

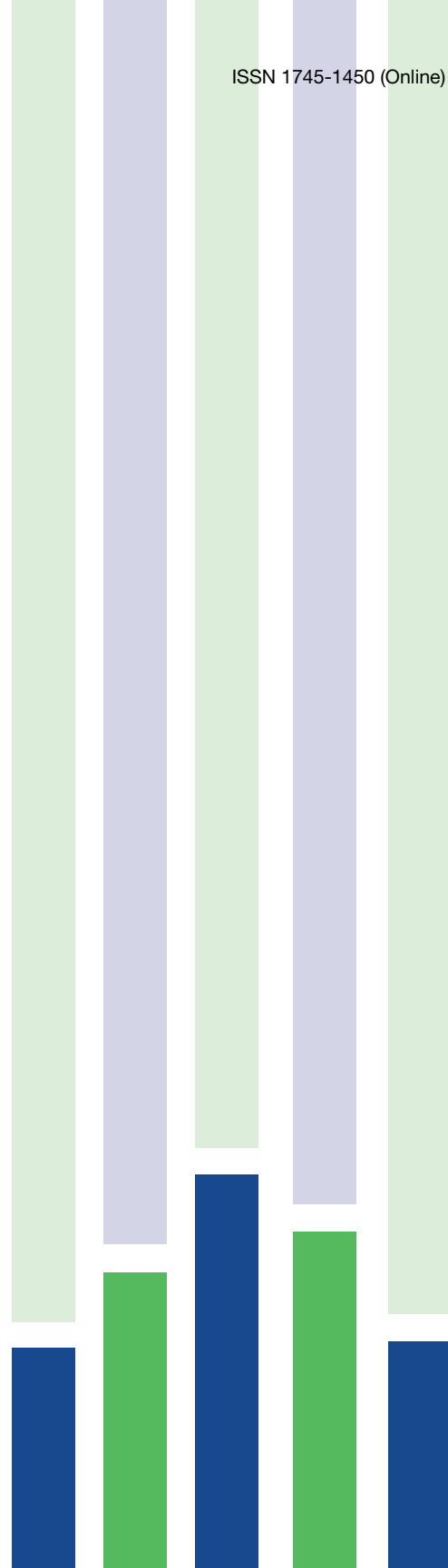


National Joint Registry

www.njrcentre.org.uk



Surgical data to December 2009



**National Joint Registry
for England and Wales**

7th Annual Report

2010

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Acting Chairman's introduction

Professor Paul Gregg

As Vice Chairman and currently Acting Chairman of the National Joint Registry (NJR) Steering Committee, I am delighted to introduce our 7th Annual Report.

I must begin by expressing my sincere thanks and gratitude to Bill Darling for the personal contribution he has made to the NJR since its inception in 2003. Bill resigned as Chair in late 2009 and it is his significant work and energetic leadership that has led the NJR to become a recognised tool for enabling best practice and continued improvement in patient care.

It is gratifying to note that compliance for the calendar year 2009 increased to 98%, compared with 86% in 2008. The financial year 2009/10 saw the overall compliance with reporting to the NJR (from 1st April 2003 to 31st March 2010) reaching 82%; the figures for consent rate and linkability being 80% and 81% respectively.

There have now been more than 905,000 procedures registered and we are on course to reach one million this year, making the NJR by far the largest registry of its kind in the world.

Significant progress has been made with the implementation of our Strategic Plan; there has been successful preparation for the launch of ankle joint replacement data collection from 1st April 2010 and arrangements for the collection of data on shoulder and elbow replacements are well advanced. In order to improve the quality, timeliness and availability of information to our stakeholders, a stakeholder committee has been established under the chairmanship of Mr Andrew Woodhead.

As noted by Bill Darling in last year's report, there has been a dramatic increase in the number of requests for data for research and other studies. In view of this, and in keeping with our strategic aim of promoting and facilitating high quality research, we have established a Research Sub-group of the NJR Steering Committee, chaired by Professor Alex MacGregor. This Sub-group has specific responsibility for managing and processing research requests and the establishment of a Research Request Protocol. A new research officer post has been created and appointed to assist with this. I am also pleased to report that the NJR Steering Committee has recently approved the creation and funding of two research posts which are available, through open competition, to specialist registrars in trauma and orthopaedic surgery.

The very sensitive issue of the identification and management of 'potential outlier' surgeons continues to cause concern. Because of this, the Royal College of Surgeons Clinical Effectiveness Unit (RCS CEU) carried out a review of the methodology last year. As a result, the methodology and process for managing potential outliers was changed and, because of the complexities, an Outlier Sub-group of the NJR Steering Committee was established under my Chairmanship. This whole issue has recently undergone a thorough review and I am hopeful we will be able to move forward next year to a system that is robust, fair and has the support of the British Orthopaedic Association (BOA). In relation to this, and as reported in my Vice Chairman's introduction last year, I still believe that the registration of joint replacements should be made mandatory to allow robustness and fairness in the outlier process. Despite further attempts to achieve this, I am sorry

to report we have been unsuccessful. It is also unfortunate that a workable system for the assessment of case complexity has still not been achieved.

The outlier process has also been strengthened by the recent establishment of an Implant Outlier Sub-group, to deal specifically with potentially outlying prostheses, under the Chairmanship of Mr Keith Tucker.

The Department of Health's (DH's) national Patient Reported Outcome Measures (PROMs) study into primary hip and knee replacement started in April 2009. I am pleased to report that preparations have been made for our own large-scale, long term follow up of patient reported outcomes of hip and knee replacement surgery in England, extending the short term capture of data undertaken in the DH programme.

I wish to record my thanks to all members of the NJR Steering Committee for their work and contribution during the past year. In particular, I thank the Chairs of the Sub-groups for their hard work and leadership; Mr Martyn Porter, Editorial Board; Professor Alex MacGregor, Research Sub-group and Mr Peter Howard, Regional Clinical Co-ordinators' Network.

My gratitude also goes to the staff of the Healthcare Quality Improvement Partnership (HQIP) for their dedication and excellent work during the year and especially to Elaine Young for her continued excellent leadership and personal support to me as Acting Chairman.

Also worthy of thanks are the Regional Clinical Co-ordinators, Regional Co-ordinators and last, but not least, the NJR contractor Northgate Information Solutions (UK) Ltd.

Thanks, finally, to my surgical colleagues for entering their data.



Professor Paul J Gregg

Vice Chairman and Acting Chairman
NJR Steering Committee

Foreword from the Chairman of the Editorial Board

The 7th Annual Report has been produced in three parts:

- **Part 1** is the public report for the financial year 2009/10
- **Part 2** describes the clinical activity during the calendar year 2009, based on all the data held in the NJR. It describes the practice and type of joint replacements carried out in England and Wales with some comparisons over the lifespan of the NJR. This work has been undertaken by Northgate Information Solutions (UK) Ltd, the contractor for the NJR
- **Part 3** is the outcomes section containing information mainly based on survivorship analysis, but also data on mortality and length of stay obtained from Hospital Episodes Statistics (HES) and Patient Episode Database Wales (PEDW). This analysis has been carried out by the RCS CEU.

In producing the survivorship data, we have used a subset of all entries on the NJR database to ensure the most complete record of revision activity. This has been achieved by linking the NJR registrations with cases recorded in HES/PEDW. As such the NJR describes almost exclusively NHS activity. As data quality improves, we hope to include private operations carried out in the private sector.

Other considerations worth noting are that the NJR for England and Wales:

- differs from other joint registers, which have their own reporting formats. It is important to understand these differences when comparing international registry data
- records a revision as being a revision for any cause and therefore includes both aseptic and septic revisions. Again, in the fullness of time, we hope to sub-stratify revisions by indication

- attributes a revision to the joint replacement, which means we do not specify whether the revision was a consequence of acetabular, femoral, tibial or combined failure. In future years we hope to resolve this.

It is well recognised that many factors predispose a patient to a revision, including the complex interaction between patient demographics, surgical technique and the implant. In some analyses we have used statistical techniques to adjust for case mix, but it is inevitable that there are other variables that we have not been able to take into account. This is particularly relevant when one quotes the revision rate of an implant, as quite clearly the reasons for revision may not be directly related to the performance of the prosthesis.

Revision rates at one, three and five years are reported together with 95% confidence intervals (CIs). Most readers understand the importance of confidence intervals, but I should like to emphasise, for the benefit of lay readers, the importance of interpreting the data presented in this report; that is not to focus entirely on the revision rate, but also to take into account the upper and lower confidence intervals before drawing conclusions on the relative performance of implant brands. One should avoid the temptation to create 'league tables' of performance. We are in the process of developing statistical methods, including funnel plots, to assess variations in implant performance. It is our intention to include these data in future reports.

There is clearly much work to be done and we are under no illusion - the NJR is a 'work in progress'. I have said many times at public meetings that caution needs to be exercised in making definite conclusions from any registry information. It is my view that registers provide extremely important observations on surgical outcomes following joint replacement, but the information should be used in association with other validated orthopaedic data, including peer review publications and other registry data.

This report is mainly descriptive in format and this is deliberately so at this early stage of the NJR.

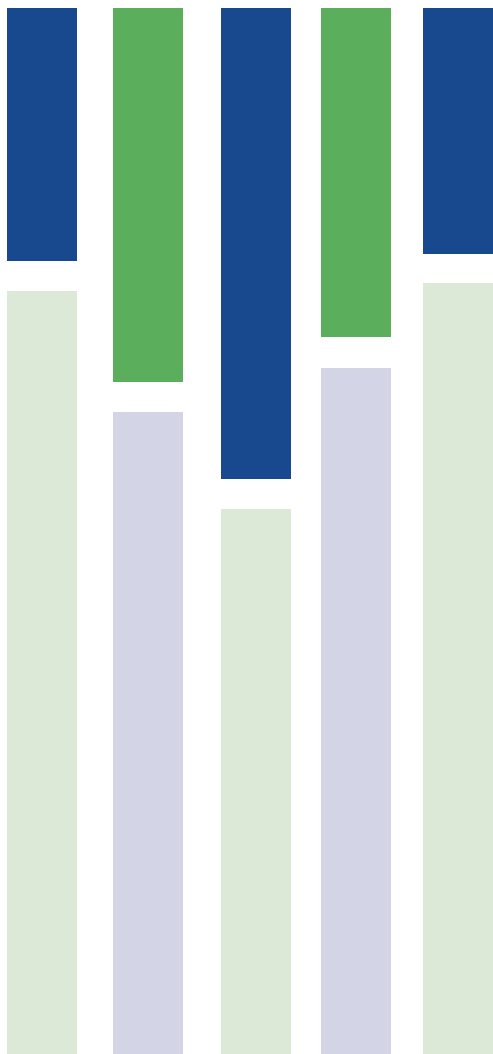
I should like to express my gratitude to all members of the NJR Editorial Board, the NJR Steering Committee, Northgate Information Solutions (UK) Ltd, RCS CEU and M&M Communications for all their contributions and hard work in once again producing this report on time.

A handwritten signature in black ink that reads "Martyn Porter". The signature is written in a cursive, flowing style.

Mr Martyn Porter

Chairman, Editorial Board

Executive summary



Part 1: Annual progress

The 7th Annual Report of the NJR for England and Wales is the formal public report for the period 1st April 2009 to 31st March 2010 (Part 1). Also included are statistics on joint replacement activity for the period 1st January to 31st December 2009 (Part 2) and a survivorship analysis of hip and knee joint replacement surgery using data from 1st April 2003 to 31st December 2009 (Part 3).

The NJR began the collection of data on hip and knee replacement operations on 1st April 2003. It aims to improve surgical outcomes and patient safety by providing information to all those involved in the management and delivery of joint replacement surgery and also to patients.

The work of the NJR is funded through a levy raised on the sale of hip and knee replacement implants.

Part 1 reports on the performance of the NJR during the financial year 2009/10, provides a summary of developments during the year and outlines key plans for the future.

The financial year 2009/10 saw:

- 163,940 hip and knee joint replacement procedures submitted to the NJR, more than in any previous year. This takes overall compliance with reporting to the NJR (from 1st April 2003 to 31st March 2010) to 82.0%
- 87.5% of records submitted to the NJR with patient consent, taking the overall consent rate for all NJR records to 79.7%
- 94.4% of records submitted with an NHS number¹, allowing data linkage for outcomes analysis. The overall rate of linkable records in the NJR is now 81.0%
- the total number of procedures reported to the NJR (from 1st April 2003 to 31st March 2010) reaching 905,384, of which:
 - 64.9% took place in NHS hospitals
 - 26.1% took place in independent hospitals

- 4.8% took place in NHS treatment centres
- 4.1% took place in independent sector treatment centres (ISTCs).

Progress and achievements during 2009/10 included:

- successful preparation for the launch of ankle joint replacement data collection from 1st April 2010
- the withdrawal from the European market of a specific knee implant by the supplier, using information from the NJR's outlier analysis
- hospitals being notified by the NJR of more than 1,000 patients affected by Medical Device Alerts, issued by the Medicines and Healthcare products Regulatory Agency (MHRA)
- the establishment of a Research Sub-group of the NJR Steering Committee with specific responsibility for research requests
- the establishment of a Research Request Protocol
- the establishment of an Outlier Sub-group responsible for the development and management of the NJR outlier process.

Forthcoming developments include:

- the launch of data collection on elbow and shoulder replacements
- preparation for a large-scale, long term follow up of patient reported outcomes of hip and knee replacement surgery in England. This project will extend the capture of PROMs undertaken through the DH programme
- a number of studies throughout the year looking at data quality, revision rates by surgeon volume, risk stratification and revision rates by indication for revision.

¹ This rate also includes NHS numbers traced using the NHS Personal Demographics Service (PDS) after submission to the NJR.

Part 2: Clinical activity 2009

Part 2 of the NJR 7th Annual Report summarises the data and findings for hip and knee procedures carried out in England and Wales between 1st January 2009 and 31st December 2009 and entered into the NJR by the 28th February 2010.

During 2009, 411 orthopaedic units were open, including NHS hospitals in England and Wales, independent hospitals, NHS treatment centres and ISTCs. Of these, 393 (96%) submitted at least one hip or knee procedure to the NJR. The compliance rate for the calendar year 2009 was 97.8%, which is much higher than the 86% achieved in the 2008 calendar year.

On average 185 hip replacements and 199 knee replacements were submitted per orthopaedic unit. These numbers are very similar to the submissions in 2008. However, the number of procedures entered by units varied widely; the maximum number of hip submissions being 1,275 and the maximum number of knee submissions being 1,420.

Hip replacement procedures

In 2009, there were 72,432 hip replacement procedures recorded on the NJR, representing a 1% increase compared with the same reporting period last year². Of these, 65,229 were primary procedures and 7,203 were revision surgeries, representing a revision 'burden' of 10%, an increase from 9.2% last year.

Of the 65,229 primary hip procedures undertaken in 2009, 36% were cemented total hip replacements (THRs), 39% were cementless THRs and 16% were hybrids³ or reverse hybrid THRs. The remaining 10% were large head metal on metal replacements, comprising 6% resurfacing and 4% large head metal on metal total hip replacements (LHMoM THRs).

Last year it was noted that despite the superior short term results for cemented total hip replacements, there was an increasing trend away from fixation with cement towards cementless fixation. In 2004, 53% of THRs were cemented procedures compared with only 36% in 2009. This is the first year that cementless fixation has overtaken cemented fixation as the preferred fixation modality.

Patient demographics in terms of age and gender distribution have not changed substantially since 2003. In 2009, 30% of patients were 75 years of age and above, 35% between the ages of 65 and 74, 23% between the ages of 55 and 64 and 12% below the age of 55.

Last year we commented on a reduction in the number of patients regarded as being fit and healthy prior to surgery, (ASA grade 1)⁴. This year, the ASA distribution is comparable to last year with 17% being regarded as fit and healthy prior to surgery (18% in 2008).

The average body mass index (BMI)⁵ has increased to 28.4, compared with 27.3 in 2004.

It would appear that NHS hospitals are dealing with less fit patients, with 19% being ASA grade 3 or 4, compared with 7% in independent hospitals, 12% in NHS treatment centres and 8% in ISTCs.

Patients' age and gender significantly influenced the fixation type and type of replacement operation carried out. For example, in male patients under 55 years of age, 33% were resurfacing and 10% cemented replacements, compared with male patients over 75 years of age in whom less than 1% were resurfacings and 50% were cemented. In female patients less than 55 years of age, 14% were resurfacing and 14% cemented replacements, compared with female patients over 75 years of age in whom less than 1% were resurfacings and 56% were cemented.

² 71,367 hip procedures were recorded in 2008. This number has now increased to 76,347 as a result of 2008 activity being registered in 2009. For the purposes of comparative analysis, 2008 figures reported in 6th Annual Report have been used.

³ Of the hybrids, 86% were conventional hybrids (cemented stem and cementless socket) and 14% were reverse hybrids (cementless stem and cemented socket).

⁴ American Society of Anaesthesiology system for grading the overall physical condition of the patient as follows: P1 – fit and healthy; P2 – mild disease, not incapacitating; P3 – incapacitating systemic disease; P4 – life threatening disease; P5 – not expected to survive 24 hours.

⁵ BMI: 20-24 normal; 25-29 overweight; 30-39 obese; 40+ morbidly obese.

The indications for surgery were recorded as osteoarthritis (93%), avascular necrosis (2%), fractured neck of femur (2%), Developmental Dysplasia of the Hip (1%) and inflammatory arthropathy (1%).

In terms of surgical technique, the lateral position was used in 91% of cases and the posterior approach was used in 57%. Minimally invasive surgery was described as being used in 5% of cases and image-guided surgery in 1%. Antibiotic loaded bone cement was used in 92% of cases when cement was used.

The most frequently prescribed chemical method of thromboprophylaxis for total hip replacement was low molecular weight heparin (LMWH) (71%) and the most used mechanical method was thrombo embolus deterrent (TED) stockings (64%).

In 2009, 151 different brands of femoral stem were used, 127 different brands of acetabular components and 12 different brands of resurfacing cups.

The Orthopaedic Data Evaluation Panel (ODEP)⁶ ratings for prostheses were again studied. The full 10A benchmark rating was achieved in 83% of cemented stems, 62% of cementless stems, 43% of cemented cups, 7% of cementless cups and 48% of resurfacing cups.

When cemented hip stems were used, the Exeter V40 remained the market leader with more than 60% of the market share. The Contemporary cup is the market leader with a market share of just under 35%.

With cementless brands, the Corail stem remains the market leader at 47% and the Pinnacle socket with a market share of approximately 33%.

Hip resurfacing declined from 5,707 in 2008 to 4,099 in 2009. The Birmingham Hip Resurfacing (BHR) remains the market leader.

There is an increasing trend to use larger head devices. In 2009, 26% were 36mm or above, compared with 20% in 2008 and only 1% in 2003.

A total of 7,136 hip revision procedures was reported in 2009, which is an increase of 555 compared with 2008. Of these, 83% were single stage revision procedures, 7% were stage one of a two stage procedure, 9% were stage two of a two stage procedure and 1% were excision arthroplasty procedures.

Indications for revision in single stage revision were aseptic loosening (56%) and infection (3%). When the indication was stage one of a two stage revision, aseptic loosening was recorded in 15% of cases and infection in 80%.

Both components were revised in 45% of single stage revisions, compared with 80% in stage one of a two stage revision.

During a single stage revision, a hybrid reconstruction was the most popular where in about three quarters of cases a cemented stem and an uncemented acetabular component were used.

Knee replacement procedures

The number of knee replacement procedures recorded on the NJR during 2009 was 77,545, which represents an increase of 2.5% compared with 2008.

There were 4,565 revision procedures. The revision 'burden' for knee replacement procedures has increased from 4.3% in 2007 to 5.9% in 2009.

Unlike hip replacements, the type and fixation of knee replacements has remained largely unchanged over the lifespan of the NJR. In 2009, 83% were cemented primary total knee replacements (TKRs), 6% were uncemented TKRs, 1% were hybrid TKRs, 8% were unicompartmental knee replacements and 1% were patello-femoral replacements.

This year we included a breakdown of bicondylar primary knee replacements by constraint. Of the bicondylar replacements, just over 72% were cruciate retaining, 25% posterior stabilised, 3% constrained condylar and less than 1% were hinged or link knee replacements. Again this trend has not changed substantially between 2005 and 2009.

⁶ Orthopaedic Data Evaluation Panel of NHS Supply Chain.

The ASA grades indicate that less fit patients were treated in NHS hospitals with approximately 18% being ASA grade 3 or 4, compared with 9% in independent hospitals, 12% in NHS treatment centres and 9% in ISTCs.

BMI has increased to 30.5 from 29.2 in 2004. Patient BMI is higher in knee procedures compared with hip procedures.

Age and gender influence the choice of type of replacement. Male patients and younger patients (under 55 years of age) have a higher proportion of unicompartmental and patello-femoral replacements, compared with elderly patients who have a higher proportion of TKRs using cement.

In terms of surgical techniques, a medial parapatellar incision was used in 92% of cases. The patella was resurfaced in approximately two thirds of these. Minimally invasive surgery was used in 8% of cases and image guided surgery in 3%.

The most frequently prescribed chemical method of thromboprophylaxis for knee replacement was LMWH (69%) while TED stockings were the most commonly used mechanical method (68%).

The PFC Sigma was the market leader for total condylar knee replacements, being used in approximately 36% of cases. The Oxford Knee was the market leader for unicompartmental knee replacements, used in more than 72% of unicompartmentals. The Avon was the brand leader in patello-femoral joints, used in approximately 45% of cases, although its market share has fallen proportionally with an increase in the use of other brands.

The ODEP classification does not include knee replacements.

Of the 4,565 knee revision procedures, 75% were single stage operations, 12% were stage one of a two stage procedure, and 13% were stage two of a two stage revision.

Part 3: Implant survivorship 2003 to 2009

Part 3 of the 7th Annual Report describes the clinical outcomes of hip and knee replacement surgery, represented by survivorship analysis up to a maximum of five years. The results were analysed according to prosthesis type, implant brand, age, gender and bearing surfaces. Where appropriate, regression analysis was used to estimate risk factors for revision and to adjust for differences in the case mix.

The analysis was carried out on all patients entered into the NJR whose record could be linked to HES or PEDW. As such, it describes almost exclusively NHS activity and the reasons for this are outlined later in this report.

Of the 662,879 hip and knee replacements entered into the NJR between April 2003 and December 2009, 455,424 were linked to HES/PEDW and identified as being 'first linked' primary procedures. Of these, 216,693 were primary hip replacements, which were associated with 3,903 first hip revisions. The corresponding figures for knee replacements were 238,731 primary knee replacements, associated with 4,797 first revisions.

Of 3,903 first hip revisions, 1,835 were identified in the NJR and in HES/PEDW, 1,555 were identified only in HES/PEDW, 513 only in the NJR.

Corresponding figures for the 4,797 first knee revisions were 2,211 in the NJR and in HES/PEDW, 2,027 only in HES/PEDW and 559 only in the NJR.

Hip replacement procedures

The overall revision rates (with 95% CI) following primary hip replacement were 1.0% (0.9% to 1.0%) at one year, 2.1% (2.0% to 2.1%) at three years and 2.9% (2.8% to 3.0%) at five years.

Revision rates varied according to the type of prosthesis ($p < 0.0001$). Five year revision rates were lowest at 2.0% (1.8% to 2.1%) in patients who received a cemented prosthesis and highest at 7.8% (6.6% to 9.3%) after LHMOM THR. The five year revision rate was 3.4% (3.2% to 3.7%) in patients who received a cementless prosthesis and 2.7% (2.4% to 3.0%) in patients who received hybrid prosthesis. In patients who received a resurfacing prosthesis the five year revision rate was 6.3% (5.7% to 7.0%).

Age and gender significantly influenced revision rates. In male patients under 55 years of age, the five year revision rate was 4.4% (3.2% to 6.0%) using cemented, 4.0% (3.1% to 5.1%) with uncemented, 2.6% (1.7% to 3.8%) with hybrid, 5.6% (4.5% to 6.9%) with hip resurfacing and 6.4% (4.5% to 8.9%) with LHMOM THR.

In comparison, the corresponding five year revision rates for female patients older than 65 years were 1.6% (1.5% to 1.8%) for cemented THR, 3.0% (2.7% to 3.4%) for uncemented, 2.0% (1.6% to 2.4%) for hybrid, 8.8% (5.2% to 14.7%) for hip resurfacing and 10.5% (6.1% to 17.8%) for LHMOM THR.

Revision rates following primary hip replacement varied according to brand. The most commonly used cemented stem, the Exeter V40, had a revision rate of 1.9% (1.7% to 2.0%) at five years.

For uncemented stems, the Corail (the most commonly used uncemented stem) had a revision rate of 3.8% (3.3% to 4.3%) at five years.

For cemented cups, the Contemporary, which was used most frequently, had a five year revision rate of 1.9% (1.6% to 2.3%).

For uncemented cups, the Pinnacle was the market leader and had a five year revision rate of 2.9% (2.4% to 3.5%).

A number of these prostheses were implanted in relatively small numbers and despite the difference in revision rates and hazard ratios, the 95% CIs frequently overlapped, indicating that not of all of these differences were statistically significant. Therefore care needs to be taken when interpreting these data.

In resurfacing procedures, there were differences between brands of resurfacing. The market leader, the BHR, had a five year revision rate of 4.3% (3.8% to 4.9%). The ASR had a five year revision rate of 12.0% (9.3% to 15.4%).

The overall mortality after primary hip replacement was 0.6% at 90 days and 9.9% at five years. Mortality was lower in patients who underwent hip resurfacing than in those who received other types of prostheses, even after multivariable adjustment.

The mean length of stay in hospital after primary hip replacement was 6.9 days. Elderly patients, females and those in poor physical condition stayed longer. The length of stay of patients in treatment centres and independent hospitals was shorter than those treated in an NHS hospital even after multivariable adjustment.

Knee replacement procedures

The overall revision rate⁷ following primary TKR was 0.7% at one year (0.6% to 0.7%), 2.5% (2.5% to 2.6%) at three years and 3.6% (3.5% to 3.7%) at five years. The five year revision rates were 3.0% with cemented knee replacement (2.9% to 3.1%), 3.7% with cementless knee replacements (3.3% to 4.1%) and 4.2% with hybrid prostheses (3.3% to 5.2%).

The five year revision rate for unicondylar replacement was 9.4% (8.7% to 10.2%) and 11.6% for patello-femoral replacement (9.6% to 13.9%).

Revision rates were lower in female patients compared with male patients, with the exception of unicondylar replacement where the five year revision rate in male patients was 8.6% (7.7% to 9.7%) compared with 10.2% (9.3% to 11.4%) in females.

Revision rates did not differ significantly according to type of provider when adjusted for other risk factors.

The PFC Sigma was the market leader of the TKR brands, the five year revision rate being 2.4% (2.2% to 2.5%). The Oxford unicondylar knee replacement was the market leader for unicondylar knees and had a five year revision rate of 9.1% (8.3% to 10.0%). The Avon patello-femoral replacement was the market leader for patello-femoral replacement and had a five year revision rate of 10.2% (7.9% to 13.2%).

