$ | 86% (5 750) | 97% (5 413) | 97% (1 313) |
| $\text{medialisation}_{post}$ | 88% (5 840) | 99% (5 497) | 99% (1 337) |
| $\text{medialisation}_{pre}$ | 86% (5 750) | 97% (5 413) | 97% (1 313) |
| $\text{proximalisation}_{post}$ | 88% (5 840) | 99% (5 497) | 99% (1 337) |
| $\text{proximalisation}_{pre}$ | 86% (5 750) | 97% (5 413) | 97% (1 313) |
| cup inclination | 88% (5 840) | 99% (5 497) | 99% (1 337) |
| anteversion | 88% (5 840) | 99% (5 497) | 99% (1 337) |
| penetration of ilioischial line | 88% (5 840) | 99% (5 497) | 99% (1 337) |

## 2.5 Total Knee Arthroplasties

Similarly to hip, changed from KOOS-pf to KOOS-12 at the start of 2022

| | | Completeness (values available) | |
|---|---|---|---|
| PROM | time point | 2017 to 2021 | 2022 to 2024 |
| KOOS-pf | pre-op | 56% (1 151) | |
| | 6 month | 33% (688) | |
| | 1 year | 23% (482) | |
| | 2 year | 16% (325) | |
| KOOS-12 | pre-op | | 67% (3 921) |
| | 6 month | | 37% (2 149) |
| | 1 year | | 26% (1 229) |
| | 2 year | | 19% (490) |

Various pre- and post-op x-rays are captured with the following measurements recorded

| Parameter | Description |
|---|---|
| medial slant | tibial component's varus slant relative to the tibial centre line in the post-op AP view |
| MPTA | medial proximal tibial angle (MPTA) on the post-op hip-knee-ankle AP view |
| LDFA | lateral distal femoral angle (LDFA) on the post-op hip-knee-ankle AP view |
| MPTA pre-op | medial proximal tibial angle (MPTA) on the pre-op hip-knee-ankle AP view |
| LDFA pre-op | lateral distal femoral angle (LDFA) on the pre-op hip-knee-ankle AP view |
| posterior slant | tibial component's posterioral slant |
| femur medial slant error | measures the angle between the femoral contact line's medial slant (relative to the tibial contact inserts contact line) and subtracts that from the expected value for the implant |
| notching | femoral notching (+ cortex removal, - implant tip proud) |
| angle femur tibia centre lines | angle between femoral and tibial centre lines in the post-op AP close up view. (- is valgus rotation) |
| HKA pre-op | hip-knee-ankle varus rotation in HKA pre-op in xray |
| HKA post-op | hip-knee-ankle varus rotation in HKA post-op in xray |

| | Completeness (values available) | | |
|---|---|---|---|
| Parameter | 2015 or later | 2019 to 2024 | only 2024 |
| medial slant | 83% (6 822) | 91% (6 822) | 100% (2 230) |
| MPTA | 17% (1 431) | 19% (1 431) | 21% (475) |
| LDFA | 17% (1 431) | 19% (1 431) | 21% (475) |
| MPTA pre-op | 5% (393) | 5% (393) | 18% (393) |
| LDFA pre-op | 5% (393) | 5% (393) | 18% (393) |
| posterior slant | 83% (6 820) | 91% (6 820) | 100% (2 230) |
| femur medial slant error | 83% (6 822) | 91% (6 822) | 100% (2 230) |
| notching | 28% (2 258) | 30% (2 258) | 100% (2 222) |
| angle femur tibia centre lines | 83% (6 822) | 91% (6 822) | 100% (2 230) |
| HKA pre-op | 16% (1 279) | 17% (1 279) | 21% (471) |
| HKA post-op | 18% (1 507) | 20% (1 507) | 21% (475) |

## 2.6 Uni Knee Arthroplasties

The completeness for uni-compartmental knee patient questionnaires is

| | | Completeness (values available) | |
|---|---|---|---|
| PROM | time point | 2017 to 2021 | 2022 to 2024 |
| KOOS-pf | pre-op | 55% (140) | |
| | 6 month | 38% (97) | |
| | 1 year | 28% (72) | |
| | 2 year | 23% (58) | |
| KOOS-12 | pre-op | | 69% (472) |
| | 6 month | | 43% (288) |
| | 1 year | | 29% (165) |
| | 2 year | | 26% (77) |

The uni-compartmental x-ray parameters recorded are

| Parameter | Description |
|---|---|
| femoral comp varus rotation 1 | femoral component varus rotation relative to the femoral centre line (- is valgus rotation) |
| femoral comp varus rotation 2 | femoral component varus rotation relative to the tibial centre line (- is valgus rotation) |
| femoral comp varus rotation 3 | femoral component varus rotation relative to the tibial component (- is valgus rotation) |
| tibial comp medial overhang | tibial component medial overhang (+ indicates the prosthesis edge extends over the bone edge) |
| tibial comp varus rotation | tibial component varus rotation relative to the tibial centre line (- is valgus rotation) |
| tibial comp posteroinferior tilt | posteroinferior tilt from Lat x-ray (+ indicates an anterior tilt ) |
| femoral comp flexion-ext angle | femoral comp flexion-ext angle (if Restoris MCK, value offset by 23.7 deg to be comparable to Oxford) |
| tibial comp anterior overhang | tibial comp anterior overhang in post-op Lat x-ray |
| tibial comp posterior overhang | tibial comp posterior overhang in post-op Lat x-ray |
| femoral comp posterior overhang | femoral comp posterior overhang in post-op Lat x-ray |