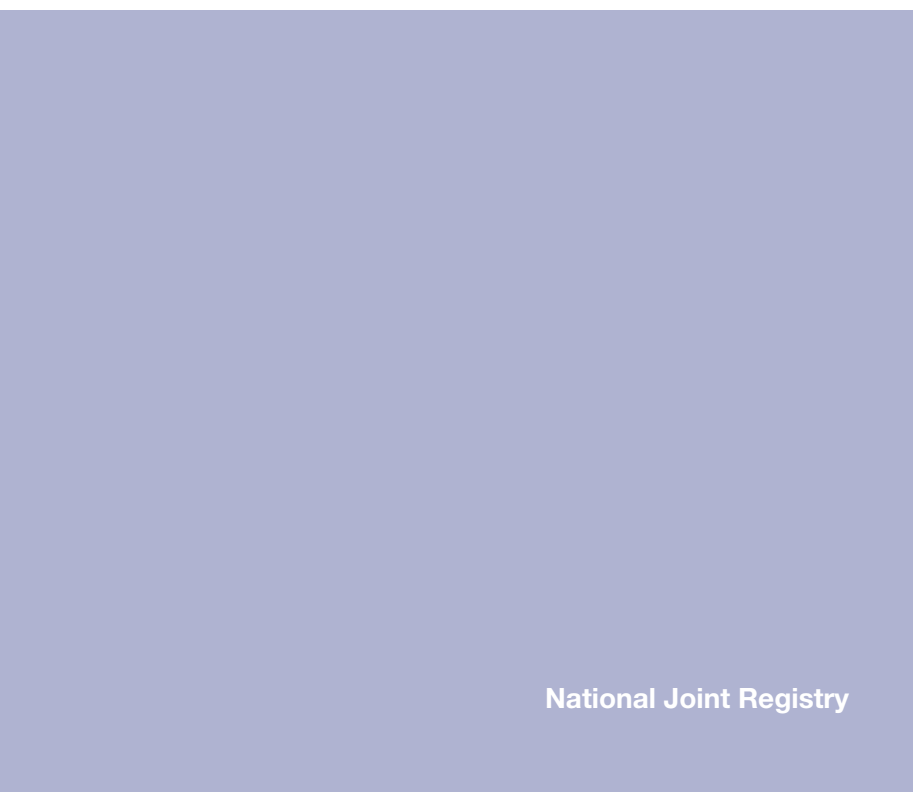
The 90 day mortality rate after primary knee replacement was 0.4% and 9.4% after five years. The mean length of stay after primary knee replacement was 6.6 days. The length of stay following unicondylar replacement was 4.2 days (4.2 to 4.3) compared with 6.8 days (6.8 to 6.8) with total knee replacement. The length of stay was 4.4 days in ISTCs (4.3 to 4.5) compared with 6.9 in NHS hospitals (6.9 to 7.0).

⁷ These revisions included operations where one element of the component had been removed and replaced. This will include cases dealing with early prosthetic infection, whereby the knee is washed out in combination with exchange of the polyethylene bearing component.

Part 1

Annual progress

1.1 Introduction



1.1.1 Annual Report

This is the 7th Annual Report of the NJR. The NJR provides information about hip and knee joint replacement surgery in England and Wales in both the NHS and independent healthcare sector. The information published in this report is of use to surgeons, patients and manufacturers of hip and knee implants (artificial joints). The NJR collects data in order to provide a broad range of stakeholders with information that will lead to an improvement in the outcomes of joint replacement surgery and improved patient safety.

The report is divided into three main parts:

- **part 1** – a general outline of the work of the NJR for the financial year 1st April 2009 to 31st March 2010. It provides summary statistics of the data provided during the financial year, summarises major developments and outlines proposed work for the financial year 2010/11
- **part 2** – a description of joint replacement activity as reported to the NJR in the calendar year 1st January to 31st December 2009
- **part 3** – provides an analysis of survivorship of hip and knee replacement surgery using data submitted to the NJR from 1st April 2003 to 31st December 2009. Data from HES and PEDW are also included in the analysis.

1.1.2 The NJR

The NJR was established in October 2002 and began collecting and studying data on hip and knee replacement procedures in April 2003. The aim of the NJR is to provide information to all those involved in the management and delivery of joint replacement surgery with regard to surgical and implant performance and clinical best practice. This includes the regulatory authorities such as the MHRA and the Care Quality Commission (CQC). Central to the provision of this information is the aim of improving patient outcomes and patient safety.

The NJR can only achieve its aims if it has a continuous supply of high quality and accurate data with maximum coverage of joint replacement procedures from all units providing care. Only good quality data can enable long term monitoring of the effectiveness of hip and knee joint replacement surgery. By 31st March 2010, the NJR held information on approximately 905,000 individual procedures undertaken in England and Wales, making it the largest registry of its type in the world.

1.1.3 Management and funding

The NJR is managed by HQIP under contract with the DH. HQIP supports the work of the NJR Steering Committee, an advisory non-departmental public body whose current list of members and their declarations of interest are listed in Appendix 1. The NJR Steering Committee oversees the strategic direction and running of the NJR.

The NJR Centre is responsible for the running and the development of the NJR database for all data collection and analysis. It is managed by Northgate Information Solutions (UK) Ltd under contract with HQIP.

The NJR is funded through a levy raised on the sale of hip and knee implants. HQIP manages the levy payment collections and holds the NJR budget on behalf of the NJR Steering Committee.

Part 1

1.2 Data completeness and quality

1.2.1 Key indicators

The completeness and quality of the data submitted to the NJR Centre is measured using three key indicators:

- **compliance** – this is the rate, expressed as a percentage, of procedure records submitted to the NJR compared with the levy returns for the number of implants sold
- **consent** – the number of records submitted for which the patient has agreed to his or her personal data being stored on the NJR database, compared with the number of procedures recorded on the NJR⁸
- **linkability** – the number of records submitted with the patient's NHS number compared with the number of procedures recorded on the NJR. The NHS number is required to link all primary and revision procedures relating to a single patient⁹.

The performance against the key indicators has continued to improve year on year, although it does require the provision of continual support to orthopaedic units either to maintain or improve performance levels.

1.2.2 Performance against key indicators

Progress against the three measures of compliance, consent and linkability for the financial year 2009/10 is given here.

Compliance

The DH expects all NHS trusts and NHS foundation trusts to submit details of all hip and knee joint replacement procedures to the NJR. For independent sector hospitals and ISTCs, the data collection is mandatory. Compliance is measured by comparing the number of records submitted to the NJR to the number of levies raised through the sale of implants¹⁰. The compliance of individual NHS trusts can also be measured by comparing submissions to the NJR with records submitted to HES and PEDW. Trust compliance figures are available through the NJR StatsOnline service on the NJR website.

Figure 1.1 illustrates the compliance rate across all units for the past five years. The figures are derived by comparing the number of procedures recorded on the NJR with the number of levies raised through implant sales. The compliance rate has shown a steady upward trend since 2004. The compliance rate for 2009/10 was 114.4%, indicating that there were more procedures submitted to the NJR than there were implant sales recorded within the past year. Significant variations in implant sales reported over the past three years are likely to be a major cause of the reported compliance rate exceeding 100%. 2008/09 saw an unusually high volume of sales (a 9.4% increase on sales in 2007/08), including a large number of sales in March 2009. Conversely, 2009/10 has seen a large decrease in reported sales (a 17.9% decrease on sales in 2008/09). The overall compliance rate from 1st April 2003 to 31st March 2010 is 82%.

⁸ Personal information includes NHS number, name, date of birth and postcode.

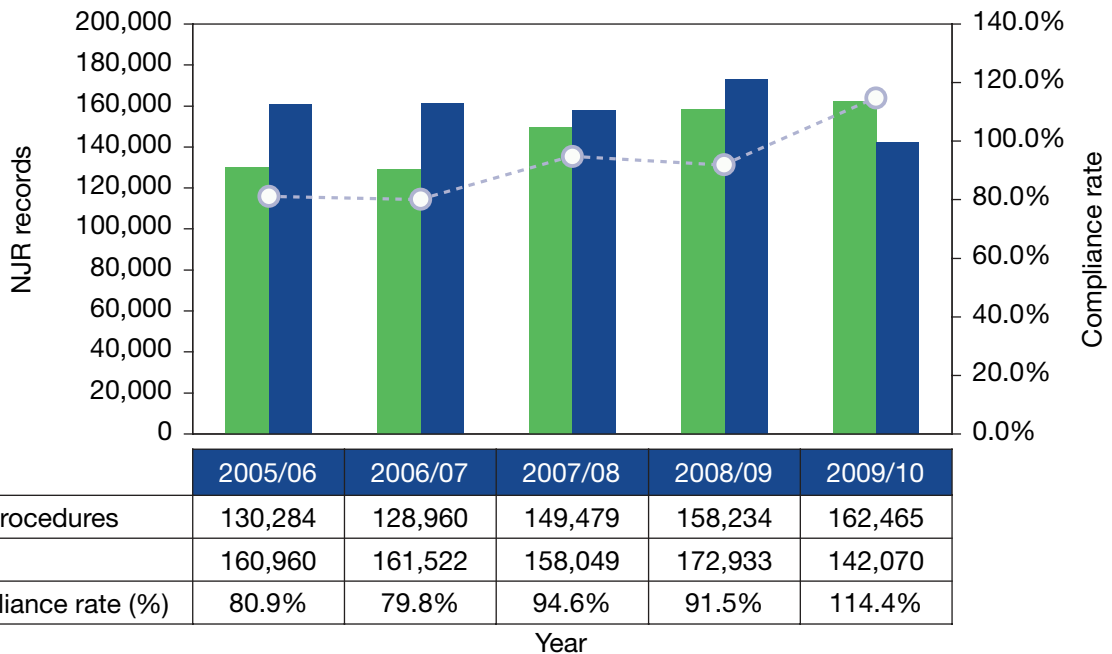
⁹ NJR data is submitted for NHS number tracing; the linkability figure includes NHS numbers that were traced subsequent to details of the operation being submitted to the NJR.

¹⁰ For compliance analysis only, the number of procedures excludes the following procedures: re-operations other than revision; stage one of a two stage revision; hip excision arthroplasty; knee amputation and knee conversion to arthrodesis. These are excluded because they do not include the implantation of a component attracting the levy.

Figure 1.1

NJR compliance: 2005/06 to 2009/10, based on levies from implant sales.

Source: Procedures entered into the NJR, 1st April 2005 to 31st March 2010, and levy submissions to the NJR by implant suppliers and manufacturers^{10,11}.



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The NJR StatsOnline service publishes figures for each hospital and treatment centre. Patients, clinicians and managers are able to view the contribution being made by their unit to the NJR and, ultimately, to improving patient outcomes and safety. Compliance varies widely with some orthopaedic units failing to

submit any records. The number of non-returning units has reduced, from 11 last year to 4 for the year 1st April 2009 to 31st March 2010. The following hospitals performed elective hip and knee replacement surgery but did not submit any data to the NJR:

Table 1.1 List of non-returning units, 2009/10.

| Trust | Hospital |
|--------------------------------------------|--------------------------------------------|
| Orthopaedics and Spine Specialist Hospital | Orthopaedics and Spine Specialist Hospital |
| Salford Royal NHS Foundation Trust | Hope Hospital |
| South London Healthcare NHS Trust | Orpington Treatment Centre |
| South London Healthcare NHS Trust | Princess Royal University Hospital |

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¹¹ Compliance figures for previous years appear slightly lower than in the previous Annual Report owing to a continuous process of data cleansing to remove duplicate records from the NJR. When duplicates are identified, units are alerted and duplicate records deleted.

Consent

By consenting to store their personal details, patients enable the NJR to monitor the outcomes of hip and knee replacement procedures. Recording these details, including the NHS number, allows the NJR to link together a patient's operations over time. This allows the identification of problems with implants and surgery at an early stage so that appropriate action may be taken. Without patient consent, the NJR cannot meet its aims.

When a record is submitted to the NJR, the unit must confirm whether the patient has consented. There are three options: 'Yes', 'No' and 'Not recorded'. The NJR has been granted support under Section 251 of the NHS Act 2006, enabling patient details to be recorded where consent is 'Not recorded'. This exemption is temporary, subject to annual review and is granted on the understanding that efforts are made to ensure consent is recorded. It is therefore essential that all

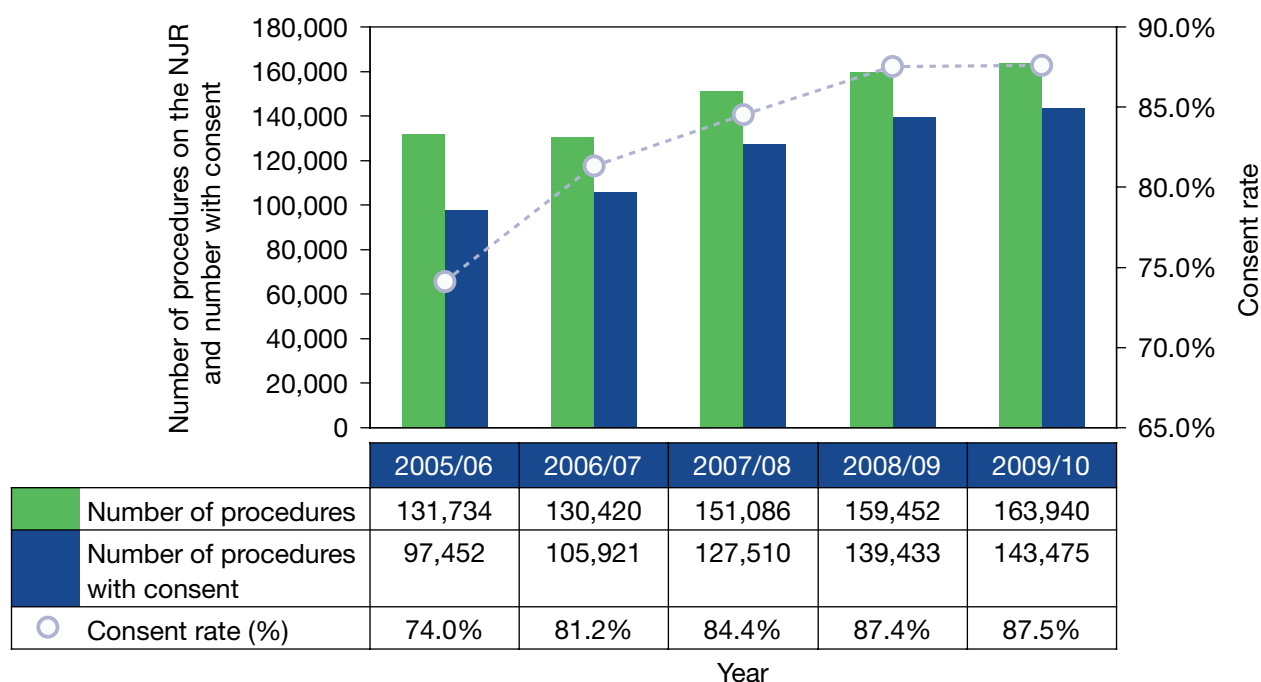
units take action to ensure a sound consent process is in place. Patients, when asked, rarely refuse to consent and the failure to record consent is usually the result of the consent form not being available to the person entering the data.

Consent rates have levelled off following four years of steady increases, as shown in Figure 1.2. The consent rate for 2009/10 was 87.5%. The fact that the consent rate has not increased in the past year is, in part, due to a number of previously non-compliant units beginning to submit data to the NJR prior to the establishment of good consent processes. The NJR Regional Co-ordinators are working with these units to improve consent rates. The consent rate for all operations submitted to the NJR from 1st April 2003 to 31st March 2010 is 79.7%.

Figure 1.2

NJR consent: annual analysis of total records received and those received with patient consent, 2005/06 to 2009/10.

Source: *Procedures entered into the NJR, 1st April 2005 to 31st March 2010.*



Linkability

The linkability rate refers to the ability to link all operations relating to a single patient. It is dependent on having both patient consent and an NHS number recorded. Linkability is essential to monitoring the performance of implants and surgery and the NJR will fail in its aims if records cannot be linked.

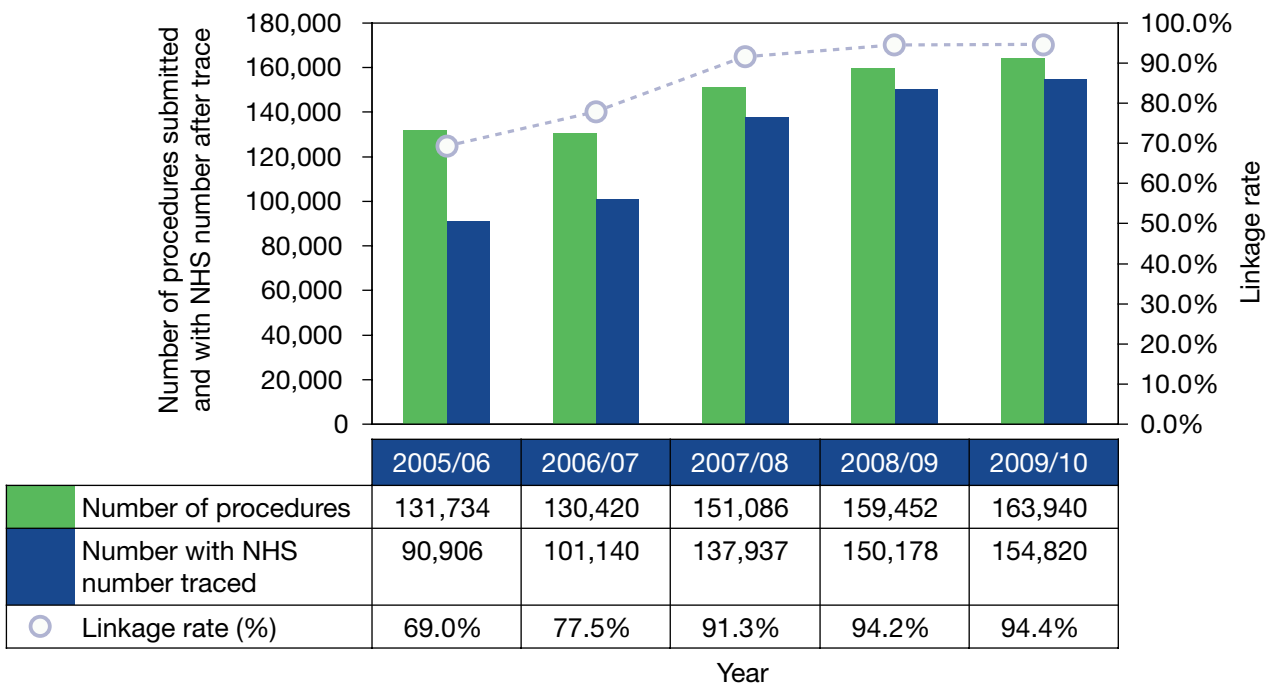
Where the NHS number is not recorded, and for independent sector cases, tracing is attempted using the NHS PDS, which relies on the patient’s name, date of birth and postcode being correctly recorded.

Figure 1.3 shows the percentage of linkable records submitted to the NJR from 2005/06 to 2009/10. The linkability rate for 2009/10 was approximately equal to the rate for 2008/09 (94.4% compared with 94.2%). The linkability rate for the whole NJR database is now 81%, the highest rate since its inception. The increase is, in part, due to units clearing backlogs and updating consent status for operations in previous years.

Figure 1.3

NJR linkability: analysis of total records received and those for which NHS numbers have been traced, 2005/06 to 2009/10.

Source: Procedures entered into the NJR, 1st April 2005 to 31st March 2010.



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Part 1

1.3 Key figures



1.3.1 Operation totals

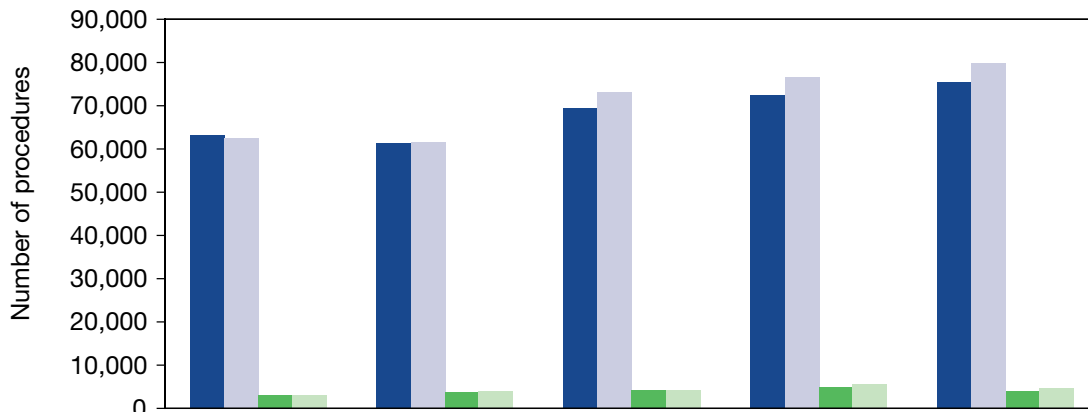
From the launch of the NJR on 1st April 2003 to March 31st 2010, 905,384 hip and knee replacement procedures in England and Wales were recorded on the NJR. 2009/10 saw the largest number of submissions to date (163,940).

The total number of procedures recorded on the NJR in England and Wales each year from 2005/06 to 2009/10 is shown in Figure 1.4. For the fourth year running, the number of knee replacement procedures (84,527) exceeded the number of hip replacement procedures (79,413).

Figure 1.4

Total hip and knee joint replacement procedures entered into the NJR, 2005/06 to 2009/10, recorded by the country in which the procedure took place.

Source: Procedures entered into the NJR, 1st April 2005 to 31st March 2010



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| | 2005/06 | 2006/07 | 2007/08 | 2008/09 | 2009/10 |
|--------------|---------|---------|---------|---------|---------|
| England hip | 63,167 | 61,369 | 69,485 | 72,389 | 75,465 |
| England knee | 62,556 | 61,476 | 73,091 | 76,447 | 79,897 |
| Wales hip | 2,984 | 3,674 | 4,192 | 4,937 | 3,948 |
| Wales knee | 3,027 | 3,901 | 4,318 | 5,679 | 4,630 |

Procedures by year and country

Operation types

The NJR has records for three different types of hip and knee joint replacement procedures:

- **primary** – the first time a joint is replaced
- **revision** – an operation that involves the removal and replacement of one or more components of a joint replacement
- **re-operation other than revision** – an operation, following either a primary or revision operation, which does not require any joint implants to be removed or replaced, e.g. a wound debridement or wash out¹².

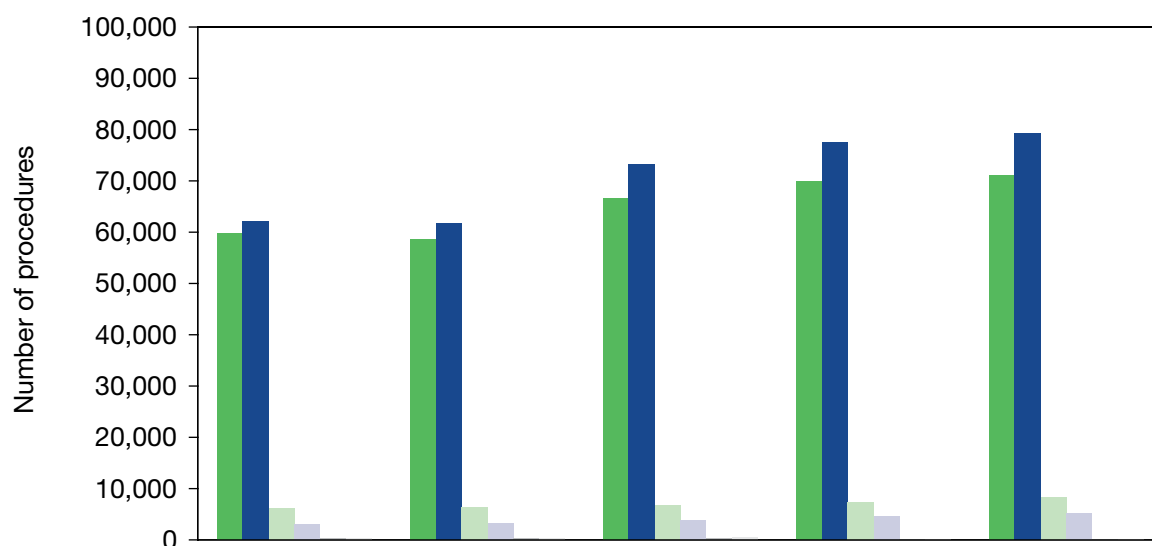
Figure 1.5 below shows the number of procedures reported by type from 1st April 2005 to 31st March 2010. Primary operations continue to represent the most reported procedures (91.7%) with the difference in the number of knee primary procedures and hip primary procedures continuing to increase in favour of the former (in 2005/06 there were 2.1% more knee than hip primary procedures as a proportion of the total, compared with 5.5% more in 2009/10).

¹² Re-operation information was not collected on the first version of the Minimum Dataset (MDSv1) from 1st April 2003 to 31st March 2004. It was included on MDSv2 from 1st April 2004 and removed from MDSv3, which came into use on 1st November 2007. However, some units are continuing to use MDSv2, which is why some re-operations continue to be reported. The figures are included for completeness only.

Figure 1.5

Hip and knee joint replacement procedures entered into the NJR, 2005/06 to 2009/10, recorded by procedure type.

Source: Procedures entered into the NJR, 1st April 2005 to 31st March 2010



| | 2005/06 | 2006/07 | 2007/08 | 2008/09 | 2009/10 |
|---------------------------------|---------|---------|---------|---------|---------|
| Hip primary | 59,648 | 58,538 | 66,668 | 69,888 | 71,021 |
| Knee primary | 62,217 | 61,705 | 73,269 | 77,517 | 79,263 |
| Hip revision | 6,169 | 6,200 | 6,729 | 7,362 | 8,309 |
| Knee revision | 3,035 | 3,299 | 3,701 | 4,521 | 5,187 |
| Hip re-operation ¹² | 334 | 305 | 280 | 76 | 83 |
| Knee re-operation ¹² | 331 | 373 | 439 | 88 | 77 |

Procedures by year and joint/type

Where the operations took place

Of the 905,384 procedures submitted to the NJR since data collection began, 94.9% were carried out in England and 5.1% in Wales. In 2009/10, 155,362 (94.8%) procedures were carried out in England, compared to 8,578 (5.2%) in Wales.

There are four types of organisations in England carrying out hip and knee joint replacement surgery:

- NHS hospital
- NHS treatment centre
- independent healthcare sector hospital
- ISTC.

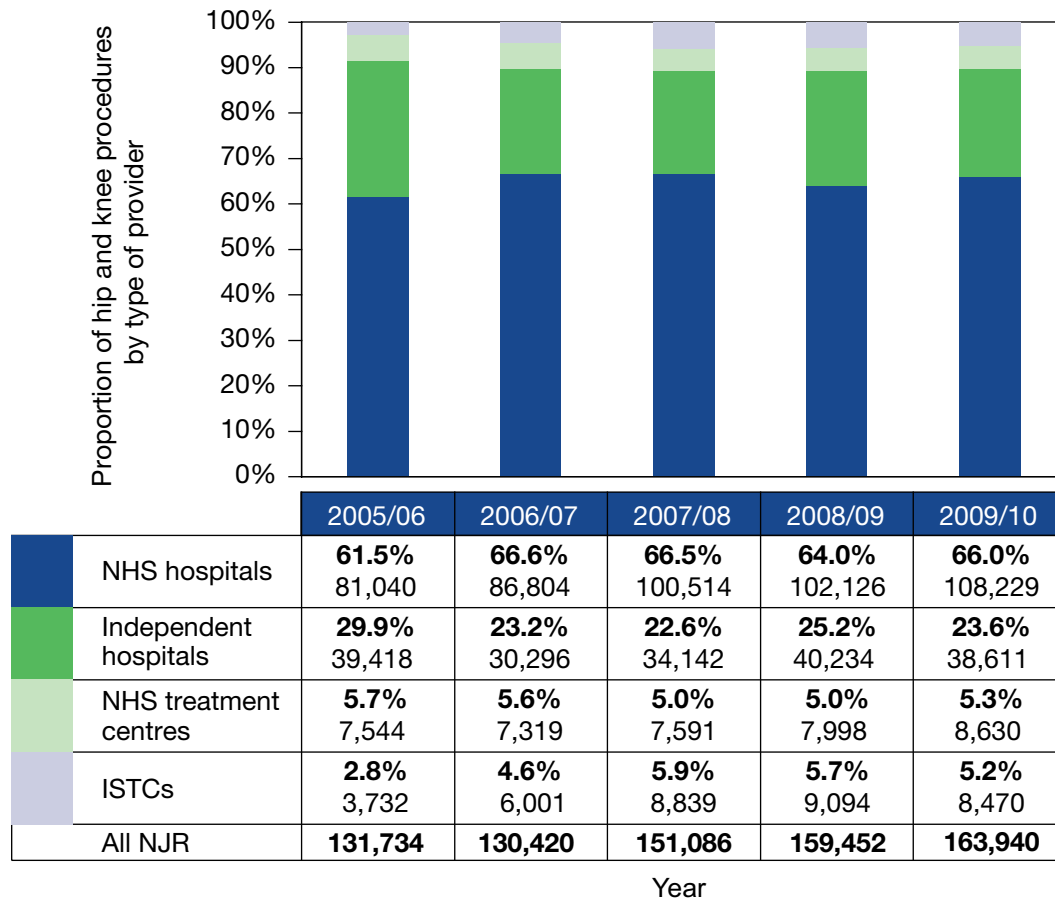
There are no NHS treatment centres or ISTCs in Wales.

Since data collection began, 587,856 (64.9%) of submitted procedures took place in NHS hospitals in England and Wales, 236,377 (26.1%) in independent hospitals, 43,657 (4.8%) in NHS treatment centres and 37,494 (4.1%) in ISTCs. Figure 1.6 shows the proportion of procedures by type of provider.

Figure 1.6

Proportion of reported procedures by type of provider, 2005/06 to 2009/10.

Source: Procedures entered into the NJR, 1st April 2005 to 31st March 2010.



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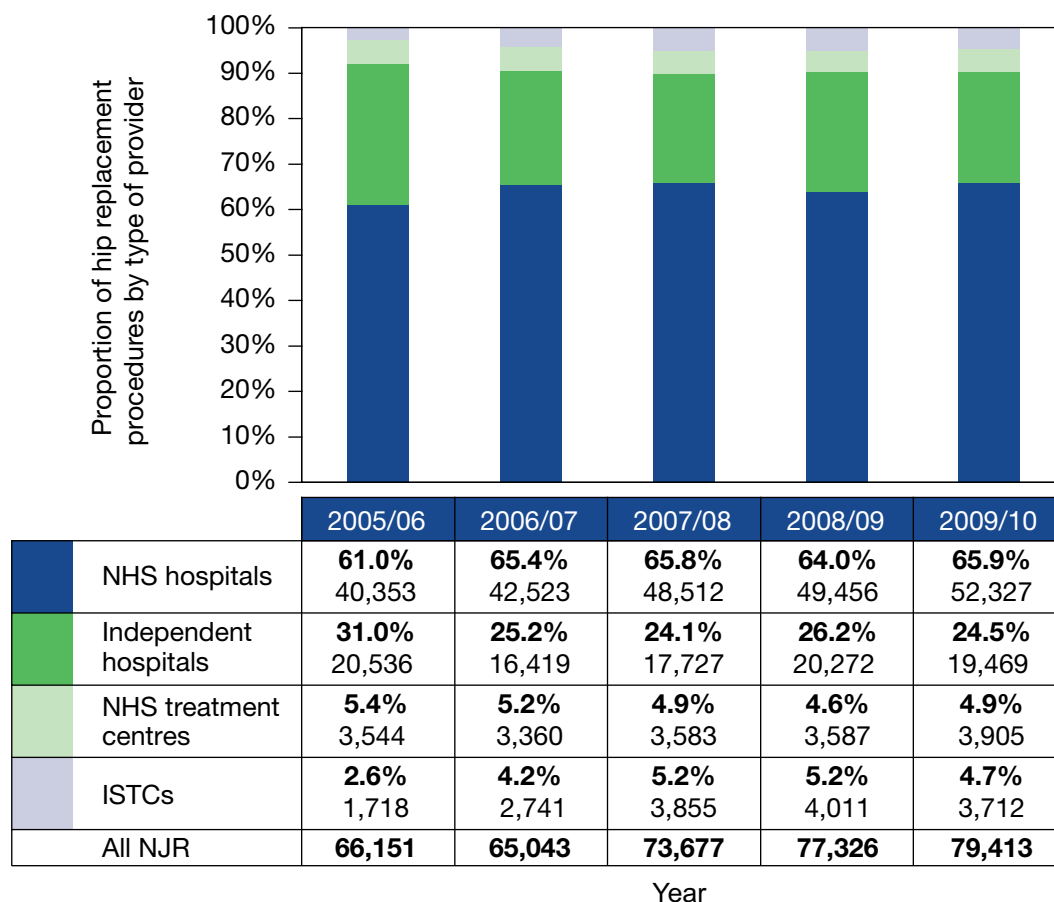
In contrast to last year's increase in the proportion of procedures undertaken in independent sector hospitals, figures for 2009/10 show a slight decrease (1.7%), compared with a slight increase (2.0%) in NHS hospitals. The proportion of procedures undertaken in NHS treatment centres and ISTCs has remained broadly similar to that reported last year.

The proportion of hip replacement procedures reported to the NJR by type of provider is shown in Figure 1.7.

Figure 1.7

Proportion of hip replacement procedures by type of provider, 2005/06 to 2009/10.

Source: Procedures entered into the NJR, 1st April 2005 to 31st March 2010.



The proportion of hip replacement procedures undertaken in independent hospitals decreased slightly (1.7%) in 2009/10, while the proportion of procedures undertaken in NHS hospitals increased slightly (1.9%). This contrasts with last year's reported increase in the proportion of procedures undertaken in

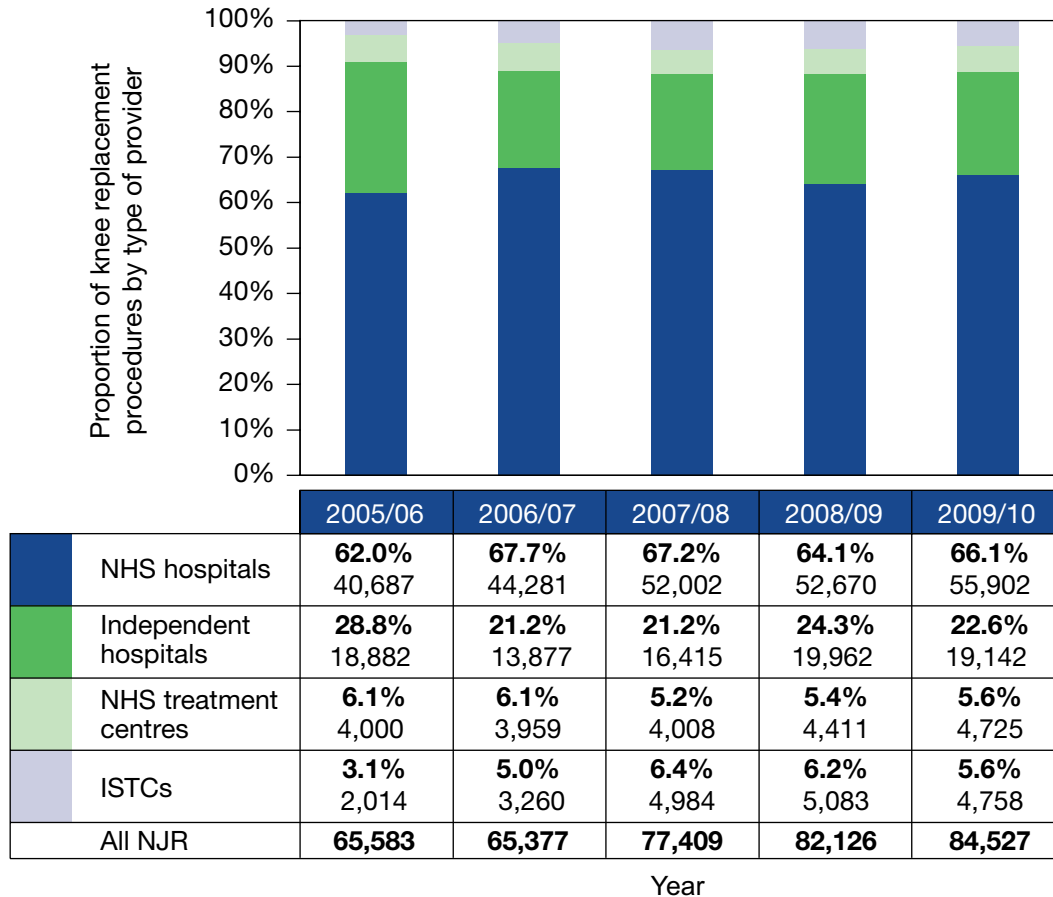
independent hospitals. The proportion of procedures undertaken in NHS treatment centres and ISTCs has remained broadly similar to that reported last year.

Figure 1.8 shows the proportion of knee replacement procedures reported to the NJR by type of provider.

Figure 1.8

Proportion of knee replacement procedures by type of provider, 2005/06 to 2009/10.

Source: Procedures entered into the NJR, 1st April 2005 to 31st March 2010.



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The proportion of knee replacement procedures undertaken by the four types of provider reported this year has seen changes similar to those reported for hip replacements. The proportion of knee procedures reported by independent hospitals decreased by

1.7%, compared with an increase of 2.0% in NHS hospitals in England and Wales. The proportion of procedures undertaken by NHS Treatment Centres and ISTCs has remained broadly similar to that reported last year.

Part 1

1.4 Progress and plans



1.4.1 Strategic Plan

Following preparatory work last year, the NJR Steering Committee agreed the NJR Strategic Plan for 2009-2011 in July 2009. The plan is built around the five strategic goals set out below.

Improve information availability

There has been a significant focus on improving compliance, consent and linkability of NJR data over the past seven years. The NJR Steering Committee recognises the need now to focus on providing stakeholders with timelier and more accessible information on joint replacement surgery. Projects supporting this goal include providing online NJR feedback services to suppliers, hospital managers and clinical governance staff, in the same vein as the existing NJR Clinician Feedback service, and dissemination of information through the NJR website.

Promote research

The NJR Steering Committee seeks to facilitate the use of NJR data to support high quality research. The NJR currently contains more than 905,000 records of hip and knee procedures which, with appropriate governance, should be made available to all those who wish to use the data for studies and research aimed at improving outcomes for patients. Projects supporting this goal include the NJR PROMs project (see 1.4.6), NJR-funded research studies and the establishment of an approved research process that monitors and manages research requests.

Improve data quality

The value of the NJR and its ability to inform local and national decision making is dependent upon the reliability and quality of the underlying data. It is therefore essential to measure, monitor and improve the quality of the data submitted to the NJR. Projects supporting this goal include data quality analysis (see 1.4.7) and redevelopment of the NJR infrastructure to support new categories of orthopaedic implants more effectively.

Increase scope

The goal of increasing the scope and geographic coverage of the NJR will extend its benefits to more patients and increase the evidence base of clinical best practice. Projects supporting this goal include data collection for additional joints (see 1.4.4 and 1.4.5) and the extension of the NJR beyond England and Wales.

Raise awareness

To ensure the benefits of the NJR are realised, ongoing work is required to increase the awareness of the NJR among all stakeholder groups, with targeted communications to encourage individuals to make best use of the NJR and its underlying information resources. Projects supporting this goal include undertaking a full communications review.

1.4.2 NJR Clinician Feedback

As reported in the 6th Annual Report, the Patient Time Incidence Rate (PTIR) report, presented to surgeons through the NJR Clinician Feedback service, had been disabled pending a review of statistical methods and presentation. Following the review undertaken by the RCS CEU, the presentation of the data has been revised and the report reinstated to NJR Clinician Feedback. The report utilises the statistical methodology used for surgeon outlier monitoring and enables surgeons to see their own position with regard to this indicator. Full details of the statistical methodology used may be found within the Healthcare providers section of the NJR website.

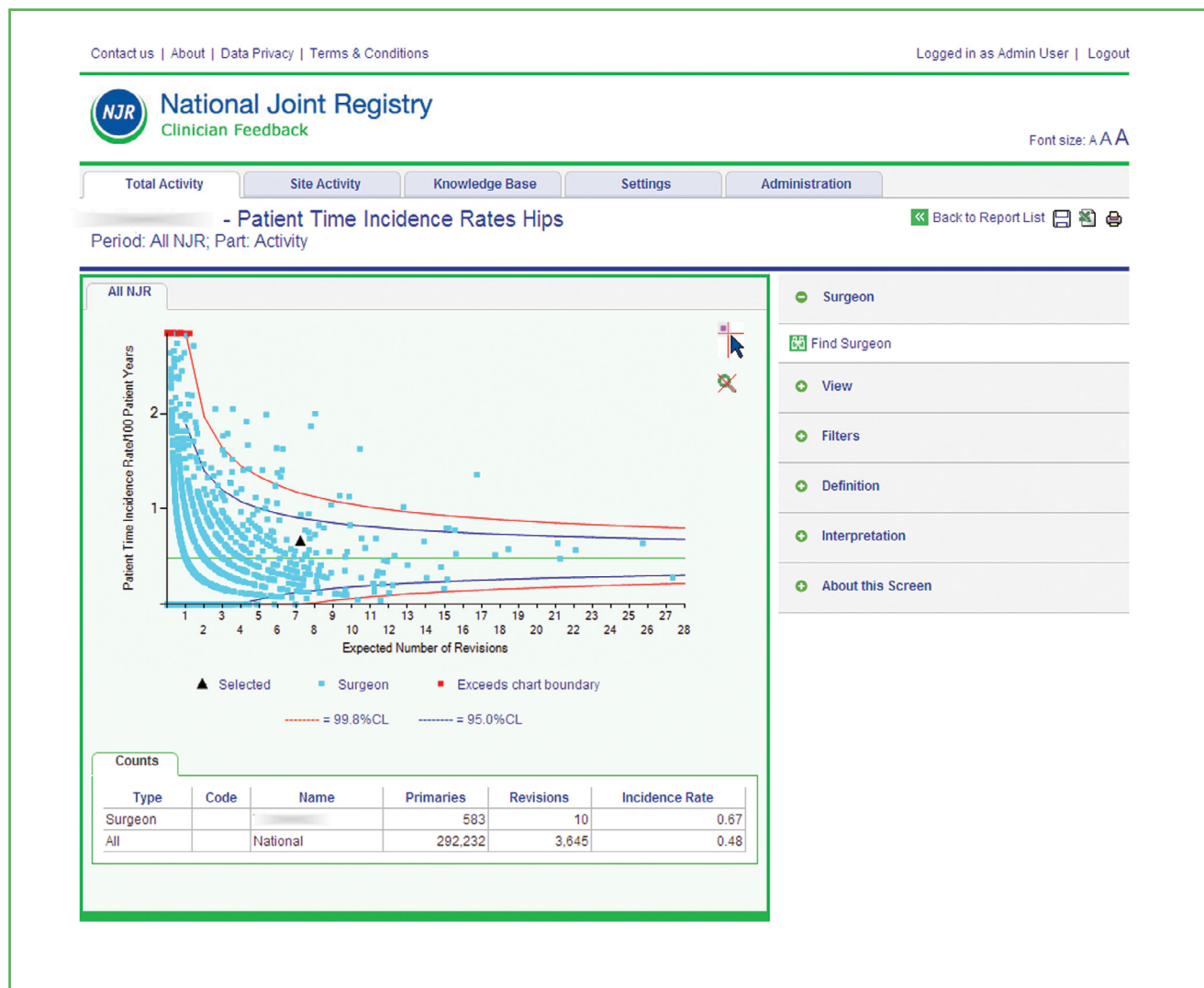
This report significantly enhances the NJR Clinician Feedback service, building upon the raw revision rate and surgeon case mix analysis previously available. Surgeons use the service to analyse their own practice and make comparisons with colleagues locally, regionally and nationally. Among the positive feedback received have been reports of surgeons using data and analysis from NJR Clinician Feedback in annual appraisals and presenting analysis of their practice to colleagues in departmental audit meetings.

Figure 1.9 shows the PTIR funnel plot. The y-axis shows the PTIR (revision rate) and the x-axis shows the expected number of revisions. The green line indicates the mean PTIR. The 95% and 99.8% control limits are shown as blue and red curves respectively.

Each surgeon is plotted as a blue dot. Surgeons above the red line may be regarded as potential outliers. Surgeons may see their own position on the funnel plot represented by a black triangle.

Figure 1.9

NJR Clinician Feedback PTIR hips report.



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1.4.3 Investigating outlier data – implants

The NJR’s outlier monitoring identified higher than expected revision rates for a particular variant of one knee implant brand. Following analysis by the MHRA and the implant manufacturer, the MHRA issued a

Medical Device Alert recommending consideration be given to annual clinical assessment of affected patients. The manufacturer discontinued the affected implant throughout Europe. Once the decision to issue an alert had been taken, the NJR was quickly able to identify those patients who had received the implant and the units that had reported such procedures to the NJR and inform those units accordingly.

During the year, the NJR advised hospitals of patients affected by two further device alerts raised by the MHRA.

Such action significantly reduces the period between the identification of a problem and the clinical review of the patient. In total, during 2009/10 the NJR notified hospitals of more than 1,000 patients affected by device alerts.

1.4.4 Ankle replacements

After a year of preparation, collection of data on ankle joint replacement procedures commenced on 1st April 2010 with levy collection starting on 1st June 2010. This project forms part of the planned extension of the NJR, referred to in the summary of the Strategic Plan (1.4.1).

Following approaches from the British Orthopaedic Foot and Ankle Society (BOFAS), a business case was prepared and presented to HQIP and it was agreed that the project should proceed. A draft minimum dataset was prepared in conjunction with Mr Andy Goldberg, Clinical Senior Lecturer and Consultant Orthopaedic Surgeon at the Royal National Orthopaedic Hospital in Stanmore. The dataset was approved by the BOFAS Council, the NJR Regional Co-ordinators and the NJR Steering Committee. The data entry system was developed to incorporate the new dataset, new data collection forms were developed and the patient consent form was updated to include ankle replacements.

Phase 2 of the project will commence in 2010/11 and will include development of the NJR StatsOnline and NJR ReportsOnline services to include ankle replacement data.

1.4.5 Elbow and shoulder replacements

Preparation is underway for the collection of data pertaining to elbow and shoulder replacement surgery. A formal request was received from the British Elbow and Shoulder Society (BESS), requesting the extension of the NJR to include these joints. This project forms part of the planned extension of the NJR outlined in the Strategic Plan (1.4.1). Work is in progress with representatives of BESS to identify the

requirements for the elbow and shoulder datasets and it is hoped that data collection will commence within 12 months.

The number of elbow and shoulder replacement operations is small in comparison to hips and knees. National monitoring is required to ensure greater certainty of outcomes, and to allow new developments to be monitored.

1.4.6 NJR PROMs

Preparatory work will begin in the first half of 2010/11 for a long term follow up of patient reported outcomes following hip and knee replacement surgery in England. This project, part of the NJR Strategic Plan (1.4.1), extends the pre-operative and post-operative capture of PROMs undertaken through the DH programme. This programme is independent of the NJR, but records can be linked.

The NJR PROMs study will capture further post-operative PROMs from patients having undergone joint replacement surgery. Self-report questionnaires will be sent to patients who have consented both to DH PROMs and to the NJR. These questionnaires will enable comparison between baseline and follow-up pain and function, assess the impact of a range of potential risk factors and provide insight into the effect of arthroplasty on healthcare utilisation and satisfaction. The cohort study will enrich the NJR with valid epidemiological data, which will inform surgical practice and help patients make more informed decisions about their care.

1.4.7 6th Annual Report specialist studies

A summary of the results for four of the five planned specialist studies is presented below. All these analyses were based on the linked NJR-HES data used for the analyses presented in Part 3 of the 6th Annual Report. The analysis of the re-revisions of first revisions was postponed until data quality issues regarding coding of side and identification of second and subsequent revisions can be resolved.

Special topic A - outcomes after THR in patients who had a femoral neck fracture

Introduction

THR is increasingly being used as a treatment for femoral neck fracture. The three year revision rate, length of hospital stay and 30 day mortality were examined in patients who had a femoral neck fracture treated with an emergency THR.

Methods

All patients who had an NJR record indicating that they had a THR between 1st April 2003 and 30th November 2008 following a fractured neck of femur and linked to a HES record for emergency admission, with matching diagnosis and procedure codes, were included.

Revision procedures were identified through linkage both within the NJR and HES. Length of stay was calculated using HES and mortality was estimated based on linked data from the Office for National Statistics

Revision rates and 30 day mortality rates were estimated using Kaplan-Meier methods. Multivariable linear and Cox regression were carried out to adjust analyses for age, gender, physical status and type of provider.

Results

The mean standard deviation (sd) age of the 1,301 patients included in the analysis was 71 years (10) and 966 (75%) were female. Of these patients, 710 (54%) had a cemented prosthesis, 350 (27%) a cementless prosthesis and 242 (19%) a hybrid.

The overall revision rate was 2.0% (1.4% to 2.8%; 95% CI) at three years. Rates varied according to prosthesis type ($p=0.02$). Three year revision rates were 0.9% (0.4% to 2.0%) with a cemented prosthesis, 4.1% (2.2% to 7.3%) with a cementless prosthesis and 2.2% (0.9% to 5.3%) with a hybrid. After adjustment, the revision rate with a cementless prosthesis was 2.9 (1.0 to 8.1) times higher than with a cemented prosthesis. The corresponding hazard ratio with a hybrid was 2.1 (1.0 to 7.6).

The mean length of hospital stay was 16 days. There were no differences according to type of prosthesis ($p=0.75$). Length of stay increased with older age ($p<0.001$) and poorer physical status according to ASA grade ($p<0.0001$). Women stayed about two days longer in hospital than men ($p=0.02$). The effect of age and physical status remained significant after adjustment (both $p<0.0001$).

Twenty patients died within 30 days of their procedure. 30 day mortality was 1.8% (1.1% to 3.2%) with a cemented prosthesis, 0.9% (0.3% to 2.6%) with a cementless prosthesis and 1.7% (0.6% to 4.4%) with a hybrid, but these differences were not statistically significant (adjusted $p=0.32$).

Conclusion

The overall revision rate in patients who had a total hip replacement for a fractured neck of femur was similar to the rate reported for patients with other indications, although the revision rate in those with a cementless prosthesis was higher. Furthermore, length of stay and mortality were increased after THR for a fractured neck of femur.

Special topic B – revision rates after cementless total hip replacement: does hydroxyapatite (HA) coating make a difference?

Introduction

Coating of components of cementless hip prostheses with HA is thought to improve the fixation to the acetabular or femoral bone. However, two systematic reviews found no clinical or radiological benefits of HA coating^{13,14}. The revision rates in patients who had received a cementless prosthesis with or without HA coating were compared according to data registered with the NJR.

Methods

In the NJR, 157,232 primary THRs carried out between April 2003 and November 2008 were identified that could be linked to a HES episode. Information about HA coating of the femoral stems and acetabular cups was extracted from the component data recorded on the NJR. The most

¹³ Goosen JH, Kums AJ, Kollen BJ, Verheyen CC. 1: Arch Orthop Trauma Surg. 2009 Sep;129(9):1165-9.

¹⁴ Gandhi R, Davey JR, Mahomed NN. J Arthroplasty. 2009 Jan;24(1):38-42.

commonly used brands of stems and cups were also identified. Revision procedures were identified through linkage within both the NJR and HES and revision rates were estimated with Kaplan-Meier methods. Multivariable Cox regression was carried out to adjust for confounding factors.

Results

Analysis found 38,013 patients with a linked NJR-HES record who had a primary cementless THR. The mean (sd) age was 65 years (11) and 22,016 (58%) were female. Of these patients, 3,357 (9%) had received a hip prosthesis of which neither the femoral or acetabular component was HA coated (group 1). Only the femoral component was coated (group 2) in 7,256 (19%) patients and only the acetabular component was HA coated (group 3) in 2,681 (7%) patients. The remaining 24,719 (65%) patients had both components coated (group 4).

The overall three year revision rate was 2.6% (2.4% to 2.8%). This rate was 2.3% (1.8% to 3.1%) in group 1, 2.5% (2.1% to 3.1%) in group 2, 3.7% (2.5% to 5.2%) in group 3 and 2.5% (2.4% to 2.9%) in group 4. After adjustment for age, gender, physical status and type of provider these differences were not significant ($p=0.82$).

The revision rates for procedures in which the same brand of the stem-cup combination was used, but with a different coating status, were also compared. The three year revision rate was 3.0% (2.1% to 4.3%) in 3,793 patients with an HA coated Corail stem and an uncoated Pinnacle cup and 2.2% (1.7% to 2.7%) in 7,897 patients with an HA coated Corail stem and an HA coated Pinnacle cup ($p=0.21$).

The three year revision rate was 3.1% (2.1% to 4.6%; 95% CI) in 1,480 patients with an HA coated Corail stem and an uncoated Duraloc cup and 1.9% (1.2% to 3.0%) in 999 patients with an HA coated Corail stem and an HA coated Duraloc cup ($p=0.11$).

Conclusion

The analysis of NJR data indicates that there is no evidence that the revision rate of primary hip replacements with a cementless prosthesis differs according to HA coating group.

Special topic C - data quality and completeness of the identification of revision operations

Introduction

Longitudinal linkage within HES and within the NJR was used to identify revisions in patients for whom there is an NJR-HES linked record of the primary joint replacement. Capture-recapture analysis was carried out to evaluate the completeness of this identification process. This allowed an estimate of the number of revisions that are missed provided that specific assumptions are met, the most important being the independence of data capturing for both databases. A detailed analysis of reasons why revisions could not be identified through longitudinal linkage within HES or through longitudinal linkage within the NJR was carried out.

Methods

A HES record was assumed to represent a revision procedure if one of the procedure codes corresponded with Office of Population, Censuses and Surveys (OPCS) codes defined by the project team (definitions are available on request). Revisions identified through linkage within HES or within the NJR should be on the same joint and the same side as the primary joint replacement.

For the detailed analysis of reasons for not identifying revisions, random samples of revisions were reviewed. One sample included revisions identified within HES but not within the NJR and another included revisions identified within the NJR but not within HES.

Results

The analysis identified 2,464 revisions of primary hip replacements; 332 (14%) only within the NJR, 1,188 (48%) only within HES and 944 (38%) within both. Capture-recapture analysis estimated that 418 revisions had not been identified within either source. As a result, the revision rate based on both NJR and HES is likely to underestimate the 'true' revision rate by about 15%.

Similarly, 3,061 revisions of primary knee replacements were identified; 375 (12%) only within the NJR, 1,466 (48%) only within HES and 1,220 (40%) within both. It is estimated that 451 had not been identified within either source and the 'true' revision rate is likely to be underestimated by about 13%.

Revisions identified within the NJR but not within HES

52 hip revisions and 49 knee revisions identified within the NJR, but not within HES, were selected at random. The starting point was to assume that the information about the revision recorded in the NJR was correct. Reasons why the 52 revisions of primary hip replacements had not been identified within HES were broadly due to 'coding' issues in 73% of cases and 'linkage' issues in 27% of cases. Coding issues seemed to have occurred if: there was a HES record of a matching episode, but without a procedure code that represented a revision (44%); with a revision code for another joint (23%) or with a revision code for the same joint on the other side (6%). Linkage issues are likely if there was no HES record of a matching episode (19%) or if the revision fell in the same episode as the primary replacement (8%). A detailed analysis of the 49 knee revisions showed a similar picture.

Revisions identified within HES but not within the NJR

25 hip revisions and 22 knee revisions identified within HES, but not within the NJR, were randomly selected. The starting point in this case was to assume that the information about the revision recorded in HES was correct. Analysis found that 12% of the revisions of primary hip replacements had not been identified in the NJR because of coding issues (for example, matching NJR record, but revision not on same side; matching NJR record, but procedure recorded as primary; matching NJR record, but recorded as re-operation other than revision). Linkage issues were the likely explanation for not identifying 88% of the revisions within the NJR (for example, no matching NJR record; matching NJR record of a revision, but not linked to primary procedure).

Conclusions

HES identified 68% more revisions than the NJR. The reasons why HES failed to identify revisions were mainly related to coding issues. The reasons why the NJR failed were mainly related to linkage issues.

Special topic D – thromboprophylaxis in primary hip replacement: an evaluation of the effect of LMWH versus aspirin on outcomes after hip replacement surgery

Introduction

The method of thromboprophylaxis after hip and knee replacement is still hotly debated. The use of LMWH is included in current guidelines along with dabigatran, rivaroxiban and fondaparinux in England but aspirin is considered not to provide adequate prophylaxis for venous thromboembolism (VTE). NJR data was used to compare VTE outcomes in patients undergoing primary hip replacement who were prescribed either LMWH or aspirin as thromboprophylaxis.