| | Completeness (values available) | | |
|---|---|---|---|
| Parameter | 2015 or later | 2019 to 2024 | only 2024 |
| femoral comp varus rotation 1 | 96% (919) | 99% (891) | 99% (251) |
| femoral comp varus rotation 2 | 96% (919) | 99% (891) | 99% (251) |
| femoral comp varus rotation 3 | 96% (919) | 99% (891) | 99% (251) |
| tibial comp medial overhang | 96% (919) | 99% (891) | 99% (251) |
| tibial comp varus rotation | 96% (919) | 99% (891) | 99% (251) |
| tibial comp posteroinferior tilt | 96% (919) | 99% (891) | 99% (251) |
| femoral comp flexion-ext angle | 96% (919) | 99% (891) | 99% (251) |
| tibial comp anterior overhang | 96% (919) | 99% (891) | 99% (251) |
| tibial comp posterior overhang | 96% (919) | 99% (891) | 99% (251) |
| femoral comp posterior overhang | 96% (919) | 99% (891) | 99% (251) |

# 3 Data Validation

The process begins with the creation of a new patient record on the JointCare system. The JointCare-partnered orthopaedic surgeon captures the patient data. Use may be made of a lookup facility based on the medical aid number to automatically complete some of the details. This lookup facility interfaces with the medical aid database, and was originally purposed to verify the medical aid details are associated with the correct patient, but acts as a validation of patient age. The case

record is then populated by the JointCare-partnered orthopaedic surgeon. This includes the type and proposed date of operation, medical team, hospital and prosthesis supplier. The diagnostic and procedural codes are also added by the orthopaedic surgeon.

Following the operation, the surgeon and anaesthetist submit their reports which are added to the case record. There is a specific section to disclose operative and post-operative complications up to 6 weeks after surgery. This may report the necessity for a revision along with the indication for such. There is a degree of validation built into the JointCare system, for example if a height or mass is outside a normative range this is flagged for investigation. The prosthesis supplier's invoice is used to add prosthesis details to the case record. Diagnostic and procedural codes are derived from the hospital invoice. Antibiotic data is derived from the hospital pharmacy invoice.

The orthopaedic surgeon or an outsourced JointCare processor uploads the pre- and post-operative x-rays onto the system. In the latter case, the processor accesses the x-ray online through the x-ray department's picture archiving and communication system (PACS). The x-rays are then processed by a measurer to extract the radiographic parameters, followed by a reviewer who checks the work of the measurer. The reviewer is also responsible for flagging a revision as described in the complications report. Anomalous radiographic-derived parameters that the system deems statistical outliers are flagged by the system, thus bringing to the reviewer's attention for specific scrutiny.

The de-identified case data is then submitted to the JointCare registry. For the purposes of survivorship analysis, the patient or relative is contacted at specified time periods to determine the status of their implant. If a revision has taken place, the date and indication is recorded. A death may be reported at this stage and the date of such is recorded. If the patient cannot be contacted, a loss-to-followup censoring event is noted. Revision claim data is also requested by JointCare from the respective medical insurance companies. Should the subsequent cross-validation reveal revisions that were missed, the missed revision events are recorded on the JointCare registry.

There are some shortcomings in the data capture process. In terms of radiographic parameters there is a level of subjectivity and errors do occur due to inappropriate patient positioning. The measurement method is standardised (a manual is available) and measurers are trained. However there is no mandatory requirement for surgeons to submit specific x-ray types, thus the completeness of parameters varies on a case-by-case basis. Hospital coding in regard to diagnosis and procedure is somewhat unreliable. Smoking status is not recorded and diabetes is only revealed if the corresponding ICD code is used. Revision and death reporting has its limitations. Generally this information is provided by the patient which may be unreliable. There is no automated linkage of revision or death events as in the case of registries based on national health data.

# 4 Representativeness of Data

For the year 2024, it was estimated that around 14% of the primary hip and knee arthroplasties funded by private medical insurance (open and restricted schemes) were captured in the JointCare registry. The proportion of South African arthroplasties captured is unknown since there is no mandatory reporting of arthroplasties in South Africa, so the actual number of primary arthroplasties performed nationally is unknown. The 3 840 procedures captured by JointCare in 2024 where done by 153 surgeons operating from 83 hospitals, located in 8 out of the 9 provinces of South Africa.

# 5 Collaboration

We welcome requests for anonymised data from researchers, which will be considered on a case-by-case basis. Applicants will need to provide a detailed study proposal. Please email registry@jointcare.co.za with your requests.

# References

[1] Yoav Ben-Shlomo, Ashley Blom, Chris Boulton, Robin Brittain, Emma Clark, Sebastian Dawson-Bowling, Kevin Deere, Colin Esler, Oscar Espinoza, Jonathan Evans, et al. The national joint registry 19th annual report 2022. 2022.