Methods

According to the NJR, 157,232 primary THRs were carried out between April 2003 and November 2008. From these, patients who had been prescribed LMWH or aspirin as chemical thromboprophylaxis, with or without additional mechanical prophylaxis, were identified. Using longitudinal linkage within HES it was determined whether patients suffered a pulmonary embolism (PE) or deep vein thrombosis (DVT) within 90 days of surgery. Severe bleeding complications (such as stroke or gastrointestinal bleeds) were examined, as was return to theatre (RTT) for wound complications within 30 days. Ninety day mortality was assessed using data from the Office for National Statistics. Event rates were compared across treatment groups using multivariable logistic regression, adjusting for age, gender, physical status and the use of mechanical prophylaxis.

Results

The analysis identified 85,642 patients with LMWH (72% with mechanical prophylaxis) and 22,942 with aspirin (82% with mechanical prophylaxis). The PE rate in both groups was 0.68%. The DVT rate in patients treated with aspirin (0.99%) was slightly higher than in those treated with LMWH (0.94%; adjusted $p=0.23$). Severe bleeding complications were seen in 0.77% of the aspirin group and in 0.72% of the LMWH group (adjusted $p=0.34$). RTT rates were 0.31% in the LMWH group and 0.36% in the aspirin group (adjusted $p=0.28$). Death within 90 days occurred in 0.65% of the aspirin group and in 0.61% of the LMWH group. However, after adjustment for patient characteristics and the use of mechanical prophylaxis, it was observed that treatment with LMWH conferred a larger protective effect against death (adjusted odds ratio 0.84; 95% CI: 0.69 to 1.01) than in the unadjusted analysis (adjusted $p=0.06$).

Conclusion

The analysis showed no differences in the rate of PE, DVT, severe bleeding complications or RTT between patients receiving LMWH or aspirin after hip replacement. Ninety day mortality was slightly lower in patients treated with LMWH. However, this difference was not statistically significant and cannot be explained by differences in any of the other post-operative events.

1.4.8 7th Annual Report specialist studies

Four studies on specialist topics are planned for the coming year:

- **Data quality** – an audit of all revisions recorded within HES (linked to the NJR). The aim is to determine the extent to which revision procedures may be under-reported and to confirm reasons for revision. This exercise will compare both HES and NJR revision records against the information recorded in hospital records
- **Revision rates by surgeon volume and unit volume** – investigating whether, and to what extent, there is a relationship between the number of procedures carried out by a surgeon, or unit, and their revision rates. If a relationship is apparent, the study will examine whether the relationship differs according to the procedure type
- **Variations in the prognostic models for revision by prosthetic type** – examining how case mix variables, such as BMI, age and gender, affect clinical outcome. It will also examine whether and how these effects are different for different types of implant
- **Revision rates by indication for revision** – there are several reasons that a primary hip or knee replacement may be revised, including infection, fracture and aseptic loosening. This study will focus on the differing reasons for revision, including variations between types of procedure.

Part 1

1.5 Governance and support



1.5.1 Managing the NJR

The work of the NJR benefits a large number of diverse stakeholders and a comprehensive list of these stakeholders can be found on the NJR website:

www.njrcentre.org.uk

NJR Steering Committee

The NJR Steering Committee met four times during 2009/10 and the minutes of those meetings are published on the NJR website. The committee's current members were appointed by the Appointments Commission on behalf of the Secretary of State for Health following a formal recruitment process. For a current list of members and their declarations of interest, please see Appendix 1 or visit the NJR website.

Sub-groups of the NJR Steering Committee

Sub-groups have been established to oversee specific areas of the NJR's work and each is chaired by a NJR Steering Committee member.

- The **NJR Editorial Board** is responsible for overseeing the production of the Annual Report. The Chair of the Editorial Board is Mr Martyn Porter.
- The **Research Sub-group** is responsible for consideration of research requests and for the establishment of the Research Request Protocol. The Chair of the Research Sub-group is Professor Alex MacGregor.
- The **Outlier Sub-group** is responsible for the development and management of the NJR outlier process. The Chair of the Outlier Sub-group is Professor Paul Gregg.

Regional Clinical Co-ordinators' Network

The NJR Regional Clinical Co-ordinators' Network consists of 17 consultant orthopaedic surgeons, acting as local champions for the NJR and supporting the work of the NJR Steering Committee and the Regional Co-ordinators. Further information about the network and its members can be found in Appendix 2 and on the NJR website. The Chair of the network is Mr Peter Howard.

Regional Co-ordinators

The NJR Centre has 8 Regional Co-ordinators whose role is to provide on-site support to units. Their contact details, along with their areas of responsibility, are available on the NJR website.

Information and communication

The NJR has continued to communicate regularly with all stakeholders and a review of the communications strategy is included in the NJR Strategic Plan for 2009-2011. While publications have included the 6th Annual Report, Joint Approach newsletters, patient information leaflets and information published on the NJR website, it is recognised that more information needs to be provided to different audiences and that it is appropriate and easy to understand.

Representatives of the NJR Centre have attended various conferences and events, including the BOA Annual Congress and the Society of Orthopaedic and Trauma Nursing. NJR staff have also continued to hold regional workshops and undertake training visits to units.

Part 1

1.6 Finance



1.6.1 Income and expenditure 2009/10

The NJR is self-financing, funded by a levy raised on the sale of hip and knee implants to NHS and independent healthcare providers in England and Wales. The rate of the levy is recommended by the NJR Steering Committee for approval by the DH. It is subject to a memorandum of understanding between the DH, Welsh Assembly Government, Independent Healthcare Advisory Services and the Association of British Healthcare Industries (ABHI) Orthopaedics Special Interest Section.

Income to the NJR for the financial year 2009/10 was £2,499,110; expenditure for the same period was £2,390,921.

From 2008/09, HQIP became the responsible organisation for handling the levy income. This levy income included surplus funds transferred from the DH, which held this responsibility previously. This income was incorporated with the ongoing levy returns and has been profiled for funding the NJR Strategic Plan 2009-2011.

Members of the NJR Steering Committee and Regional Clinical Co-ordinators' Network are volunteers and do not receive payment for their work. However, they are reimbursed for travel and subsistence expenses incurred while attending meetings. The total expenditure for members' expenses during 2009/10 was £30,326 (of which £5,075 was for expenses incurred January to March 2009, but not invoiced until May 2009).

The levy was set at £20.00 per joint from 1st April 2009 to 31st March 2010.

Part 1

1.7 Appendices



Appendix 1

NJR Steering Committee, 2009/10

A1.1 NJR Steering Committee – composition

As an advisory, non-departmental public body, the NJR Steering Committee comprises:

| | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| • chair | 1 |
| • orthopaedic surgeons | 3 |
| • patient group representatives | 2 |
| • implant manufacturer/supplier industry | 2 |
| • public health/epidemiology representatives | 1 |
| • NHS organisation management representatives | 1 |
| • independent healthcare provider representatives | 1 |
| • practitioner with special interest in orthopaedic care who is a GP, nurse or allied health professional (physiotherapist or occupational therapist). | 1 |

A1.2 Membership from 1st October 2009

Members are appointed as posts become vacant.

| | |
|--------------------------|--------------------------------------------------------------------------|
| Professor Paul Gregg | Orthopaedic Surgeon Vice Chairman/Acting Chairman (from October 2003) |
| Mr Michael Borroff | Orthopaedic device industry (from October 2002) |
| Mrs Patricia Cassidy | Independent healthcare sector (from April 2007) |
| Miss Mary Cowern | Patient Group – Arthritis Care (from October 2006) |
| Mrs Patricia Durkin | Patient representative (from March 2007) |
| Professor Alex MacGregor | Public health and epidemiology (from October 2002) |
| Miss Carolyn Naisby | Practitioner with special interest in orthopaedics (from July 2006) |
| Mr Martyn Porter | Orthopaedic surgeon (from January 2003) |
| Mr Dean Sleigh | Orthopaedic device industry (from April 2008) |
| Mr Keith Tucker | Orthopaedic surgeon (from May 2007) |
| Mr Andrew Woodhead | NHS trust management (from January 2007) |

A1.3 Observers

The following have regularly attended NJR Steering Committee meetings as observers:

| | |
|-------------------|------------------------------------------------------------------|
| Mr Peter Howard | Chair of the NJR Regional Clinical Co-ordinators' Network |
| Dr Crina Cacou | MHRA |
| Mr Andy Smallwood | NHS Supply Chain (formerly the NHS Purchasing and Supply Agency) |
| Ms Elaine Young | National Development Lead, HQIP |
| Mr Robin Burgess | Chief Executive, HQIP |
| Mr Robin Rice | Welsh Assembly Government |

A1.4 Members' declarations of interest

| | |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Professor Paul Gregg | Consultant Orthopaedic Surgeon, South Tees Hospitals NHS Trust (orthopaedic unit receives research/audit funding from DePuy International Ltd, Stryker UK and Smith & Nephew plc) Orthopaedic Advisor for Ramsay Healthcare |
| Mr Michael Borroff | Chair, ABHI Orthopaedics Special Interest Section Employed by DePuy International Ltd, manufacturer of orthopaedic prostheses |
| Miss Mary Cowern | Development Manager for the UK charity, Arthritis Care |
| Professor Alex MacGregor | Professor of Chronic Disease Epidemiology, University of East Anglia Consultant Rheumatologist, Norfolk and Norwich University Hospital NHS Trust |
| Miss Carolyn Naisby | Consultant Physiotherapist, City Hospitals Sunderland NHS Foundation Trust |
| Mr Martyn Porter | Consultant Orthopaedic Surgeon, Wrightington, Wigan and Leigh NHS Trust (orthopaedic unit has received financial support from DePuy International Ltd for clinical and RSA studies for Elite Plus femoral stem and C-Stem) Has acted as a consultant to DePuy International Ltd in relation to the development of a hip femoral stem (C-Stem AMT) and received royalties on this hip stem |
| Mr Dean Sleigh | National Business Development Manager, Biomet Healthcare UK Ltd ABHI Council Member, ABHI Orthopaedics Special Interest Section |
| Mr Keith Tucker | Consultant Orthopaedic Surgeon, Norfolk and Norwich University Hospital NHS Trust (various sources of financial support for research undertaken by orthopaedic department) Royalties received from Johnson & Johnson Orthopaedics more than five years ago for contribution to design of hip prostheses (royalties paid to orthopaedic charity) |
| Mr Andrew Woodhead | Head of Mergers and Acquisitions, NHS London |

Appendix 2

NJR Regional Clinical Co-ordinators, 2009/10

| | |
|----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Chair Mr Peter Howard Vice Chair Mr Colin Esler | South East Coast Strategic Health Authority Mr Hagen Jähnich/Mr Helmut Zahn (shared position) Vacancy (Mr Guy Selmon resigned November 2009) |
| South West Strategic Health Authority Mr Evert Smith Vacancy (Mr Nick Fiddian resigned November 2009) | East Midlands Strategic Health Authority Mr Colin Esler, Vice Chair Mr Peter Howard, Chair |
| West Midlands Strategic Health Authority Mr David Dunlop Mr Ian D M dos Remedios | London Strategic Health Authority Mr Gareth Scott Vacancy (Mr Mark Rowntree retired February 2008) |
| North West Strategic Health Authority Mr Glyn Thomas | Yorkshire and Humberside Strategic Health Authority Mr Ian Stockley Vacancy (Mr John Mitchell resigned June 2010) |
| North East Strategic Health Authority Mr John Anderson Professor Andrew McCaskie | North Wales Mr Glynne Andrew |
| East of England Strategic Health Authority Mr Matthew Porteous Vacancy (Mr Godfrey Charnley resigned November 2009) | South East Wales Mr Alun John Mr David Woodnutt |
| South Central Strategic Health Authority Mr John Britton | |

NJR website

The following information is also available on the NJR website:

1. NJR 7th Annual Report Parts 1, 2 and 3 (annual progress, clinical activity 2009 and implant survivorship 2003-2009)
2. NJR 7th Annual Report Part 1: Annual progress (Welsh/Cymraeg)
3. NJR 7th Annual Report – NJR Steering Committee’s Terms of Reference
4. NJR 7th Annual Report – NJR Regional Clinical Co-ordinators’ Terms of Reference
5. NJR 7th Annual Report – Prostheses data
6. NJR 7th Annual Report – Tables and Figures

NJR Centre contact details

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Fax: 0845 345 9992
Email: health_servicedesk@northgate-is.com
Website: www.njrcentre.org.uk

Part 2

Clinical activity

2009

2.1 Introduction

This section summarises the number of hip and knee replacement procedures undertaken in England and Wales between 1st January and 31st December 2009 and entered into the NJR by 28th February 2010. The information is summarised according to the type of hospital or treatment centre, procedure type and patient characteristics.

2.1.1 Hospitals and treatment centres participating in the NJR

During 2009, 411 orthopaedic units were open and of these 393 (96%) submitted at least one hip or knee procedure to the NJR (Table 2.1). A compliance rate of 97.8% (calculated from comparing the number of procedures¹⁵ submitted with the number of leviabie components sold) was recorded for 2009. This compliance rate seems high and may be explained

by a stockpiling of implants in 2008 or a delay in the invoicing of implants used.

On average, 185 hip replacements and 199 knee replacements were recorded per orthopaedic unit over the year, although the numbers varied from one to 1,420 procedures (Table 2.2). Compared with previous years, there has been an increase in the number of units performing fewer than 50 hip or knee procedures. This is a reversal of the trend of the last few years. There has also been an increase in the number of units submitting between 300 and 399 hip or knee procedures.

Figure 2.1 shows an apparent decrease in the volume of hip and knee procedures between 2008 and 2009. However, not all procedures performed in 2009 are entered into the database before the 28th February 2010 deadline and will be entered after this date.

Table 2.1 Total number of hospitals and treatment centres in England and Wales able to participate in the NJR and the proportion actually participating in 2009.

| | Total number of units | Number of units submitting | Proportion participating |
|------------------------------|-----------------------|----------------------------|--------------------------|
| Total | 411 | 393 | 96% |
| NHS hospitals | 223 | 208 | 93% |
| England | 206 | 191 | 93% |
| Wales | 17 | 17 | 100% |
| Independent hospitals | 162 | 160 | 99% |
| England | 157 | 155 | 99% |
| Wales | 5 | 5 | 100% |
| ISTCs | 13 | 13 | 100% |
| England | 13 | 13 | 100% |
| Wales | 0 | 0 | - |
| NHS treatment centres | 13 | 12 | 92% |
| England | 13 | 12 | 92% |
| Wales | 0 | 0 | - |

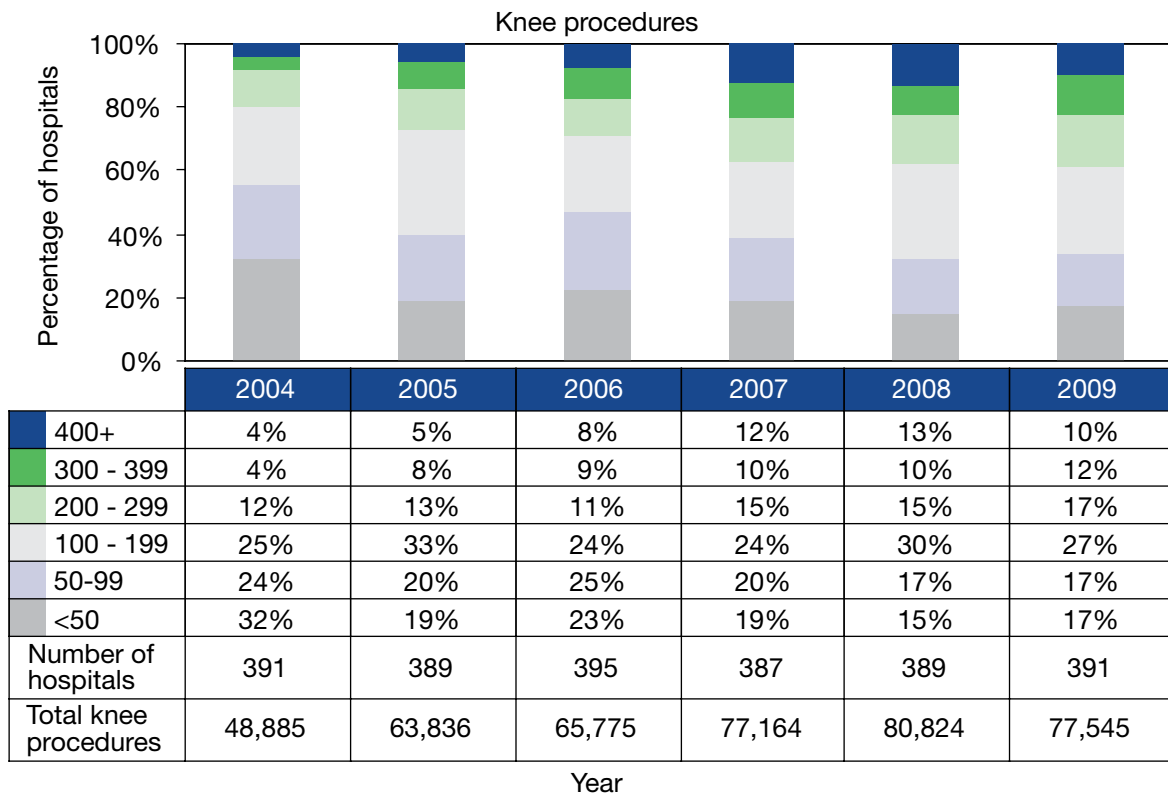
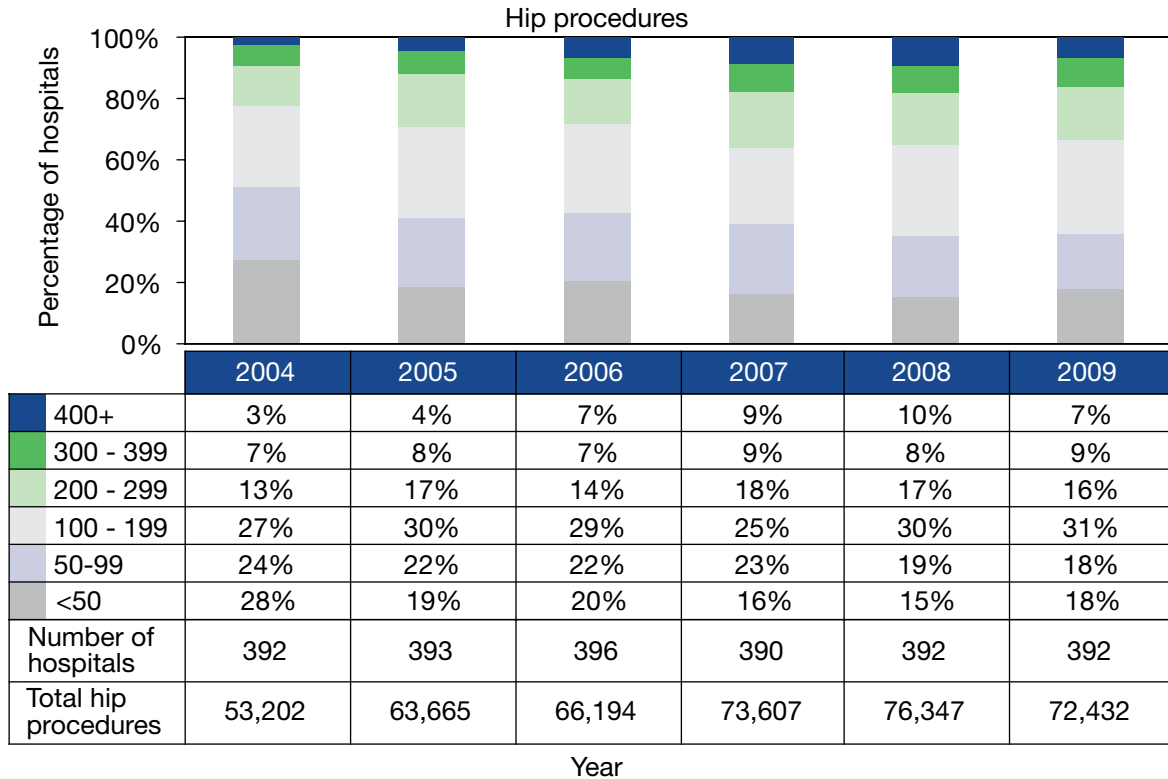
Table 2.2 Number of participating hospitals, according to number of procedures performed during 2009.

| | Total number of hospitals | Number of procedures | | | | | | Average number per unit | Min | Max |
|----------------------------------------------|---------------------------|----------------------|-------|-----------|-----------|-----------|------|-------------------------|-----|-------|
| | | <50 | 50-99 | 100 - 199 | 200 - 299 | 300 - 399 | 400+ | | | |
| All operations | | | | | | | | | | |
| Hospitals entering hip replacements | 392 | 69 | 72 | 122 | 64 | 37 | 28 | 185 | 2 | 1,275 |
| Hospitals entering knee replacements | 391 | 67 | 65 | 107 | 66 | 47 | 39 | 199 | 1 | 1,420 |
| Primary operations | | | | | | | | | | |
| Hospitals entering primary hip replacements | 392 | 77 | 78 | 120 | 68 | 28 | 21 | 167 | 2 | 1,094 |
| Hospitals entering primary knee replacements | 390 | 70 | 68 | 108 | 68 | 44 | 32 | 188 | 1 | 1,389 |

¹⁵ Some procedure types are excluded from the compliance calculation as they do not use implants, i.e. Hip stage one of two stage revision, Hip Excision Arthroplasty, Knee stage one of two stage revision, Knee Conversion to Arthrodesis and Knee Amputation.

Figure 2.1

Percentage of participating hospitals by number of procedures per annum, 2004 - 2009.



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Part 2

2.2 Hip replacement procedures, 2009



The total number of hip procedures entered into the NJR during 2009 was 72,432, an increase of 1% over 2008. Of these, 65,229 were primary and 7,203 were revision (and re-operation) procedures. The revision 'burden' has increased to 10% from 9% in the previous year.

Table 2.3 shows that 92% of patients at independent hospitals and ISTCs were graded as fit and healthy or with mild disease according to the ASA system, compared with 81% at NHS units.

Nearly all procedures (96%) undertaken at ISTCs were primary procedures. The percentage of primary hip resurfacings undertaken in independent hospitals (8%) is nearly double that of NHS hospitals (5%), as shown in Figure 2.2. At NHS treatment centres, 46% of activity relates to cementless hip primary procedures – a greater proportion than at any other type of provider.

At NHS hospitals, revision procedures account for a higher percentage of total procedures (13%) than at any other type of provider (10% overall). NHS hospitals perform 83% of all hip revision procedures.

Table 2.3 Patient characteristics and procedure details, according to type of provider for hip procedures in 2009.

| | NHS hospital | | Independent hospital | | NHS treatment centre | | ISTC | | Total | |
|---------------------------------------------------------------------|---------------|------------|----------------------|------------|----------------------|------------|--------------|------------|---------------|------------|
| | No. | % | No. | % | No. | % | No. | % | No. | % |
| Total | 47,018 | | 18,748 | | 3,201 | | 3,465 | | 72,432 | |
| Patient physical status | | | | | | | | | | |
| P1 – fit and healthy | 6,241 | 13% | 4,682 | 25% | 648 | 20% | 451 | 13% | 12,022 | 17% |
| P2 – mild disease not incapacitating | 31,900 | 68% | 12,676 | 68% | 2,158 | 67% | 2,722 | 79% | 49,456 | 68% |
| P3 – incapacitating systemic disease | 8,513 | 18% | 1,369 | 7% | 381 | 12% | 290 | 8% | 10,553 | 15% |
| P4 – life threatening disease | 360 | 1% | 20 | <1% | 14 | <1% | 2 | <1% | 396 | 1% |
| P5 – expected to die within 24 hrs with or without an operation | 4 | <1% | 1 | <1% | 0 | 0% | 0 | 0% | 5 | <1% |
| Procedure type | | | | | | | | | | |
| Primary procedures | 41,048 | 87% | 17,905 | 96% | 2,944 | 92% | 3,332 | 96% | 65,229 | 90% |
| Total prosthetic replacement using cement | 15,443 | 33% | 5,618 | 30% | 952 | 30% | 1,401 | 40% | 23,414 | 32% |
| Total prosthetic replacement not using cement | 16,577 | 35% | 8,107 | 43% | 1,463 | 46% | 1,345 | 39% | 27,492 | 38% |
| Total prosthetic replacement not classified elsewhere (e.g. hybrid) | 6,806 | 14% | 2,676 | 14% | 283 | 9% | 515 | 15% | 10,280 | 14% |
| Resurfacing arthroplasty of joint | 2,222 | 5% | 1,504 | 8% | 246 | 8% | 71 | 2% | 4,043 | 6% |
| Revision procedures | | | | | | | | | | |
| Revision procedures | 5,970 | 13% | 843 | 4% | 257 | 8% | 133 | 4% | 7,203 | 10% |
| Hip single stage revision | 4,847 | 10% | 750 | 4% | 228 | 7% | 130 | 4% | 5,955 | 8% |
| Hip stage one of two stage revision | 441 | 1% | 42 | <1% | 13 | <1% | 1 | <1% | 497 | 1% |
| Hip stage two of two stage revision | 550 | 1% | 49 | <1% | 16 | <1% | 2 | <1% | 617 | 1% |
| Hip excision arthroplasty | 65 | <1% | 2 | <1% | 0 | 0% | 0 | 0% | 67 | <1% |
| Hip re-operation other than revision ¹⁶ | 67 | <1% | 0 | 0% | 0 | 0% | 0 | 0% | 67 | <1% |
| Bilateral or unilateral¹⁷ | | | | | | | | | | |
| Bilateral | 178 | <1% | 198 | 1% | 24 | 1% | 42 | <1% | 442 | 1% |
| Unilateral | 46,840 | 100% | 18,550 | 99% | 3,177 | 99% | 3,423 | 100% | 71,990 | 99% |
| Funding | | | | | | | | | | |
| Independent | 737 | 2% | 10,221 | 55% | 5 | <1% | 188 | 5% | 11,151 | 15% |
| NHS | 46,270 | 98% | 8,527 | 45% | 3,195 | 100% | 3,277 | 95% | 61,269 | 85% |
| Not selected | 11 | <1% | 0 | 0% | 1 | <1% | 0 | 0% | 12 | <1% |

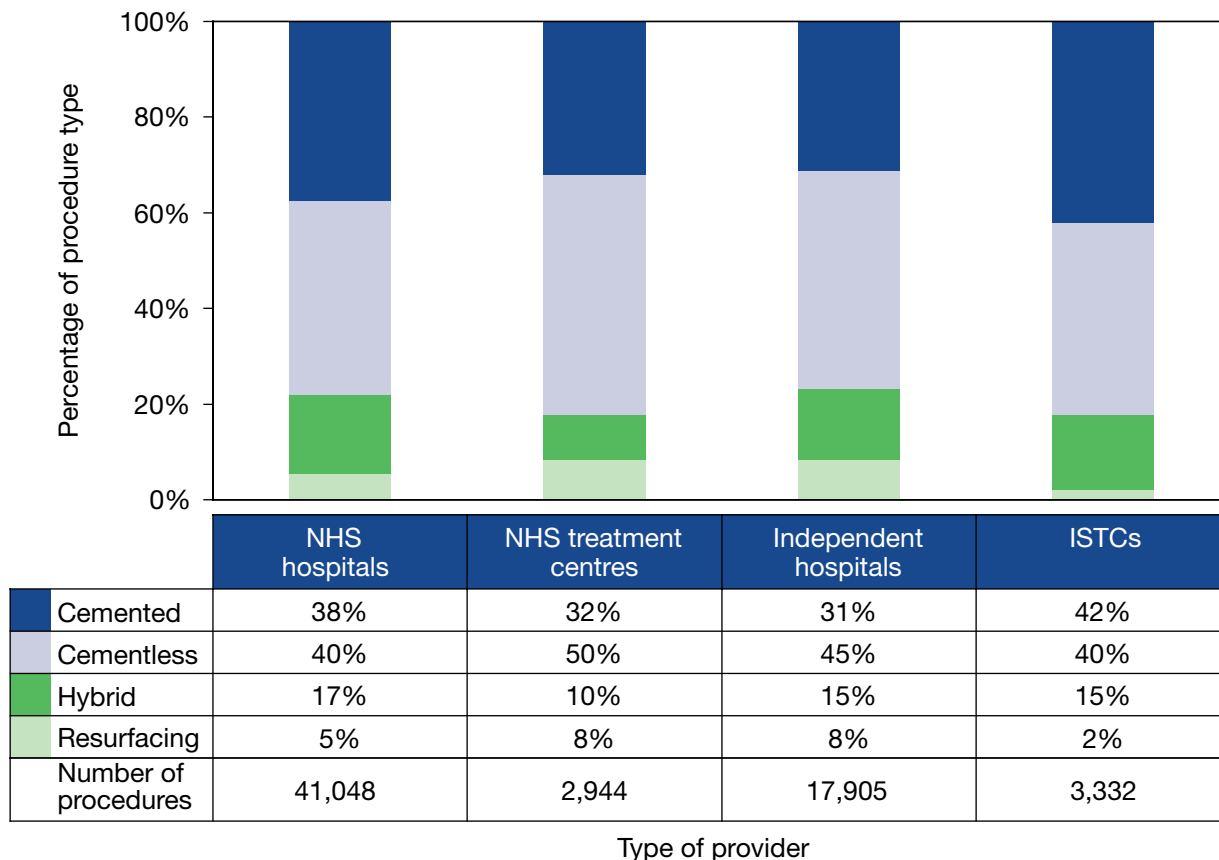
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¹⁶ Hip re-operations other than revision are recorded because some units continue to use MDSv2 where these procedures were included. MDSv3 no longer records re-operations. Therefore, the re-operation procedure totals will not reflect the actual number performed.

¹⁷ Bilaterals will only be counted as a bilateral if they are entered under the same operation during data entry. If the two procedures are recorded under two different operations they will be counted as two unilateral procedures. Therefore, the count of bilaterals is likely to be an underestimate.

Figure 2.2

Primary hip procedures by type of provider.



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2.2.1 Primary hip replacement procedures, 2009

Of the 65,229 primary hip replacement procedures undertaken in 2009, 36% were cemented THRs, 39% were cementless, 6% were hip resurfacing procedures and 4% were LHMOM THRs (Figure 2.3). Figure 2.3 shows an apparent decrease in the volume of hip procedures between 2008 and 2009. However, not all procedures performed in 2009 were entered into the database before the 28th February 2010 deadline and will be entered after this date.

Compared with previous years, there has been a reduction in the percentage of cemented THR procedures and a corresponding increase in the percentage of cementless interventions. Cemented procedures dropped from 54% in 2005 to 36% in

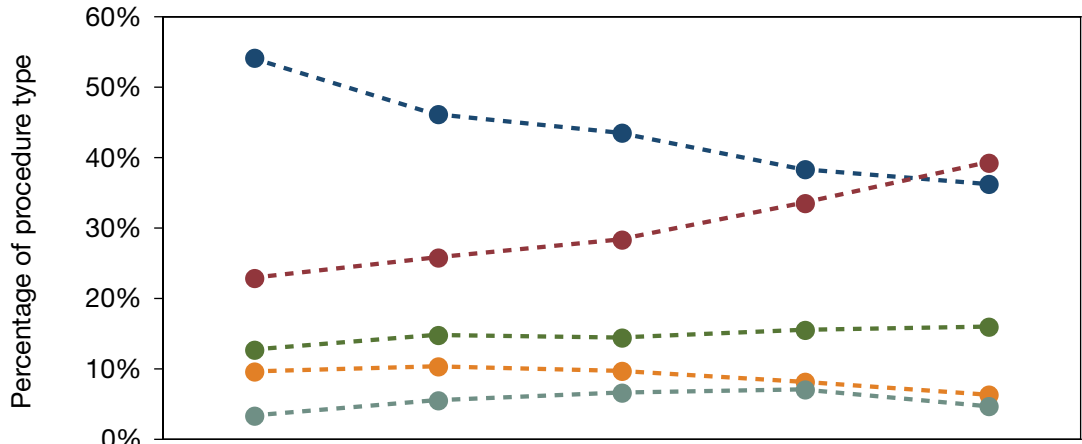
2009, while cementless surgeries rose from 22% in 2005 to 39% in 2009. As a result, for the first time since the inception of the NJR, cementless primary hip replacement has become the most commonly performed procedure.

There has also been a decrease in the percentage of resurfacing procedures and in procedures where a large head is used with a resurfacing cup. As the figures shown later in this section demonstrate, this has mainly resulted from the reduction of such procedures performed in elderly and female patients.

In 2009, 14% of hybrid procedures were reverse hybrid (cementless stem, cemented socket) and 86% were standard hybrid (cemented stem, cementless socket).

Figure 2.3

Type of primary hip replacement procedures undertaken between 2005 and 2009.



| | 2005 | 2006 | 2007 | 2008 | 2009 |
|-------------------------------------|--------|--------|--------|--------|--------|
| ● - Cemented | 54% | 46% | 43% | 38% | 36% |
| ● - Cementless | 22% | 25% | 28% | 33% | 39% |
| ● - Hybrid | 12% | 14% | 14% | 15% | 15% |
| ● - Resurfacing | 9% | 10% | 9% | 8% | 6% |
| ● - Large head with resurfacing cup | 3% | 5% | 6% | 7% | 4% |
| Number of procedures | 56,229 | 59,547 | 66,315 | 68,976 | 65,229 |

Year

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2.2.1.1 Patient characteristics

Age and gender were included for those patients who gave consent for their personal identifiers to be entered into the NJR and where consent was 'Not recorded' (a total of 94% of records, an increase of 3% compared with 2008). The average age was 66.7 years, the same as last year. Approximately 56% of the patients were female (Table 2.4). On average, female patients were older than male patients at the time of their primary hip replacement (68.5 years and 65.9 years respectively, Table 2.5). Patients undergoing a resurfacing procedure were the youngest, at an average age of 54.6 years (Figure 2.4). Three times as many males have a resurfacing procedure compared with females.

According to the ASA system, 17% of patients undergoing a primary hip replacement in 2009 were

graded as fit and healthy prior to surgery, compared with 37% in 2003. Figure 2.5 shows the changes in ASA grade over seven years. Patient BMI¹⁸ has increased over the past five years from 27.4 to 28.4, as shown in Figure 2.6(a). Females undergoing THR have a consistently higher mean BMI than males; the converse is the case for TKR (Figure 2.18(a)). Figure 2.6(b) shows that there has been an increase in the number of patients with a BMI of between 30 and 39 and a decrease in the number of patients with BMI between 18.5 and 24. The single largest indication recorded for surgery was osteoarthritis, recorded in 93% of procedures (Table 2.4). Figure 2.4(b) shows that the percentage of patients within the age group bands has not changed significantly since 2003, suggesting that the increase in BMI and reduction in fitness of patients is not due to an ageing patient cohort.

¹⁸ BMI: 20-24 normal, 25-29 overweight, 30-39 obese, 40+ morbidly obese.

Table 2.4 Patient characteristics for primary hip replacement procedures in 2009, according to procedure type.

| | Primary total prosthetic replacement using cement | | Primary total prosthetic replacement not using cement | | Primary total prosthetic replacement not classified elsewhere (e.g. hybrid) | | Primary resurfacing arthroplasty of joint | | Total | |
|-------------------------------------------------------------------|---------------------------------------------------|------------|-------------------------------------------------------|------------|-----------------------------------------------------------------------------|------------|-------------------------------------------|-----------|---------------|------------|
| | No. | % | No. | % | No. | % | No. | % | No. | % |
| Total hip primaries | 23,414 | 36% | 27,492 | 42% | 10,280 | 16% | 4,043 | 6% | 65,229 | |
| Total hip primaries with patient data | 22,057 | | 25,788 | | 9,662 | | 3,708 | | 61,215 | 94% |
| Average age | 72.98 | | 65.64 | | 69.72 | | 54.59 | | 66.75 | |
| SD | 9.35 | | 11.31 | | 10.77 | | 9.48 | | 13.33 | |
| Interquartile range | 67.7 - 79.4 | | 59.4 - 73.4 | | 63.3 - 77.2 | | 49.0 - 61.1 | | 61.6 - 76.2 | |
| Gender | | | | | | | | | | |
| Female | 14,560 | 66% | 14,689 | 57% | 6,162 | 60% | 1,008 | 25% | 36,419 | 56% |
| Male | 7,497 | 34% | 11,098 | 43% | 3,500 | 40% | 2,700 | 75% | 24,795 | 44% |
| Patient physical status | | | | | | | | | | |
| P1 – fit and healthy | 2,584 | 11% | 5,440 | 20% | 1,415 | 14% | 1,822 | 45% | 11,261 | 17% |
| P2 – mild disease not incapacitating | 16,772 | 72% | 18,799 | 68% | 7,225 | 70% | 2,089 | 52% | 44,885 | 69% |
| P3 – incapacitating systemic disease | 3,935 | 17% | 3,134 | 11% | 1,590 | 15% | 131 | 3% | 8,790 | 13% |
| P4 – life threatening disease | 120 | 1% | 118 | <1% | 50 | <1% | 1 | <1% | 289 | <1% |
| P5 – expected to die within 24 hours with or without an operation | 3 | <1% | 1 | <1% | 0 | 0% | 0 | 0% | 4 | <1% |
| BMI | | | | | | | | | | |
| Average | 28.14 | | 28.74 | | 28.21 | | 28.35 | | 28.41 | |
| SD | 5.1 | | 5.3 | | 5.3 | | 4.4 | | 5.1 | |
| Indications for surgery | | | | | | | | | | |
| Osteoarthritis | 21,897 | 94% | 25,678 | 93% | 9,335 | 91% | 3,868 | 96% | 60,778 | 93% |
| Avascular necrosis | 438 | 2% | 687 | 2% | 305 | 3% | 74 | 2% | 1,504 | 2% |
| Fractured neck of femur | 419 | 2% | 352 | 1% | 274 | 3% | 7 | <1% | 1,052 | 2% |
| Congenital dislocation | 129 | 1% | 514 | 2% | 193 | 2% | 103 | 3% | 939 | 1% |
| Inflammatory arthropathy | 335 | 1% | 361 | 1% | 170 | 2% | 32 | 1% | 898 | 1% |
| Failed hemiarthroplasty | 98 | <1% | 41 | <1% | 46 | <1% | 3 | <1% | 188 | <1% |
| Trauma – chronic | 316 | 1% | 327 | 1% | 182 | 2% | 25 | 1% | 850 | 1% |
| Previous surgery, non-trauma related | 39 | <1% | 123 | <1% | 51 | <1% | 7 | <1% | 220 | <1% |
| Previous arthrodesis | 14 | <1% | 22 | <1% | 8 | <1% | 1 | <1% | 45 | <1% |
| Previous infection | 1 | <1% | 1 | <1% | 0 | 0% | 1 | <1% | 3 | <1% |
| Other | 369 | 2% | 464 | 2% | 216 | 2% | 72 | 2% | 1,121 | 2% |
| Side | | | | | | | | | | |
| Bilateral | 58 | <1% | 256 | 1% | 66 | <1% | 60 | 2% | 440 | <1% |
| Left, unilateral | 10,432 | 45% | 12,314 | 45% | 4,576 | 45% | 1,864 | 46% | 29,186 | 45% |
| Right, unilateral | 12,924 | 55% | 14,922 | 54% | 5,638 | 55% | 2,119 | 52% | 35,603 | 55% |

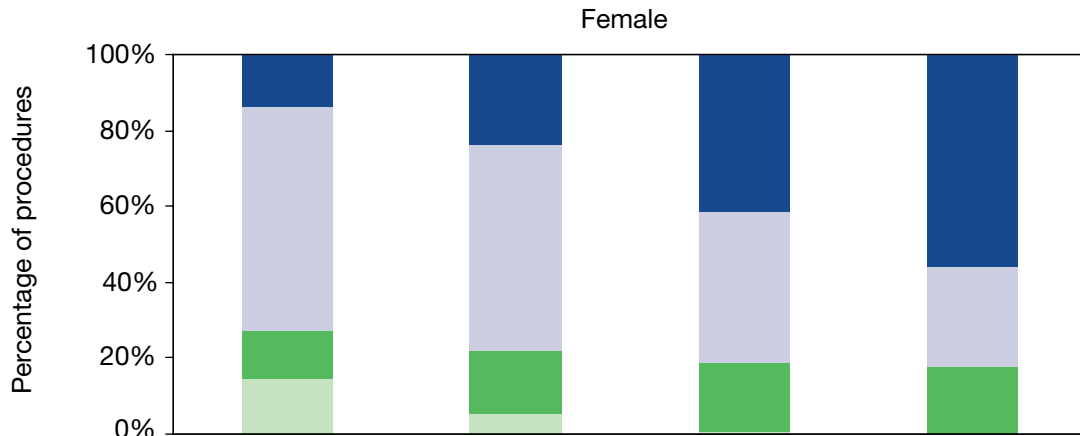
Table 2.5 Age and gender for primary hip replacement patients in 2009.

| | Primary total prosthetic replacement using cement | | Primary total prosthetic replacement not using cement | | Primary total prosthetic replacement not classified elsewhere (e.g. hybrid) | | Primary resurfacing arthroplasty of joint | | Total | |
|------------------------------|---------------------------------------------------|-----|-------------------------------------------------------|-----|-----------------------------------------------------------------------------|-----|-------------------------------------------|-----|---------------|-----|
| | No. | % | No. | % | No. | % | No. | % | No. | % |
| Average age by gender | | | | | | | | | | |
| Female | 14,560 | | 14,689 | | 6,162 | | 1,008 | | 36,419 | |
| Average | 73.5 | | 66.21 | | 70.2 | | 53.73 | | 68.51 | |
| SD | 9.24 | | 11.36 | | 10.64 | | 10.20 | | 12.51 | |
| Interquartile range | 68.3-79.8 | | 59.7-74.0 | | 63.9-77.8 | | 48.2-59.9 | | 62.8-77.5 | |
| Male | 7,497 | | 11,098 | | 3,500 | | 2,700 | | 24,795 | |
| Average | 71.97 | | 64.89 | | 68.88 | | 54.91 | | 65.89 | |
| SD | 9.47 | | 11.19 | | 10.93 | | 9.18 | | 12.43 | |
| Interquartile range | 66.5 - 78.3 | | 58.9 - 72.6 | | 62.6 - 76.3 | | 49.4 - 61.4 | | 59.8 - 74.9 | |
| Age group by gender | | | | | | | | | | |
| Female | | | | | | | | | | |
| <45 years | 120 | 1% | 627 | 4% | 136 | 2% | 162 | 16% | 1,045 | 3% |
| 45 - 54 years | 384 | 3% | 1,518 | 10% | 330 | 5% | 361 | 36% | 2,593 | 7% |
| 55 - 64 years | 1,866 | 13% | 4,176 | 28% | 1,292 | 21% | 393 | 39% | 7,727 | 21% |
| 65 - 74 years | 5,338 | 37% | 5,133 | 35% | 2,289 | 37% | 71 | 7% | 12,831 | 35% |
| 75 - 84 years | 5,566 | 38% | 2,769 | 19% | 1,740 | 28% | 16 | 2% | 10,091 | 28% |
| >85 years | 1,286 | 9% | 466 | 3% | 375 | 6% | 5 | <1% | 2,132 | 6% |
| Male | | | | | | | | | | |
| <45 years | 97 | 1% | 622 | 6% | 116 | 3% | 388 | 14% | 1,223 | 5% |
| 45 - 54 years | 288 | 4% | 1,214 | 11% | 222 | 6% | 882 | 33% | 2,606 | 11% |
| 55 - 64 years | 1,157 | 15% | 3,381 | 30% | 779 | 22% | 1,133 | 42% | 6,450 | 26% |
| 65 - 74 years | 2,899 | 39% | 3,935 | 35% | 1,336 | 38% | 271 | 10% | 8,441 | 34% |
| 75 - 84 years | 2,630 | 35% | 1,771 | 16% | 890 | 25% | 24 | 1% | 5,315 | 21% |
| >85 years | 426 | 6% | 175 | 2% | 157 | 4% | 2 | <1% | 760 | 3% |

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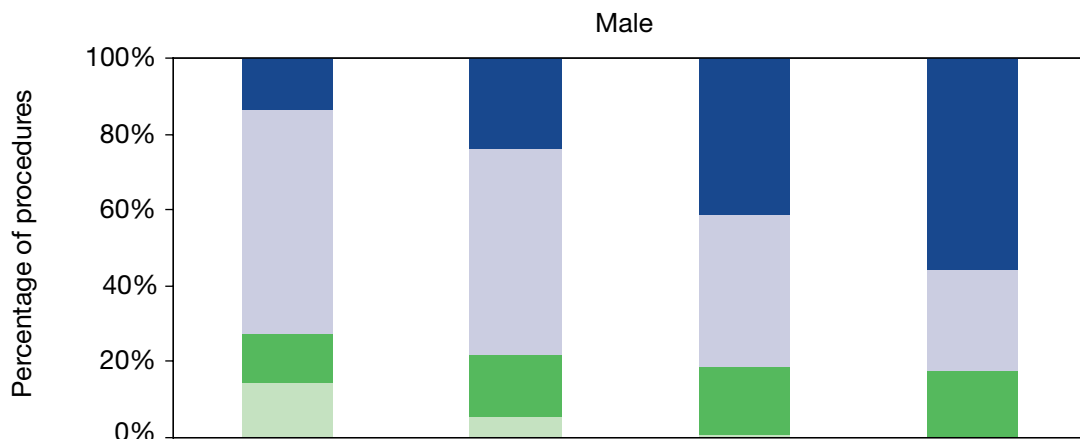
Figure 2.4(a)

Age and gender for primary hip replacement patients in 2009.



| Age group | <55 | 55 - 64 | 65 -74 | 75+ |
|--------------------|-------|---------|--------|--------|
| Cemented | 14% | 24% | 42% | 56% |
| Cementless | 59% | 54% | 40% | 26% |
| Hybrid | 13% | 17% | 18% | 17% |
| Resurfacing | 14% | 5% | 1% | <1% |
| Number of patients | 3,638 | 7,727 | 12,831 | 12,223 |

Age group



| Age group | <55 | 55 - 64 | 65 -74 | 75+ |
|--------------------|-------|---------|--------|-------|
| Cemented | 10% | 18% | 34% | 50% |
| Cementless | 48% | 52% | 47% | 32% |
| Hybrid | 9% | 12% | 16% | 17% |
| Resurfacing | 33% | 18% | 3% | <1% |
| Number of patients | 3,829 | 6,450 | 8,441 | 6,075 |

Age group

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Figure 2.4(b)

Age for primary hip replacement patients between 2003 and 2009.

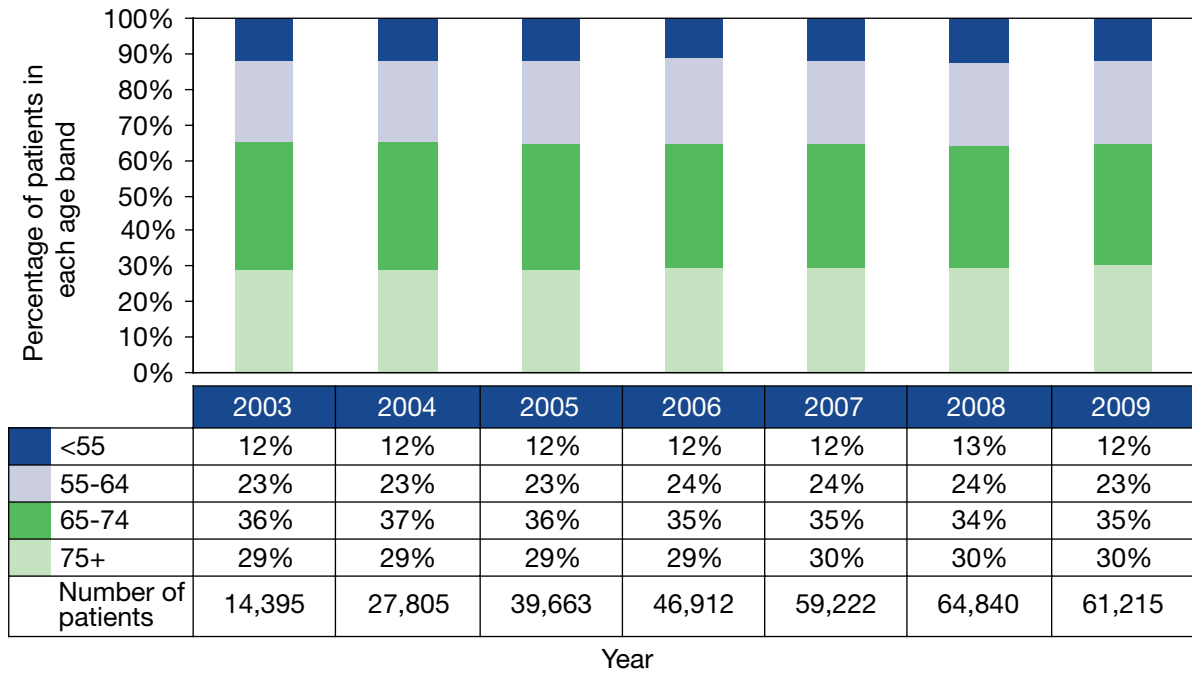


Figure 2.5

ASA grades for primary hip replacement patients between 2003 and 2009.

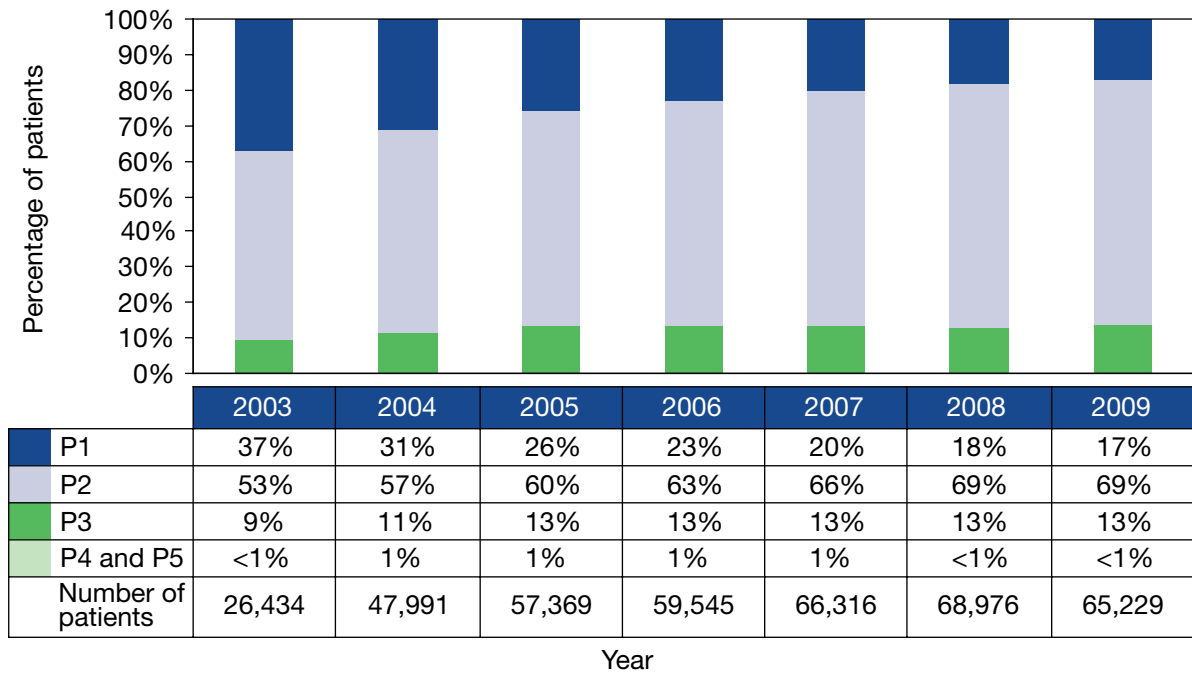
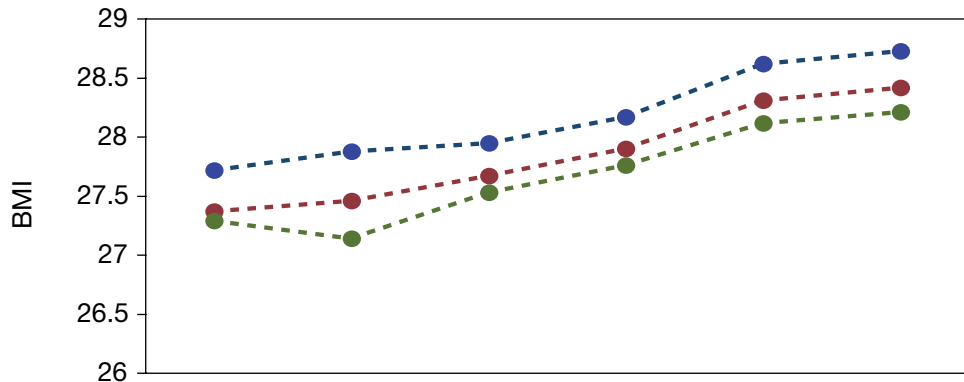


Figure 2.6(a)

BMI for primary hip replacement patients between 2004 and 2009



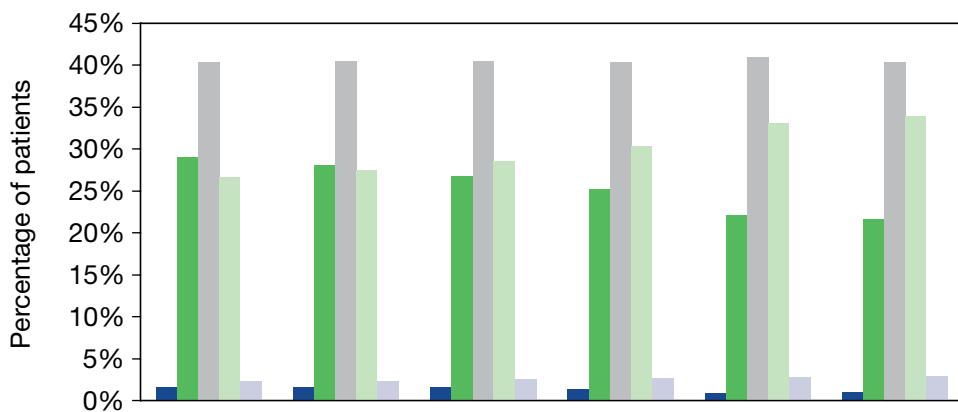
| | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---------------------------------------------------|-------|-------|--------|--------|--------|--------|
| - ● - All | 27.36 | 27.45 | 27.66 | 27.89 | 28.30 | 28.41 |
| - ● - Female | 27.28 | 27.13 | 27.52 | 27.75 | 28.11 | 28.20 |
| - ● - Male | 27.71 | 27.87 | 27.94 | 28.16 | 28.61 | 28.72 |
| Number of patients with BMI data | 5,913 | 8,976 | 10,438 | 14,091 | 33,282 | 36,903 |
| Number of patients with BMI data (females) | 2,473 | 4,381 | 5,450 | 8,064 | 19,342 | 21,297 |
| Number of patients with BMI data (males) | 1,756 | 2,937 | 3,703 | 5,396 | 13,210 | 14,800 |
| Number of patients with BMI data (unknown gender) | 1,684 | 1,658 | 1,285 | 631 | 730 | 806 |

Year

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Figure 2.6(b)

BMI groups for primary hip replacement patients between 2004 and 2009



| | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|--------------------|-------|-------|--------|--------|--------|--------|
| BMI <18.5 | 2% | 2% | 2% | 1% | 1% | 1% |
| BMI 18.5 - 24 | 29% | 28% | 27% | 25% | 22% | 22% |
| BMI 25 - 29 | 40% | 40% | 40% | 40% | 41% | 40% |
| BMI 30 - 39 | 27% | 27% | 29% | 30% | 33% | 34% |
| BMI 40+ | 2% | 2% | 3% | 3% | 3% | 3% |
| Number of patients | 5,913 | 8,976 | 10,438 | 14,091 | 33,282 | 36,903 |

Year

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2.2.1.2 Surgical techniques

The surgical techniques used in procedures undertaken in 2009 are summarised in Table 2.6. Patients were mainly positioned laterally. The lateral position was used more frequently in hybrid and resurfacing procedures than in cemented and cementless procedures. As would be expected, the most frequently used incision approach was posterior for all procedure types.

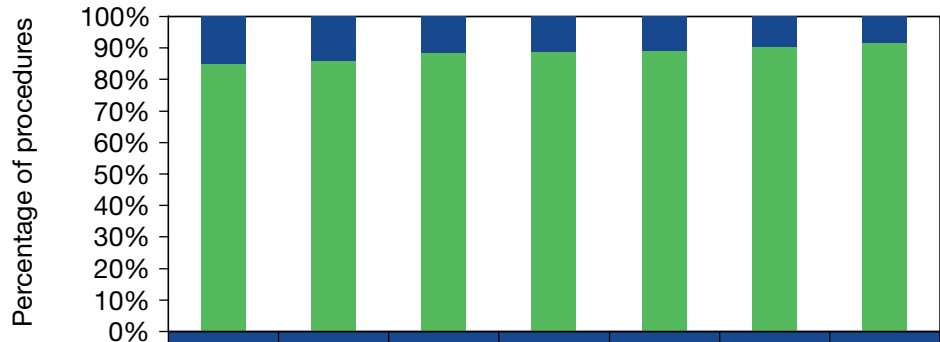
The reduction in the use of cemented stems from 77% in 2004 to 51% in 2009 and the use of cemented cups, from 56% to 37%, is consistent with the reduction seen in the overall number of cemented procedures (Figure 2.3). The relative usage of different types of bone cement is shown in Figure 2.7 and shows that the use of antibiotic cement has increased from 85% in 2003 to 92% in 2009. Use of minimally invasive surgery was greatest in cementless procedures, although it was used in less than 5% of all procedures (Table 2.6).

Table 2.6 Characteristics of surgical practice for primary hip replacement procedures in 2009, according to procedure type.

| | Primary total prosthetic replacement using cement | | Primary total prosthetic replacement not using cement | | Primary total prosthetic replacement not classified elsewhere (e.g. hybrid) | | Primary resurfacing arthroplasty of joint | | Total | |
|-----------------------------------|---------------------------------------------------|------|-------------------------------------------------------|-----|-----------------------------------------------------------------------------|------|-------------------------------------------|-----|---------------|-----|
| | No. | % | No. | % | No. | % | No. | % | No. | % |
| Total | 23,414 | | 27,492 | | 10,280 | | 4,043 | | 65,229 | |
| Patient position | | | | | | | | | | |
| Lateral | 20,400 | 87% | 25,161 | 92% | 9,783 | 95% | 3,965 | 98% | 59,309 | 91% |
| Supine | 3,014 | 13% | 2,331 | 8% | 497 | 5% | 78 | 2% | 5,920 | 9% |
| Incision | | | | | | | | | | |
| Antero/antero-lateral | 133 | 1% | 188 | 1% | 50 | <1% | 32 | 1% | 403 | 1% |
| Lateral (inc. Hardinge) | 10,426 | 45% | 9,503 | 35% | 3,015 | 29% | 769 | 19% | 23,713 | 36% |
| Posterior | 10,966 | 47% | 16,124 | 59% | 6,749 | 66% | 3,106 | 77% | 36,945 | 57% |
| Trochanteric osteotomy | 473 | 2% | 33 | <1% | 17 | <1% | 54 | 1% | 577 | 1% |
| Other | 1,416 | 6% | 1,644 | 6% | 449 | 4% | 82 | 2% | 3,591 | 6% |
| Minimally invasive surgery | | | | | | | | | | |
| Yes | 528 | 2% | 2,110 | 8% | 239 | 2% | 77 | 2% | 2,954 | 5% |
| No | 22,814 | 97% | 24,893 | 91% | 9,919 | 96% | 3,920 | 97% | 61,546 | 94% |
| Not selected | 72 | <1% | 489 | 2% | 122 | 1% | 46 | 1% | 729 | 1% |
| Image guided surgery | | | | | | | | | | |
| Yes | 60 | <1% | 339 | 1% | 55 | 1% | 75 | 2% | 529 | 1% |
| No | 23,328 | 100% | 26,875 | 98% | 10,146 | 99% | 3,922 | 97% | 64,271 | 99% |
| Not selected | 26 | <1% | 278 | 1% | 79 | 1% | 46 | 1% | 429 | 1% |
| Femoral bone graft used | | | | | | | | | | |
| Yes | 126 | 1% | 214 | 1% | 38 | <1% | 26 | 1% | 404 | 1% |
| No | 23,288 | 99% | 27,278 | 99% | 10,242 | 100% | 4,017 | 99% | 64,825 | 99% |
| Acetabular bone graft used | | | | | | | | | | |
| Yes | 680 | 3% | 1,035 | 4% | 657 | 6% | 131 | 3% | 2,503 | 4% |
| No | 22,734 | 97% | 26,457 | 96% | 9,623 | 94% | 3,912 | 97% | 62,726 | 96% |

Figure 2.7

Bone cement types for primary hip replacement procedures undertaken between 2003 and 2009.



| | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|-----------------------------------|--------|--------|--------|--------|--------|--------|--------|
| Non-antibiotic bone cement | 15% | 14% | 12% | 11% | 11% | 10% | 8% |
| Antibiotic loaded bone cement | 85% | 86% | 88% | 89% | 89% | 90% | 92% |
| Number of procedures using cement | 18,889 | 33,170 | 39,161 | 38,843 | 42,074 | 40,791 | 36,797 |

Year

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2.2.1.3 Thromboprophylaxis

The most frequently prescribed chemical method of thromboprophylaxis for hip replacement patients was LMWH, at 71%, and the most used mechanical method was TED stockings (64%), (Table 2.7). There has been an increase in the use of LMWH, from 64% in 2007 to 71% in 2009. Similarly, there has been an increase in the prescription of intermittent calf

compression, from 26% in 2007 to 33% in 2009. The number of procedures for which both chemical and mechanical methods were prescribed rose from 63% in 2007 to 81% in 2009. In July 2009, direct thrombin inhibitor was added as an option to the thromboprophylaxis regime in MDSv3. Therefore the volume usage might appear lower than expected, as the reporting period was only five months.

Table 2.7 Thromboprophylaxis regime for primary hip replacement patients, prescribed at time of operation.

| | Primary total prosthetic replacement using cement | | Primary total prosthetic replacement not using cement | | Primary total prosthetic replacement not classified elsewhere (e.g. hybrid) | | Primary resurfacing arthroplasty of joint | | Total | |
|---------------------------------|---------------------------------------------------|-----|-------------------------------------------------------|-----|-----------------------------------------------------------------------------|-----|-------------------------------------------|-----|---------------|-----|
| | No. | % | No. | % | No. | % | No. | % | No. | % |
| Total | 23,414 | | 27,492 | | 10,280 | | 4,043 | | 65,229 | |
| Aspirin | 5,032 | 21% | 4,523 | 16% | 2,625 | 26% | 1,119 | 28% | 13,299 | 20% |
| LMWH | 17,246 | 74% | 19,852 | 72% | 6,975 | 68% | 2,419 | 60% | 46,492 | 71% |
| Pentasaccharide | 189 | 1% | 288 | 1% | 104 | 1% | 26 | 1% | 607 | 1% |
| Warfarin | 322 | 1% | 745 | 3% | 249 | 2% | 91 | 2% | 1,407 | 2% |
| Direct thrombin inhibitor | 115 | <1% | 169 | 1% | 60 | 1% | 13 | <1% | 357 | 1% |
| Other chemical | 1,289 | 6% | 2,329 | 8% | 550 | 5% | 341 | 8% | 4,509 | 7% |
| No chemical | 2,068 | 9% | 2,245 | 8% | 1,068 | 10% | 427 | 11% | 5,808 | 9% |
| Foot pump | 6,809 | 29% | 7,802 | 28% | 3,037 | 30% | 1,036 | 26% | 18,684 | 29% |
| Intermittent calf compression | 7,142 | 31% | 9,496 | 35% | 3,264 | 32% | 1,569 | 39% | 21,471 | 33% |
| TED stockings | 14,704 | 63% | 18,010 | 66% | 6,401 | 62% | 2,667 | 66% | 41,782 | 64% |
| Other mechanical | 807 | 3% | 443 | 2% | 355 | 3% | 116 | 3% | 1,721 | 3% |
| No mechanical | 2,531 | 11% | 2,305 | 8% | 968 | 9% | 462 | 11% | 6,266 | 10% |
| Both mechanical and chemical | 18,773 | 80% | 22,498 | 82% | 8,157 | 79% | 3,121 | 77% | 52,549 | 81% |
| Neither mechanical nor chemical | 48 | <1% | 38 | <1% | 7 | <1% | 14 | <1% | 107 | <1% |

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2.2.1.4 Untoward intra-operative events

Untoward intra-operative events were reported in just under 1% of procedures (Table 2.8). Of the 904 untoward events reported, an increase of 356 events compared with 2008, 33% were attributed to

calcar crack. As would be expected, this occurred more often in cementless than in cemented hips. Furthermore, 14% were trochanteric fractures, also more common in cementless replacements.

Table 2.8 Reported untoward intra-operative events for primary hip replacement patients in 2009, according to procedure type.

| | Primary total prosthetic replacement using cement | Primary total prosthetic replacement not using cement | Primary total prosthetic replacement not classified elsewhere (e.g. hybrid) | Primary resurfacing arthroplasty of joint | Total |
|----------------------------|---------------------------------------------------|-------------------------------------------------------|-----------------------------------------------------------------------------|-------------------------------------------|---------------|
| | No. | No. | No. | No. | No. |
| Total | 23,414 | 27,492 | 10,280 | 4,043 | 65,229 |
| Not selected ¹⁹ | 118 | 508 | 119 | 81 | 826 |
| None specified | 23,044 | 26,474 | 10,040 | 3,941 | 63,499 |
| Event specified | 252 | 510 | 121 | 21 | 904 |
| Calcar crack | 36 | 221 | 33 | 4 | 294 |
| Pelvic penetration | 50 | 25 | 17 | 0 | 92 |
| Shaft fracture | 8 | 22 | 6 | 0 | 36 |
| Shaft penetration | 5 | 4 | 5 | 0 | 14 |
| Trochanteric fracture | 49 | 68 | 14 | 0 | 131 |
| Other | 104 | 170 | 46 | 17 | 337 |

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2.2.1.5 Hip primary components

This section outlines in more detail the trends in brand usage for hips. For a full listing of brands used in 2009, please visit the NJR website at www.njrcentre.org.uk. This section includes an analysis of usage according to National Institute for Health and Clinical Excellence (NICE) guidelines, as interpreted by ODEP.

2.2.1.5.1 Compliance with ODEP and NICE guidelines

In 2009, 127 brands of acetabular cups, 12 brands of resurfacing cups and 151 brands of femoral stems were used in primary and revision procedures and recorded on the NJR. There was a similar number of cups used compared with 2008, but an additional 14 stem brands used in 2009 compared with 2008.

The 2nd NJR Annual Report in 2004²⁰ gave a full description of the NICE guidance on the selection of prostheses for primary THRs and metal on metal hip resurfacing arthroplasty. It also described the establishment of ODEP. Its remit is to provide

an independent assessment of clinical evidence, submitted by suppliers, on the compliance of their implants for THR and hip resurfacing against NICE benchmarks for safety and effectiveness. ODEP produced detailed criteria for this assessment and in 2009 there was an ongoing review of this guidance by all stakeholders.

The ODEP committee reviewed suppliers' clinical data submissions and ODEP ratings have been given to 54 brands of femoral stems (38% of those available) and 52 brands of acetabular cups (44%) used in primary procedures. However, there are 49 brands of acetabular cup (41%) and 65 brands of femoral stem (46%) currently being used in England and Wales for which no data has yet been submitted to ODEP. The latest listings for brands currently being used in England and Wales can be seen on the ODEP website:

www.supplychain.nhs.uk/portal/page/portal/Communities/Orthopaedics/ODEP%20%database

¹⁹ In MDSv2, the intra-operative event question was not mandatory and this 'not selected' value reflects those MDSv2 submissions where the question was not answered.

²⁰ See pages 86 to 92 of the 2nd NJR Annual Report, available on the NJR website www.njrcentre.org.uk

Analysis of the summary data for primary procedures shows that the usage of products meeting the full 10 year (10A) benchmark, as recommended by NICE, is as follows:

- cemented stems 83% (using 14 brands out of 74 recorded on the NJR)
- cementless stems 62% (11 brands out of 67)
- cemented cups 43% (10 brands out of 51)
- cementless cups 7% (7 brands out of 67)
- resurfacing cups 48% (1 brand out of 10).

These percentages are based on the current ODEP ratings from clinical outcomes data already submitted to the ODEP committee. Manufacturers are expected to submit additional data to progress through the ratings and this will result in these percentages changing in the future.

Comparison with the 2008 figures shows that usage of cemented and cementless stems fully compliant with NICE guidelines has not changed significantly (74% in 2008 to 73% in 2009). However, the corresponding

percentages for cementless cups were 11% for 2008 and 7% for 2009, suggesting a growing usage of products for which there is shorter term clinical outcomes data.

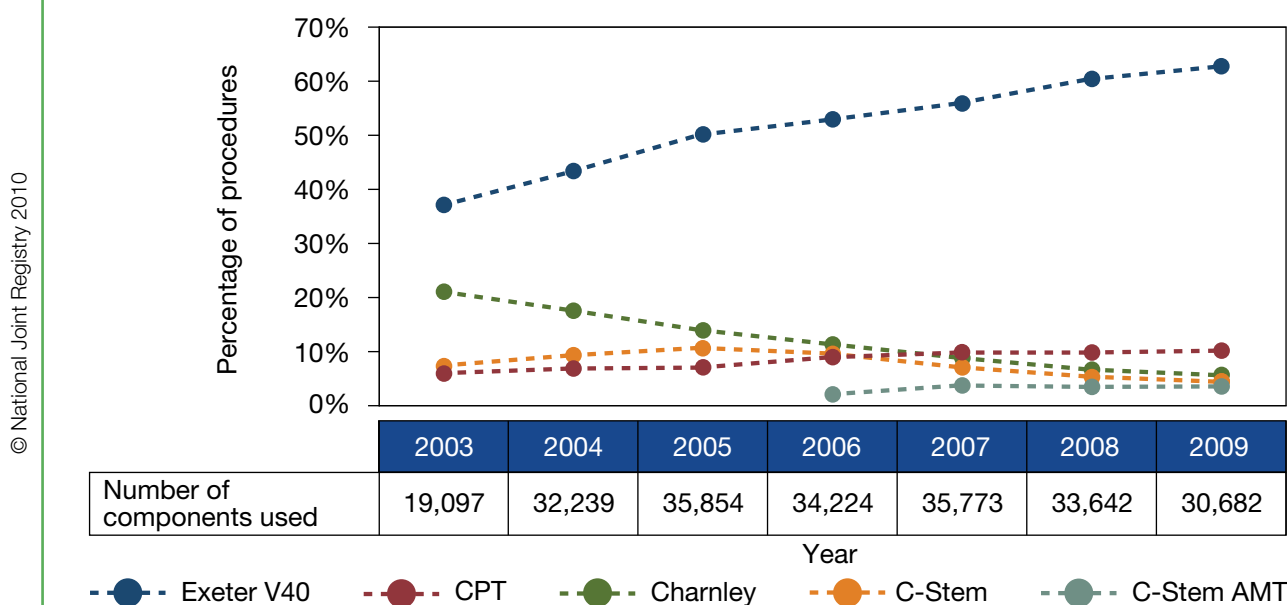
2.2.1.5.2 Hip brand usage in primary procedures

Figures 2.8 to 2.12 show historical trends in usage of the most popular brands of cemented stems, cemented cups, cementless stems, cementless cups and hip resurfacing cups.

Figure 2.8 shows that the market is now completely dominated by polished collarless tapered stems, with the Exeter V40 having a market share of more than 60% and the CPT stem consolidating its position in second place. There has been a corresponding decrease in the usage of Charnley-type low friction arthroplasty implants; this segment in total now represents only approximately 10% of the overall market for cemented primary stems.

Figure 2.8

Top five cemented hip stem brands, usage trends 2003 to 2009.

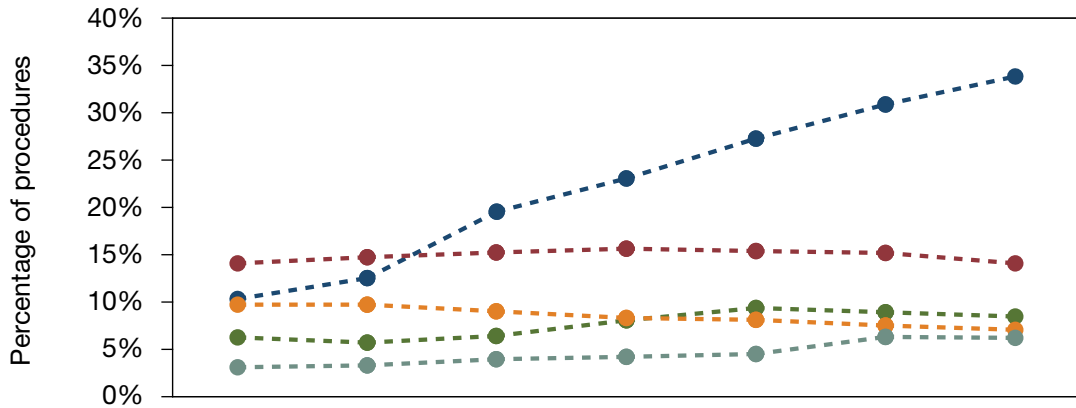


The trend for cemented cups (Figure 2.9) continues to show that sales of different brands are in line with the popularity of the stem manufacturer. Therefore, the

market share of the Contemporary cup from Stryker has grown, as sales of Exeter stems have increased during the last few years.

Figure 2.9

Top five cemented hip cup brands, usage trends 2003 to 2009.



| | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---------------------------|--------|--------|--------|--------|--------|--------|--------|
| Number of components used | 15,244 | 25,511 | 28,121 | 25,948 | 27,163 | 25,099 | 22,034 |

-●- Contemporary
 -●- Elite Plus Ogee
 -●- Elite Plus
 -●- Exeter Duration
 -●- Opera

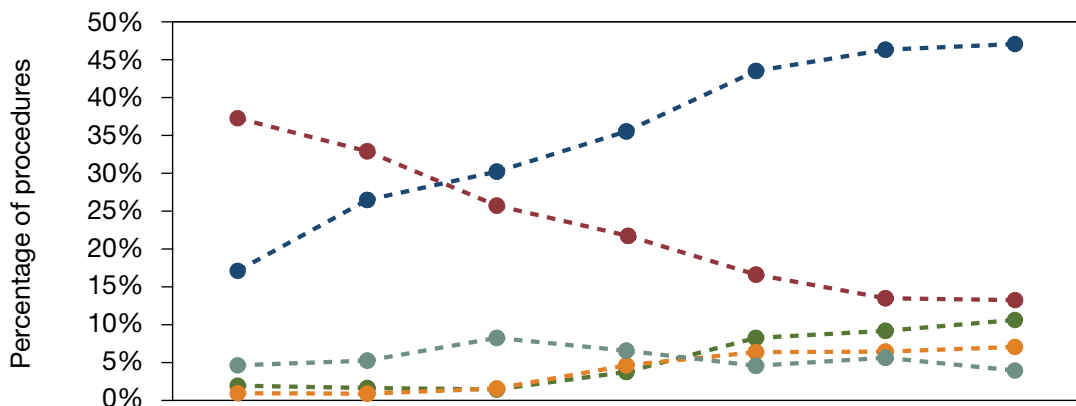
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The relative sales of cementless stem brands (Figure 2.10) are very similar to the previous year, with pressfit

HA coated stems continuing to dominate the market.

Figure 2.10

Top five cementless hip stem brands, usage trends 2003 to 2009.



| | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---------------------------|-------|-------|--------|--------|--------|--------|--------|
| Number of components used | 4,092 | 9,757 | 14,174 | 17,648 | 22,405 | 27,839 | 28,740 |

-●- Corail
 -●- Furlong HAC
 -●- Accolade
 -●- Taperloc
 -●- SL-Plus

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The cementless stem market share has again been reflected in the sales of the corresponding cementless cups from the same manufacturers, which means that the Pinnacle cup from DePuy has further consolidated

its position as the market leader (Figure 2.11). Another product enjoying growth in this segment is the Trident cup from Stryker, partly due to its usage with the Exeter stem in hybrid procedures.

Figure 2.11

Top five cementless hip cup brands, usage trends 2003 to 2009.

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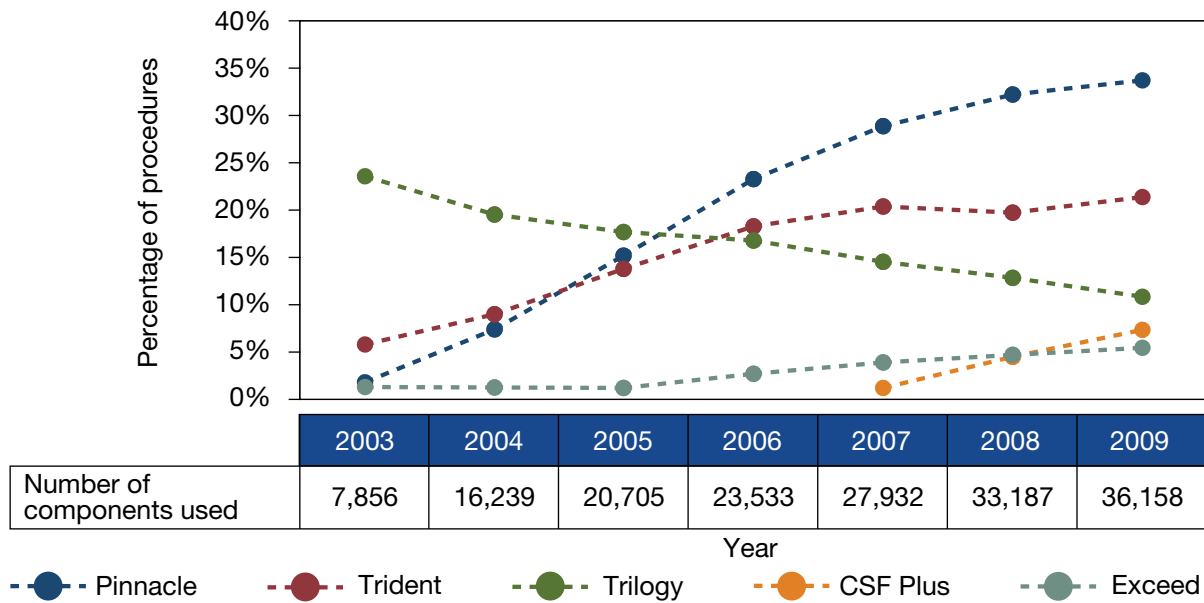
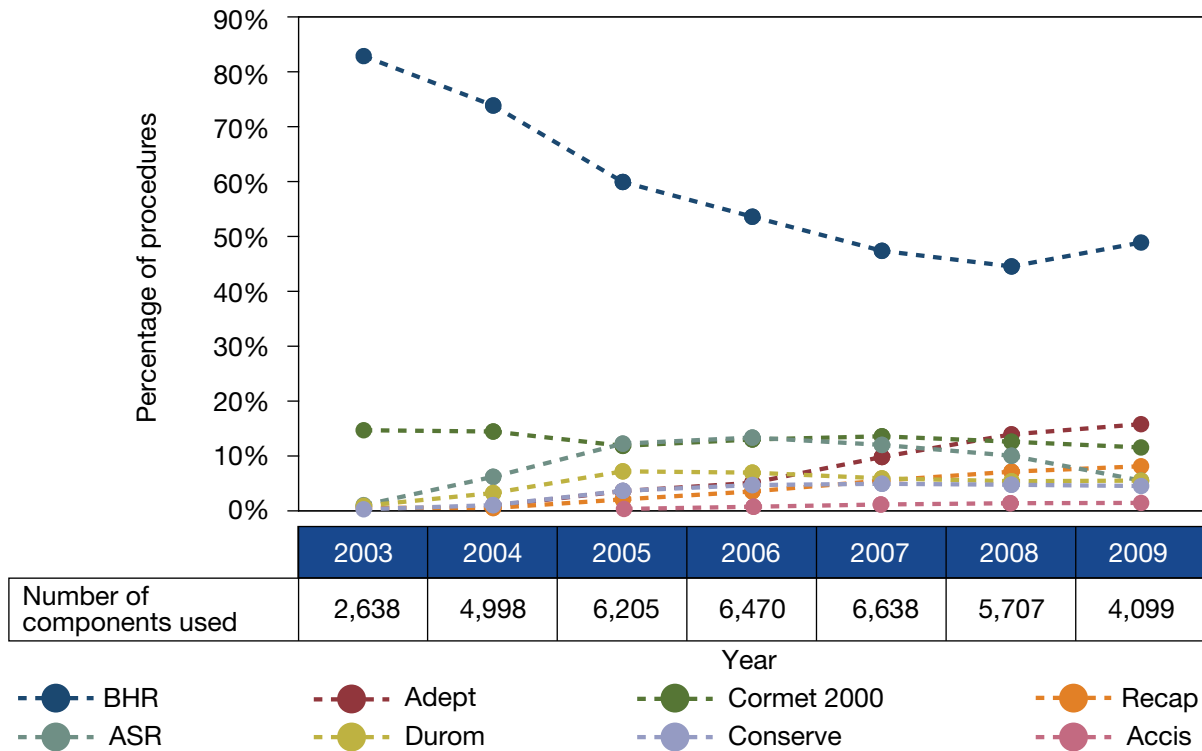


Figure 2.12 shows the sales evolution of brands of hip resurfacing prostheses in the English and Welsh markets. It is evident that the previous trend towards a decline in the usage of the original brands has been

reversed. The market share of the BHR and Adept brands increased significantly during the course of 2009, at the expense of the ASR resurfacing prosthesis from DePuy.

Figure 2.12

Top eight resurfacing head brands, usage trends 2003 to 2009.



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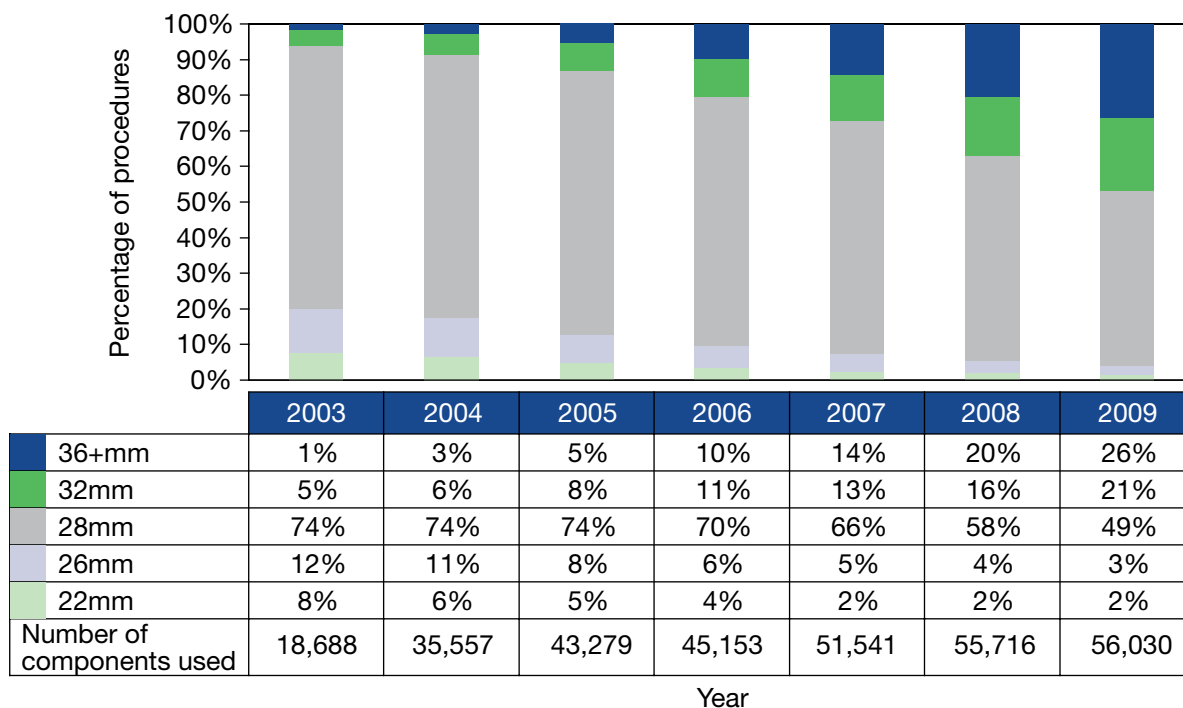
2.2.1.5.3 Trends in head size usage

Figure 2.13 shows the relative usage of different femoral head sizes each year since the inception of the NJR. It is immediately clear that there has been a gradual increase in the use of larger head sizes of 36mm diameter and above. This reflects an increase in LHMOM and ceramic on ceramic articulations used

by surgeons in an attempt to reduce the incidence of dislocation, revisions for recurrent dislocation and to reduce component wear.

Figure 2.13

Femoral head size trends, 2003 to 2009.



2.2.2 Hip revision procedures, 2009

A total of 7,136 hip revision procedures were reported in 2009, an increase of 555 compared with 2008. Table 2.9 shows that of these, 5,955 (83%) were single stage revision procedures, 497 (7%) were stage one of a two stage process, 617 (9%) procedures were stage two of a two stage revision and 67 (1%)

were excision arthroplasty procedures. The 67 hip re-operations submitted are excluded from any counts in this section. Compared with previous years, there has been a relative increase in stage two of two stage revisions compared with single stage revisions. This suggests that infection, as an indication for revision, has increased. Adverse soft tissue reaction was added to the list of reasons for revision in July 2009 and was, therefore, only available for five months of the reporting year.

Table 2.9 Patient characteristics for hip revision procedures in 2009, according to procedure type.

| | Hip single stage revision | | Hip stage one of two stage revision | | Hip stage two of two stage revision | | Hip excision arthroplasty | | Total | |
|-------------------------------------------------------------------|---------------------------|------------|-------------------------------------|-----------|-------------------------------------|-----------|---------------------------|-----------|--------------|------------|
| | No. | % | No. | % | No. | % | No. | % | No. | % |
| Total | 5,955 | 83% | 497 | 7% | 617 | 9% | 67 | 1% | 7,136 | |
| Number with patient data | 5,575 | | 461 | | 581 | | 63 | | 6,680 | 94% |
| Average age | 70.74 | | 69.10 | | 67.92 | | 72.67 | | 69.97 | |
| SD | 11.90 | | 11.20 | | 12.30 | | 14.60 | | 12.37 | |
| Interquartile range | 63.7-79.1 | | 62.3-76.7 | | 60.9-76.6 | | 65.5-83.2 | | 63.3-78.9 | |
| Gender | | | | | | | | | | |
| Female | 3,353 | 60% | 226 | 49% | 284 | 49% | 44 | 70% | 3,907 | 58% |
| Male | 2,222 | 40% | 235 | 51% | 297 | 51% | 19 | 30% | 2,773 | 42% |
| Patient physical status | | | | | | | | | | |
| P1 – fit and healthy | 646 | 11% | 40 | 8% | 65 | 11% | 4 | 6% | 755 | 11% |
| P2 – mild disease not incapacitating | 3,841 | 65% | 280 | 56% | 377 | 61% | 28 | 42% | 4,526 | 63% |
| P3 – incapacitating systemic disease | 1,381 | 23% | 170 | 34% | 167 | 27% | 31 | 46% | 1,749 | 25% |
| P4 – life threatening disease | 86 | 1% | 7 | 1% | 8 | 1% | 4 | 6% | 105 | 1% |
| P5 – expected to die within 24 hours with or without an operation | 1 | <1% | 0 | 0% | 0 | 0% | 0 | 0% | 1 | <1% |
| Indications for surgery | | | | | | | | | | |
| Aseptic loosening | 3,340 | 56% | 74 | 15% | 91 | 15% | 19 | 28% | 3,524 | 49% |
| Lysis | 913 | 15% | 46 | 9% | 31 | 5% | 9 | 13% | 999 | 14% |
| Pain | 1,847 | 31% | 89 | 18% | 83 | 13% | 16 | 24% | 2,035 | 29% |
| Dislocation/subluxation | 1,069 | 18% | 27 | 5% | 24 | 4% | 21 | 31% | 1,141 | 16% |
| Periprosthetic fracture | 569 | 10% | 15 | 3% | 31 | 5% | 3 | 4% | 618 | 9% |
| Infection | 171 | 3% | 399 | 80% | 423 | 69% | 27 | 40% | 1,020 | 14% |
| Malalignment | 399 | 7% | 5 | 1% | 2 | <1% | 1 | 1% | 407 | 6% |
| Fractured acetabulum | 87 | 1% | 2 | <1% | 0 | 0% | 1 | 1% | 90 | 1% |
| Fractured stem | 82 | 1% | 4 | 1% | 3 | <1% | 0 | 0% | 89 | 1% |
| Fractured femoral head | 30 | 1% | 2 | <1% | 1 | <1% | 0 | 0% | 33 | <1% |
| Incorrect sizing head/socket | 68 | 1% | 2 | <1% | 2 | <1% | 1 | 1% | 73 | 1% |
| Wear of acetabular component | 910 | 15% | 9 | 2% | 11 | 2% | 7 | 10% | 937 | 13% |
| Dissociation of liner | 94 | 2% | 6 | 1% | 8 | 1% | 1 | 1% | 109 | 2% |
| Adverse soft tissue reaction | 72 | 1% | 4 | 1% | 3 | <1% | 0 | 0% | 79 | 1% |
| Other | 18 | <1% | 0 | 0% | 1 | <1% | 0 | 0% | 19 | <1% |
| Side | | | | | | | | | | |
| Bilateral | 0 | 0% | 0 | 0% | 0 | 0% | 0 | 0% | 0 | 0% |
| Left, unilateral | 2,811 | 47% | 226 | 45% | 269 | 44% | 38 | 57% | 3,344 | 47% |
| Right, unilateral | 3,144 | 53% | 271 | 55% | 348 | 56% | 29 | 43% | 3,792 | 53% |

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2.2.2.1 Patient characteristics

Table 2.9 summarises patient characteristics for the 7,136 hip revision procedures undertaken in 2009. Compared with 2008, the patient demographics have largely remained unchanged. However, the percentage of patients who were graded as being fit and healthy prior to surgery has decreased from 26% in 2003 to 11% in 2009.

For stage one revisions there has been a decline in aseptic loosening, lysis and pain as reasons for revision compared with 2008. In single stage revisions, pain has increased by 4% compared with 2008 (Table 2.10).

Table 2.10 Indication for surgery for hip revision procedures, 2006 to 2009.

| | 2006 | | 2007 | | 2008 | | 2009 | | Total | |
|----------------------------------------------------------|--------------|-----|--------------|-----|--------------|-----|--------------|-----|---------------|-----|
| | No. | % | No. | % | No. | % | No. | % | No. | % |
| Indications for single stage revision | 5,405 | | 5,968 | | 6,191 | | 5,955 | | 23,519 | |
| Aseptic loosening | 3,419 | 63% | 3,628 | 61% | 3,675 | 59% | 3,340 | 56% | 14,062 | 60% |
| Lysis | 1,147 | 21% | 1,095 | 18% | 1,081 | 17% | 913 | 15% | 4,236 | 18% |
| Pain | 1,072 | 20% | 1,207 | 20% | 1,692 | 27% | 1,847 | 31% | 5,818 | 25% |
| Infection | 103 | 2% | 97 | 2% | 167 | 3% | 171 | 3% | 538 | 2% |
| Indications for stage one of a two stage revision | 374 | | 392 | | 440 | | 497 | | 1,703 | |
| Aseptic loosening | 79 | 21% | 72 | 18% | 85 | 19% | 74 | 15% | 310 | 18% |
| Lysis | 57 | 15% | 46 | 12% | 58 | 13% | 46 | 9% | 207 | 12% |
| Pain | 64 | 17% | 57 | 15% | 84 | 19% | 89 | 18% | 294 | 17% |
| Infection | 300 | 80% | 299 | 76% | 355 | 81% | 399 | 80% | 1,353 | 79% |

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2.2.2.2 Components removed and components used

Both the acetabular and femoral components were removed in half of all revision procedures (Table 2.11). However, comparison of the different types of revision procedures indicates that both components were more likely to be removed during a two stage revision

process or with a hip excision arthroplasty type procedure than during a single stage revision. This is expected since the majority of two stage revisions are carried out for reasons of infection, where all components are routinely removed. The components used during revision procedures are shown in Table 2.12.

Table 2.11 Components removed during hip revision procedures in 2009.

| | Hip single stage revision | | Hip stage one of a two stage revision | | Hip excision arthroplasty | | Total | |
|-----------------|---------------------------|-----|---------------------------------------|-----|---------------------------|-----|--------------|-----|
| | No. | % | No. | % | No. | % | No. | % |
| Total | 5,955 | | 497 | | 67 | | 6,519 | |
| Both components | 2,663 | 45% | 400 | 80% | 42 | 63% | 3,105 | 48% |
| Acetabular | 4,323 | 73% | 413 | 83% | 45 | 67% | 4,781 | 73% |
| Acetabular only | 1,660 | 28% | 13 | 3% | 3 | 4% | 1,676 | 26% |
| Femoral | 3,713 | 62% | 440 | 89% | 55 | 82% | 4,208 | 65% |
| Femoral only | 1,050 | 18% | 40 | 8% | 13 | 19% | 1,103 | 17% |
| None | 582 | 10% | 44 | 9% | 9 | 13% | 635 | 10% |

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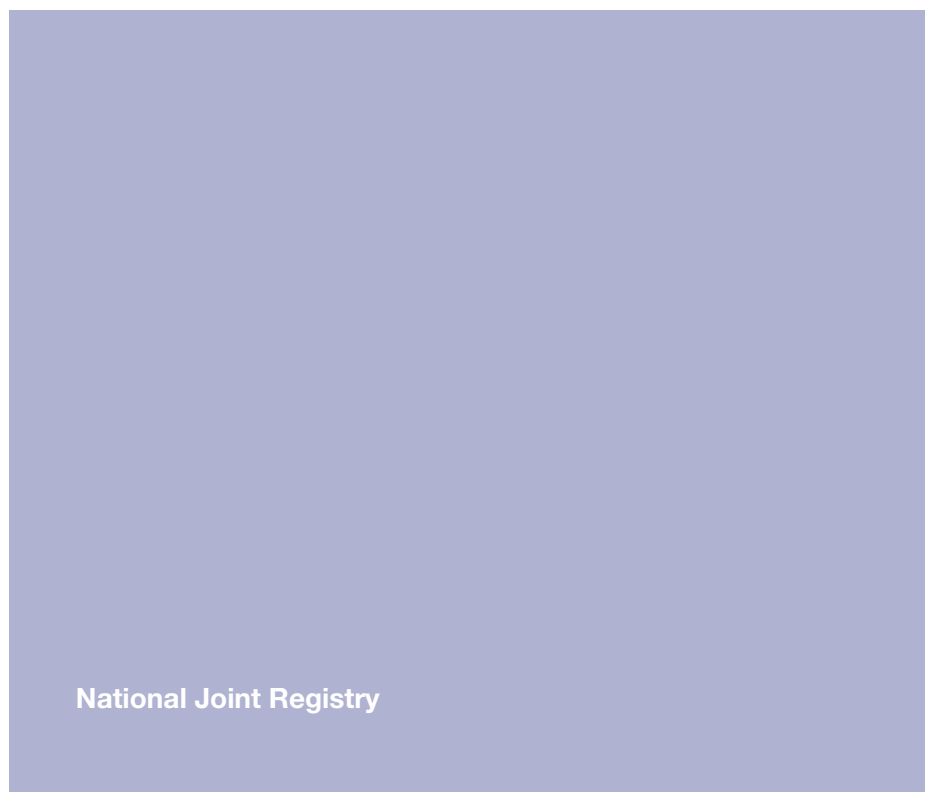
Table 2.12 Components used during single stage hip revision procedures in 2009.

| | Hip single stage revision | |
|------------------------------|---------------------------|-----|
| | No. | % |
| Total | 5,955 | |
| Femoral prosthesis | | |
| Cemented | 2,803 | 47% |
| Cementless | 1,005 | 17% |
| Not revised | 2,147 | 36% |
| Acetabular prosthesis | | |
| Cemented | 1,140 | 19% |
| Cementless | 3,600 | 60% |
| Not revised | 1,215 | 20% |

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Part 2

2.3 Knee replacement procedures, 2009



The total number of knee replacement procedures entered into the NJR during 2009 was 77,545, an increase of 2.5% compared with 2008. Of the 77,545 procedures submitted, 72,980 were primary procedures and 4,565 were revision procedures. Table 2.13 summarises the patient characteristics and details of knee replacement procedures according to type of provider.

As a percentage of their activity, independent hospitals performed more unicondylar knee replacement procedures (Figure 2.14) than any other type of provider. The revision procedures undertaken at NHS hospitals comprised 80% of all revision procedures performed.

Table 2.13 Patient characteristics and procedure details, according to type of provider for knee procedures in 2009.

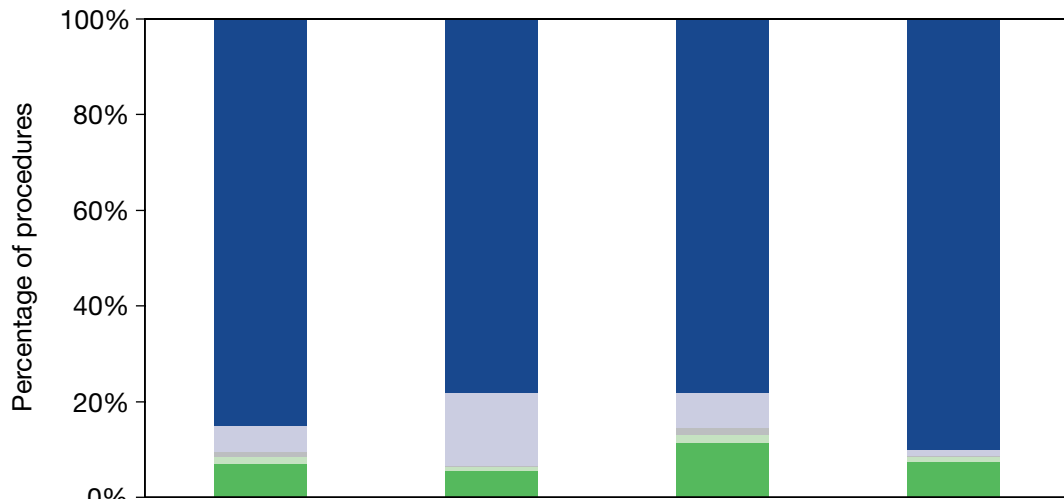
| | NHS hospitals | | Independent hospitals | | NHS treatment centres | | ISTCs | | Total | |
|-------------------------------------------------------------------|---------------|------------|-----------------------|------------|-----------------------|------------|--------------|------------|---------------|------------|
| | No. | % | No. | % | No. | % | No. | % | No. | % |
| Total | 50,421 | | 18,625 | | 3,865 | | 4,634 | | 77,545 | |
| Patient physical status | | | | | | | | | | |
| P1 – fit and healthy | 5,128 | 10% | 3,784 | 20% | 489 | 13% | 401 | 9% | 9,802 | 13% |
| P2 – mild disease not incapacitating | 36,047 | 71% | 13,226 | 71% | 2,889 | 75% | 3,836 | 83% | 55,998 | 72% |
| P3 – incapacitating systemic disease | 9,039 | 18% | 1,598 | 9% | 481 | 12% | 397 | 9% | 11,515 | 15% |
| P4 – life threatening disease | 205 | <1% | 17 | <1% | 6 | <1% | 0 | 0% | 228 | <1% |
| P5 – expected to die within 24 hours with or without an operation | 2 | <1% | 0 | 0% | 0 | 0% | 0 | 0% | 2 | <1% |
| Procedure type | | | | | | | | | | |
| Primary procedure | 46,766 | 93% | 18,003 | 97% | 3,709 | 96% | 4,502 | 97% | 72,980 | 94% |
| Total prosthetic replacement using cement | 39,839 | 79% | 14,076 | 76% | 2,902 | 75% | 4,065 | 88% | 60,882 | 79% |
| Total prosthetic replacement not using cement | 2,514 | 5% | 1,313 | 7% | 567 | 15% | 51 | 1% | 4,445 | 6% |
| Hybrid total knee | 474 | 1% | 267 | 1% | 11 | <1% | 7 | <1% | 759 | 1% |
| Patello-femoral replacement | 717 | 1% | 303 | 2% | 26 | 1% | 48 | 1% | 1,094 | 1% |
| Unicondylar knee replacement | 3,222 | 6% | 2,044 | 11% | 203 | 5% | 331 | 7% | 5,800 | 7% |
| Revision procedure | 3,655 | 7% | 622 | 3% | 156 | 4% | 132 | 3% | 4,565 | 6% |
| Knee single stage revision | 2,634 | 5% | 500 | 3% | 112 | 3% | 109 | 2% | 3,355 | 4% |
| Knee stage one of two stage revision | 446 | 1% | 59 | <1% | 20 | 1% | 13 | <1% | 538 | 1% |
| Knee stage two of two stage revision | 484 | 1% | 63 | <1% | 23 | 1% | 10 | <1% | 580 | 1% |
| Knee conversion to arthrodesis | 14 | <1% | 0 | 0% | 1 | <1% | 0 | 0% | 15 | <1% |
| Amputation | 5 | <1% | 0 | 0% | 0 | 0% | 0 | 0% | 5 | <1% |
| Knee re-operation other than revision | 72 | <1% | 0 | 0% | 0 | 0% | 0 | 0% | 72 | <1% |
| Bilateral or unilateral²¹ | | | | | | | | | | |
| Bilateral | 432 | 1% | 374 | 2% | 63 | 2% | 72 | 2% | 941 | 1% |
| Unilateral | 49,989 | 99% | 18,251 | 98% | 3,802 | 98% | 4,562 | 98% | 76,604 | 99% |
| Funding | | | | | | | | | | |
| Independent | 497 | 1% | 9,173 | 49% | 16 | <1% | 334 | 7% | 10,020 | 13% |
| NHS | 49,874 | 99% | 9,452 | 51% | 3,848 | 100% | 4,300 | 93% | 67,474 | 87% |
| Not selected | 50 | <1% | 0 | 0% | 1 | <1% | 0 | 0% | 51 | <1% |

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²¹ Bilaterals will only be counted as a bilateral if they are entered under the same single operation during data entry. If the two procedures are recorded under two different operations they will be counted as two unilateral procedures. Therefore, the count of bilaterals is likely to be an underestimate.

Figure 2.14

Primary knee procedures by type of provider.



| | NHS hospitals | NHS treatment centres | Independent hospitals | ISTCs |
|----------------------|---------------|-----------------------|-----------------------|-------|
| Cemented | 85% | 78% | 78% | 90% |
| Cementless | 5% | 15% | 7% | 1% |
| Hybrid | 1% | <1% | 1% | <1% |
| Patello-femoral | 2% | 1% | 2% | 1% |
| Unicondylar | 7% | 5% | 11% | 7% |
| Number of procedures | 46,766 | 3,709 | 18,003 | 4,502 |

Type of provider

2.3.1 Primary knee replacement procedures, 2009

Of the 72,980 primary knee replacements undertaken in 2009, 66,086 (91%) were total condylar procedures, 5,800 (8%) were unicondylar knee replacements and 1,094 (1%) were patello-femoral replacements (Table 2.14). Compared with previous years, these proportions have largely remained the same (Figure 2.15). Figure 2.15 shows an apparent decrease in the volume of knee procedures between 2008 and 2009. However, not all procedures performed in 2009 were entered into the database before the 28th February 2010 deadline and will be entered after this date.

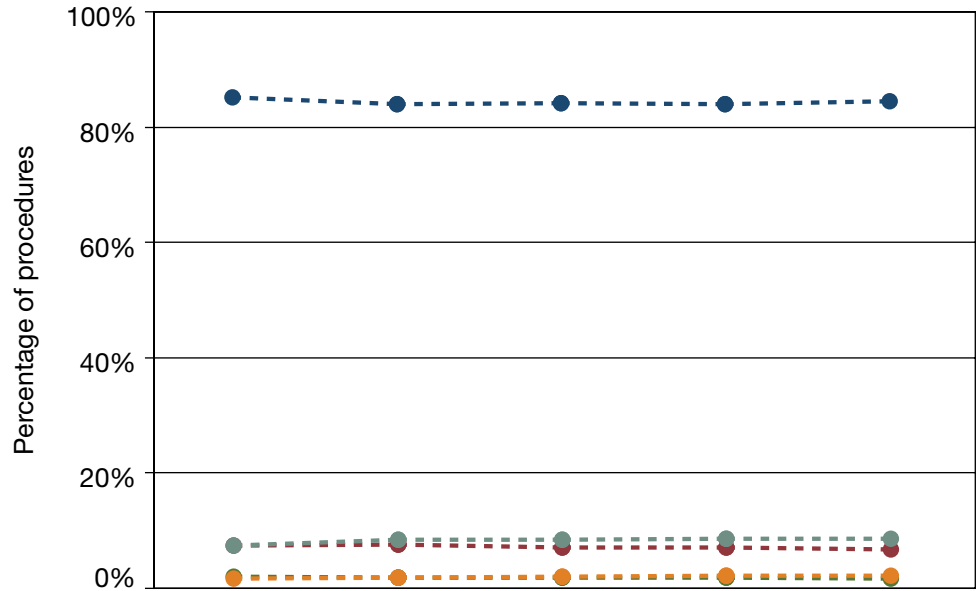
The single largest indication recorded for surgery was osteoarthritis, recorded in 97% of all primary procedures (Table 2.14).

Table 2.14 Patient characteristics for primary knee replacement procedures in 2009, according to procedure type.

| | Primary total prosthetic replacement using cement | | Primary total prosthetic replacement not using cement | | Primary total prosthetic replacement not classified elsewhere (e.g. hybrid) | | Patello-femoral replacement | | Unicondylar knee replacement | | Total | |
|-------------------------------------------------------------------|---------------------------------------------------|------------|-------------------------------------------------------|-----------|-----------------------------------------------------------------------------|-----------|-----------------------------|-----------|------------------------------|-----------|---------------|------------|
| | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % |
| Total knee primaries | 60,882 | 83% | 4,445 | 6% | 759 | 1% | 1,094 | 1% | 5,800 | 8% | 72,980 | |
| Total knee primaries with patient data | 57,443 | | 4,238 | | 723 | | 1,033 | | 5,430 | | 68,867 | 94% |
| Average age | 70.19 | | 69.00 | | 68.66 | | 60.56 | | 63.80 | | 67.46 | |
| SD | 9.32 | | 9.50 | | 9.60 | | 11.98 | | 9.72 | | 11.87 | |
| Interquartile range | 63.7 - 77.1 | | 62.5 - 76.0 | | 62.1 - 75.9 | | 51.9 - 69.6 | | 57.1 - 70.6 | | 62.9 - 76.6 | |
| Gender | | | | | | | | | | | | |
| Female | 32,914 | 57% | 2,164 | 51% | 380 | 53% | 790 | 76% | 2,663 | 49% | 38,911 | 57% |
| Male | 24,529 | 43% | 2,074 | 49% | 343 | 47% | 243 | 24% | 2,766 | 51% | 29,955 | 43% |
| Patient physical status | | | | | | | | | | | | |
| P1 – fit and healthy | 6,996 | 11% | 659 | 15% | 91 | 12% | 278 | 25% | 1,357 | 23% | 9,381 | 13% |
| P2 – mild disease not incapacitating | 44,588 | 73% | 3,149 | 71% | 567 | 75% | 684 | 63% | 3,932 | 68% | 52,920 | 73% |
| P3 – incapacitating systemic disease | 9,124 | 15% | 622 | 14% | 100 | 13% | 128 | 12% | 506 | 9% | 10,480 | 14% |
| P4 – life threatening disease | 172 | <1% | 15 | <1% | 1 | <1% | 4 | <1% | 5 | <1% | 197 | <1% |
| P5 – expected to die within 24 hours with or without an operation | 2 | <1% | 0 | 0% | 0 | 0% | 0 | 0% | 0 | 0% | 2 | <1% |
| BMI | | | | | | | | | | | | |
| Average | 30.59 | | 30.66 | | 31.14 | | 29.46 | | 29.94 | | 30.52 | |
| SD | 5.42 | | 5.18 | | 5.32 | | 5.2 | | 5.17 | | 5.39 | |
| Indications for surgery | | | | | | | | | | | | |
| Osteoarthritis | 59,228 | 97% | 4,379 | 99% | 727 | 96% | 1,051 | 96% | 5,720 | 99% | 71,105 | 97% |
| Avascular necrosis | 190 | <1% | 6 | <1% | 1 | <1% | 0 | 0% | 47 | 1% | 244 | <1% |
| Inflammatory arthropathy | 366 | 1% | 9 | <1% | 2 | <1% | 1 | <1% | 5 | <1% | 383 | 1% |
| Infection | 49 | <1% | 4 | <1% | 0 | 0% | 2 | <1% | 4 | <1% | 59 | <1% |
| Rheumatoid arthritis | 1,028 | 2% | 39 | 1% | 9 | 1% | 3 | <1% | 10 | <1% | 1,089 | 1% |
| Trauma | 305 | 1% | 11 | <1% | 11 | 1% | 9 | 1% | 29 | 1% | 365 | 1% |
| Other | 442 | 1% | 34 | 1% | 18 | 2% | 50 | 5% | 37 | 1% | 581 | 1% |
| Side | | | | | | | | | | | | |
| Bilateral | 634 | 1% | 54 | 1% | 8 | 1% | 62 | 6% | 180 | 3% | 938 | 1% |
| Left, unilateral | 28,541 | 47% | 2,055 | 46% | 346 | 46% | 474 | 43% | 2,796 | 48% | 34,212 | 47% |
| Right, unilateral | 31,707 | 52% | 2,336 | 53% | 405 | 53% | 558 | 51% | 2,824 | 49% | 37,830 | 52% |

Figure 2.15(a)

Type of primary knee replacement procedure undertaken between 2005 and 2009.

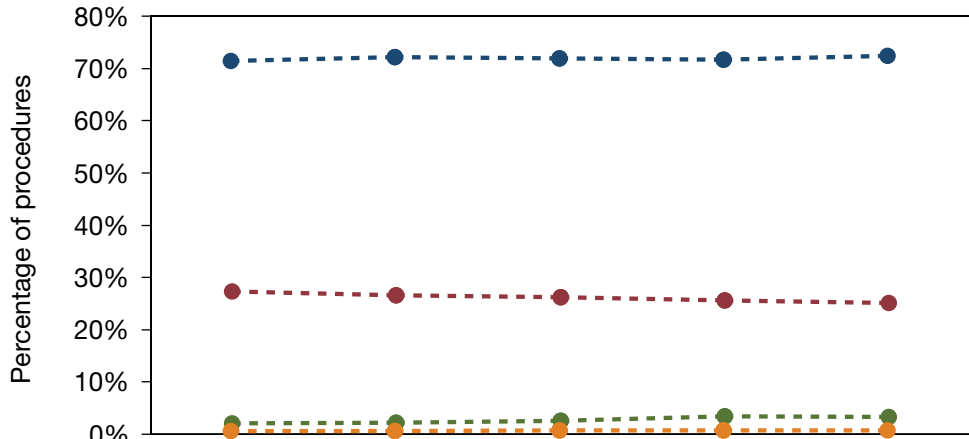


| | 2005 | 2006 | 2007 | 2008 | 2009 |
|----------------------|--------|--------|--------|--------|--------|
| TKR using cement | 84% | 83% | 83% | 83% | 83% |
| TKR not using cement | 7% | 7% | 6% | 6% | 6% |
| TKR hybrid | 1% | 1% | 1% | 1% | 1% |
| Patello-femoral | 1% | 1% | 1% | 1% | 1% |
| Unicodylar | 7% | 8% | 8% | 8% | 8% |
| Number of procedures | 59,264 | 62,046 | 72,929 | 76,255 | 72,980 |

Year

Figure 2.15(b)

Implant constraint for bicondylar primary knee replacement procedures undertaken between 2005 and 2009.



| | 2005 | 2006 | 2007 | 2008 | 2009 |
|----------------------|--------|--------|--------|--------|--------|
| Cruciate Retaining | 71% | 72% | 71% | 71% | 72% |
| Posterior Stabilised | 27% | 26% | 26% | 25% | 25% |
| Constrained Condylar | 2% | 2% | 2% | 3% | 3% |
| Hinged/Linked | <1% | <1% | <1% | <1% | <1% |
| Number of procedures | 45,857 | 46,584 | 54,151 | 57,422 | 55,480 |

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2.3.1.1 Patient characteristics

The average age of patients was 67.5 years and 57% were female. Patients undergoing a patello-femoral replacement were the youngest, at an average age of 60.6 years and 76% of these were female (Table 2.14). On average, female patients were of a similar age to male patients at the time of their primary knee replacement (68.1 years and 68.3 years respectively), see Table 2.15 and Figure 2.16. However, female patients were, on average, older than male patients for cementless, cemented and hybrid procedures but younger for patello-femoral and unicondylar procedures.

According to the ASA grade system, 13% of patients undergoing a primary knee replacement procedure were graded as fit and healthy (Table 2.14). Figure 2.17 shows the trend in ASA grade over the past six years. Since 2003, there has been a 55% reduction in the number of patients assessed as being fit and

healthy at the time of operation. Figure 2.18(a) shows the increase in BMI²² over the past five years for patients having primary knee procedures. This figure has increased from 29.4 to 30.5 over the past four years. This is equivalent to a weight increase of 1.85kg (four pounds) for a person of average height. Figure 2.18(b) shows that there has been a steady increase in the number of patients within the BMI range 30 to 39 and a decrease within the ranges 25 to 29 and 18.5 to 24. The average knee replacement patient in 2009, by BMI measurement, was clinically obese. It is interesting to note that the profile of Figure 2.18(b) is significantly different to the equivalent chart for hips, Figure 2.6(b).

²² BMI: 20-24 normal, 25-29 overweight, 30-39 obese, 40+ morbidly obese.

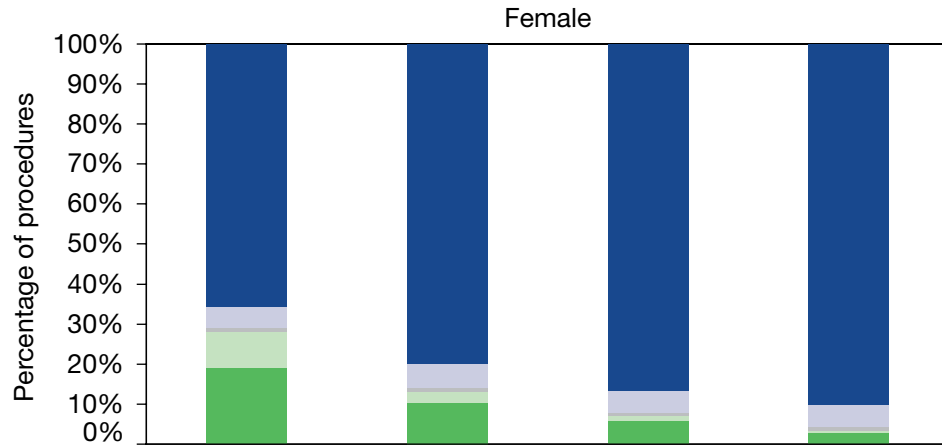
Table 2.15 Age and gender for primary knee replacement patients in 2009.

| | Primary total prosthetic replacement using cement | | Primary total prosthetic replacement not using cement | | Primary total prosthetic replacement not classified elsewhere (e.g. hybrid) | | Patello-femoral replacement | | Unicondylar knee replacement | | Total | |
|------------------------------|---------------------------------------------------|-----|-------------------------------------------------------|-----|-----------------------------------------------------------------------------|-----|-----------------------------|-----|------------------------------|-----|-----------|-----|
| | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % |
| Average age by gender | | | | | | | | | | | | |
| Female | 32,914 | 85% | 2,164 | 6% | 380 | 1% | 790 | 2% | 2,663 | 7% | 38,911 | |
| Average | 70.45 | | 69.43 | | 68.80 | | 60.09 | | 63.30 | | 68.14 | |
| SD | 9.49 | | 9.66 | | 9.46 | | 11.93 | | 9.83 | | 11.56 | |
| Interquartile range | 63.9-77.5 | | 62.5-76.7 | | 61.6-76.7 | | 51.7-69.1 | | 56.1-70.0 | | 62.9-77.1 | |
| Male | 24,529 | 82% | 2,074 | 7% | 343 | 1% | 243 | 1% | 2,766 | 9% | 29,955 | |
| Average | 69.83 | | 68.56 | | 68.51 | | 62.12 | | 64.29 | | 68.26 | |
| SD | 9.09 | | 9.30 | | 9.76 | | 12.01 | | 9.59 | | 10.71 | |
| Interquartile range | 63.6-76.4 | | 62.4-75.2 | | 62.5-75.2 | | 53.1-70.6 | | 58.0-70.9 | | 62.9-75.9 | |
| Age group by gender | | | | | | | | | | | | |
| Female | | | | | | | | | | | | |
| <45 years | 236 | 1% | 16 | 1% | 0 | 0% | 81 | 10% | 71 | 3% | 404 | 1% |
| 45 - 54 years | 1,708 | 5% | 145 | 7% | 32 | 8% | 188 | 24% | 487 | 18% | 2,560 | 7% |
| 55 - 64 years | 7,495 | 23% | 553 | 26% | 104 | 27% | 258 | 33% | 964 | 36% | 9,374 | 24% |
| 65 - 74 years | 12,101 | 37% | 762 | 35% | 132 | 35% | 172 | 22% | 797 | 30% | 13,964 | 36% |
| 75 - 84 years | 9,823 | 30% | 605 | 28% | 103 | 27% | 80 | 10% | 314 | 12% | 10,925 | 28% |
| >85 years | 1,551 | 5% | 83 | 4% | 9 | 2% | 11 | 1% | 30 | 1% | 1,684 | 4% |
| Male | | | | | | | | | | | | |
| <45 years | 158 | 1% | 19 | 1% | 3 | 1% | 16 | 7% | 63 | 2% | 259 | 1% |
| 45 - 54 years | 1,240 | 5% | 136 | 7% | 28 | 8% | 62 | 26% | 424 | 15% | 1,890 | 6% |
| 55 - 64 years | 5,993 | 24% | 558 | 27% | 87 | 25% | 65 | 27% | 986 | 36% | 7,689 | 26% |
| 65 - 74 years | 9,724 | 40% | 836 | 40% | 137 | 40% | 60 | 25% | 910 | 33% | 11,667 | 39% |
| 75 - 84 years | 6,544 | 27% | 466 | 22% | 75 | 22% | 34 | 14% | 350 | 13% | 7,469 | 25% |
| >85 years | 870 | 4% | 59 | 3% | 13 | 4% | 6 | 2% | 33 | 1% | 981 | 3% |

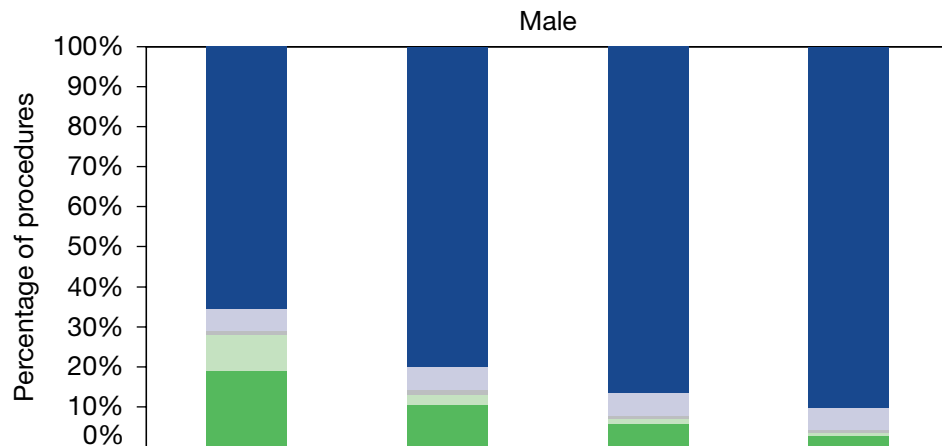
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Figure 2.16

Age and gender for primary knee replacement patients in 2009.



| Age group | <55 | 55-64 | 65-74 | 75+ |
|----------------------|-------|-------|--------|--------|
| TKR using cement | 66% | 80% | 87% | 90% |
| TKR not using cement | 5% | 6% | 5% | 5% |
| TKR hybrid | 1% | 1% | 1% | 1% |
| Patello-femoral | 9% | 3% | 1% | 1% |
| Unicondylar knee | 19% | 10% | 6% | 3% |
| Number of patients | 2,964 | 9,374 | 13,964 | 12,609 |



| Age group | <55 | 55-64 | 65-74 | 75+ |
|----------------------|-------|-------|--------|-------|
| TKR using cement | 65% | 78% | 83% | 88% |
| TKR not using cement | 7% | 7% | 7% | 6% |
| TKR hybrid | 1% | 1% | 1% | 1% |
| Patello-femoral | 4% | 1% | 1% | <1% |
| Unicondylar knee | 23% | 13% | 8% | 5% |
| Number of patients | 2,149 | 7,689 | 11,667 | 8,450 |

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Figure 2.17

ASA grades for primary knee replacement patients between 2003 and 2009.

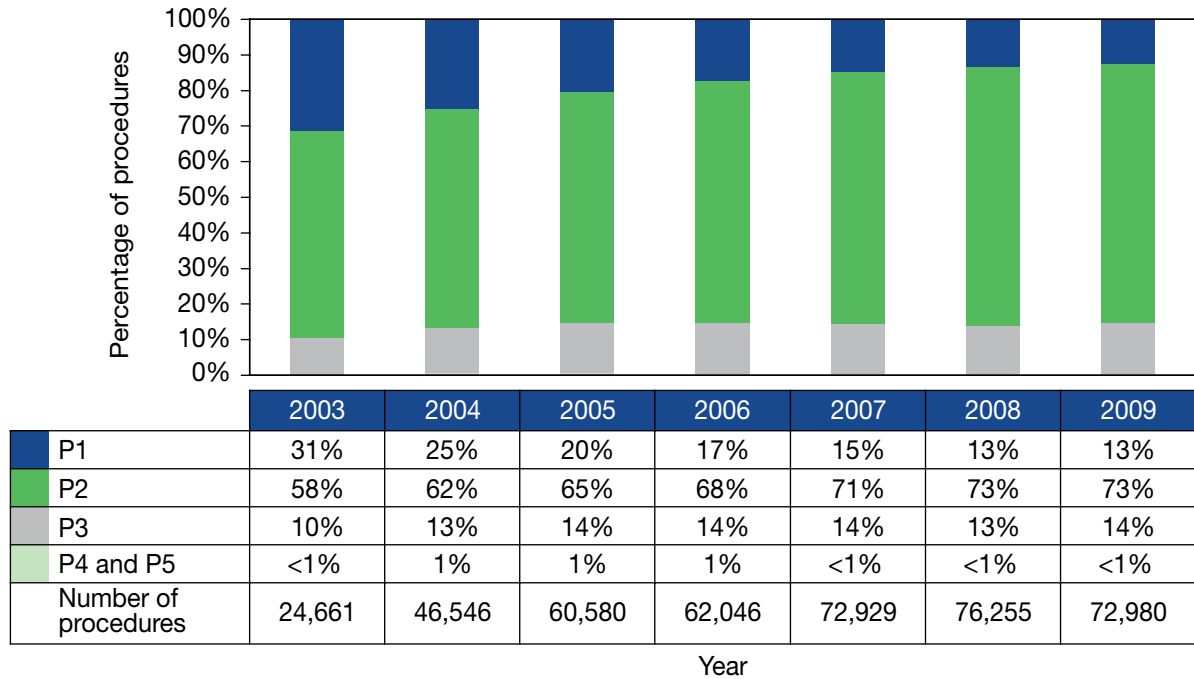


Figure 2.18(a)

BMI for primary knee replacement patients between 2004 and 2009.

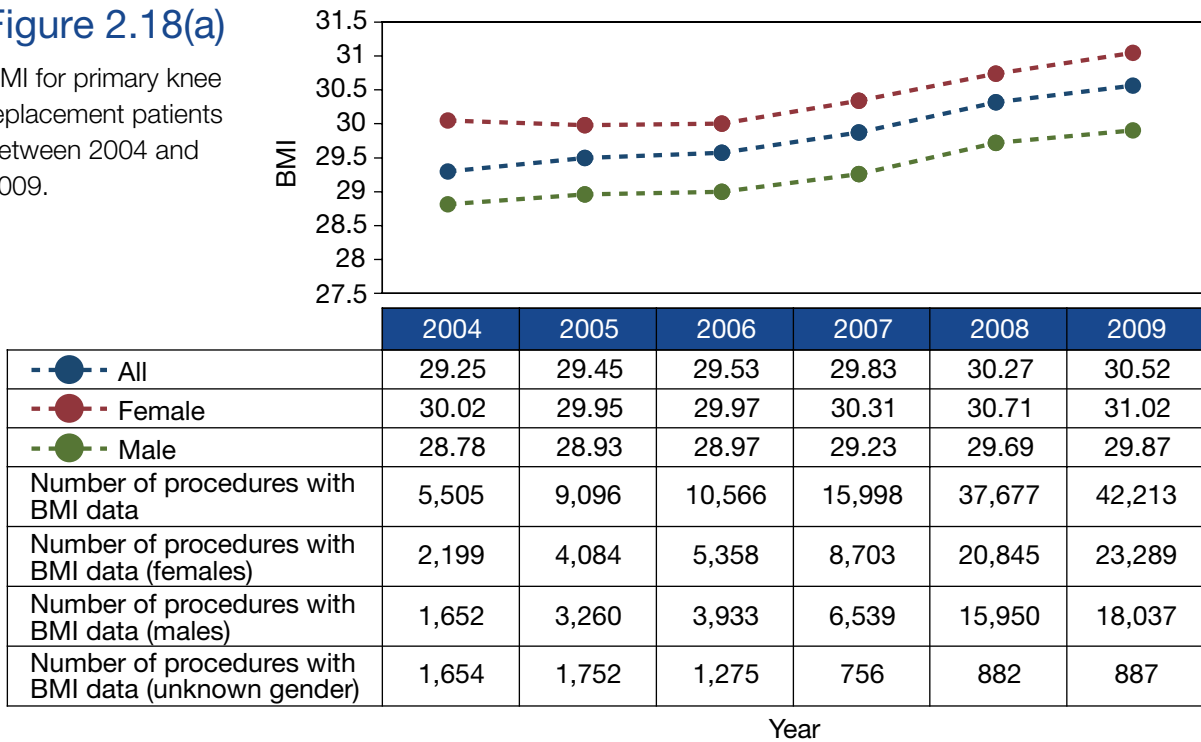
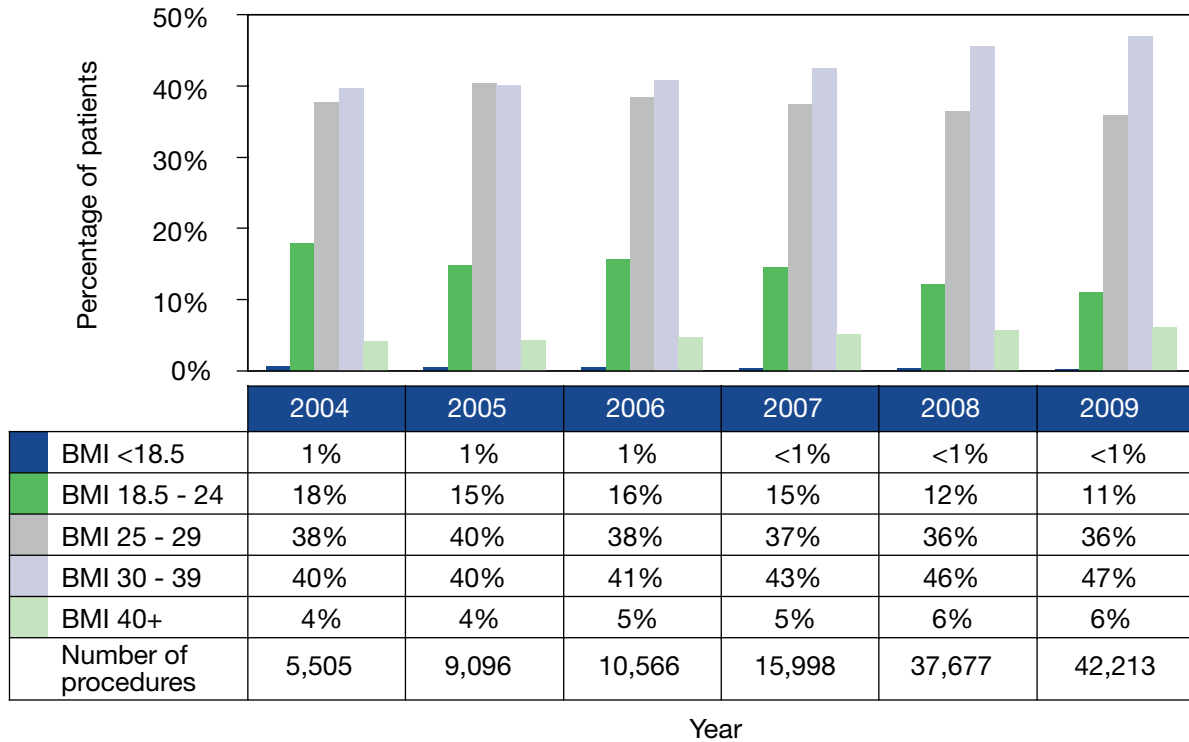


Figure 2.18(b)

BMI groups for primary knee replacement patients between 2004 and 2009.



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2.3.1.2 Surgical techniques

The most common surgical approach was the medial parapatellar, used in 92% of procedures (Table 2.16). Minimally invasive surgery (MIS) was used in 51% of unicompartmental knee replacement procedures, reflecting the popularity of the Oxford Partial Knee, but was used in only 4% of all other types of knee replacement intervention. For cemented knee procedures, 36% had the patella replaced at the time of the primary procedure whereas 9% of patellas were replaced during primary cementless knee procedures.

Compared with previous years, the surgical techniques used in primary knee replacements have largely remained unchanged. However, there has been an increase in the use of MIS in unicompartmental knee replacements, from 37% in 2004 to 51% in 2009.

The use of bone cement in primary knee procedures is summarised in Figure 2.19.

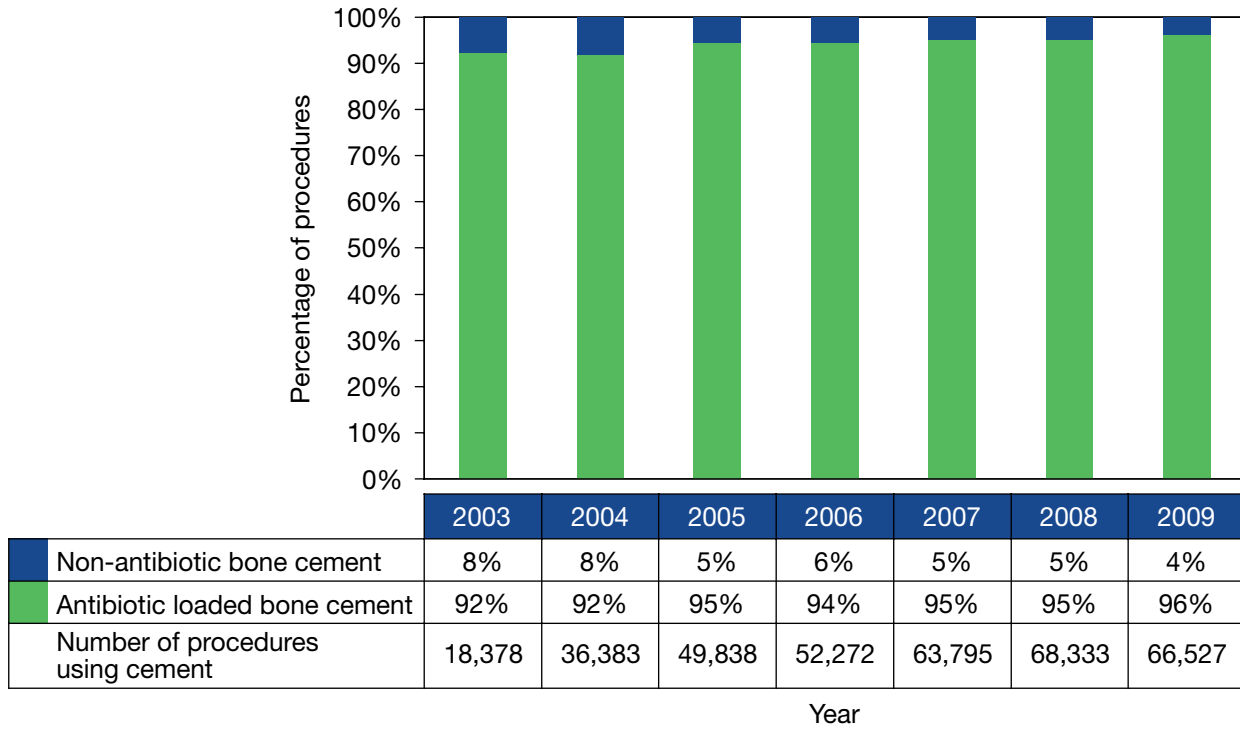
Table 2.16 Characteristics of surgical practice for primary knee replacement procedures in 2009, according to procedure type.

| | Primary total prosthetic replacement using cement | | Primary total prosthetic replacement not using cement | | Primary total prosthetic replacement not classified elsewhere (e.g. hybrid) | | Patello-femoral replacement | | Unicondylar knee replacement | | Total | |
|-----------------------------------|---------------------------------------------------|------|-------------------------------------------------------|-----|-----------------------------------------------------------------------------|-----|-----------------------------|------|------------------------------|------|---------------|------|
| | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % |
| Total | 60,882 | | 4,445 | | 759 | | 1,094 | | 5,800 | | 72,980 | |
| Surgical approach | | | | | | | | | | | | |
| Lateral parapatellar | 466 | 1% | 41 | 1% | 3 | <1% | 22 | 2% | 173 | 3% | 705 | 1% |
| Medial parapatellar | 56,493 | 93% | 4,144 | 93% | 709 | 93% | 989 | 90% | 4,991 | 86% | 67,326 | 92% |
| Mid-vastus | 1,794 | 3% | 114 | 3% | 33 | 4% | 35 | 3% | 209 | 4% | 2,185 | 3% |
| Sub-vastus | 733 | 1% | 27 | 1% | 5 | 1% | 20 | 2% | 99 | 2% | 884 | 1% |
| Other | 1,396 | 2% | 119 | 3% | 9 | 1% | 28 | 3% | 328 | 6% | 1,880 | 3% |
| Patella | | | | | | | | | | | | |
| Patella implanted | 22,061 | 36% | 383 | 9% | 349 | 46% | 1,024 | 94% | 62 | 1% | 23,879 | 33% |
| Patella not implanted | 38,821 | 64% | 4,062 | 91% | 410 | 54% | 70 | 6% | 5,738 | 99% | 49,101 | 67% |
| Minimally invasive surgery | | | | | | | | | | | | |
| No | 58,383 | 96% | 4,127 | 93% | 748 | 99% | 960 | 88% | 2,821 | 49% | 67,039 | 92% |
| Yes | 2,292 | 4% | 164 | 4% | 7 | 1% | 133 | 12% | 2,957 | 51% | 5,553 | 8% |
| Not Selected | 207 | <1% | 154 | 3% | 4 | 1% | 1 | <1% | 22 | <1% | 388 | 1% |
| Image guided surgery | | | | | | | | | | | | |
| Yes | 1,834 | 3% | 244 | 5% | 12 | 2% | 6 | 1% | 122 | 2% | 2,218 | 3% |
| No | 58,890 | 97% | 4,087 | 92% | 746 | 98% | 1,087 | 99% | 5,644 | 97% | 70,454 | 97% |
| Not Selected | 158 | <1% | 114 | 3% | 1 | <1% | 1 | <1% | 34 | 1% | 308 | <1% |
| Femoral bone graft used | | | | | | | | | | | | |
| Yes | 486 | 1% | 38 | 1% | 7 | 1% | 3 | <1% | 18 | <1% | 552 | 1% |
| No | 60,396 | 99% | 4,407 | 99% | 752 | 99% | 1,091 | 100% | 5,782 | 100% | 72,428 | 99% |
| Tibial bone graft used | | | | | | | | | | | | |
| Yes | 241 | <1% | 28 | 1% | 6 | 1% | 0 | 0% | 18 | <1% | 293 | <1% |
| No | 60,641 | 100% | 4,417 | 99% | 753 | 99% | 1,094 | 100% | 5,782 | 100% | 72,687 | 100% |

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Figure 2.19

Bone cement types for primary knee replacement procedures undertaken between 2003 and 2009.



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2.3.1.3 Thromboprophylaxis

The most frequently prescribed chemical method of thromboprophylaxis for knee replacement patients was LMWH, while TED stockings were the most used mechanical method (Table 2.17). Compared with previous years, there has been an increase in the prescription of a combined chemical and mechanical regime, from 49% in 2004 to 80% in

2009. The increase can be attributed to similar changes in the prescription of all other mechanical methods. The prescription of foot pumps increased from 28% in 2007 to 29% in 2009 and intermittent calf compression increased from 26% to 31% in the same period. Less than 1% of patients had neither mechanical nor chemical-prescribed thromboprophylaxis.

Table 2.17 Thromboprophylaxis regime for primary knee replacement patients, prescribed at time of operation.

| | Primary total prosthetic replacement using cement | | Primary total prosthetic replacement not using cement | | Primary total prosthetic replacement not classified elsewhere (e.g. hybrid) | | Patello-femoral replacement | | Unicondylar knee replacement | | Total | |
|---------------------------------|---------------------------------------------------|-----|-------------------------------------------------------|-----|-----------------------------------------------------------------------------|-----|-----------------------------|-----|------------------------------|-----|---------------|-----|
| | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % |
| Total | 60,882 | | 4,445 | | 759 | | 1,094 | | 5,800 | | 72,980 | |
| Aspirin | 12,113 | 20% | 677 | 15% | 83 | 11% | 315 | 29% | 1,638 | 28% | 14,826 | 20% |
| LMWH | 42,539 | 70% | 3,125 | 70% | 539 | 71% | 623 | 57% | 3,421 | 59% | 50,247 | 69% |
| Pentasaccharide | 416 | 1% | 70 | 2% | 2 | <1% | 7 | 1% | 27 | <1% | 522 | 1% |
| Warfarin | 1,096 | 2% | 375 | 8% | 14 | 2% | 2 | <1% | 104 | 2% | 1,591 | 2% |
| Direct thrombin inhibitor | 322 | 1% | 37 | 1% | 5 | 1% | 1 | <1% | 25 | <1% | 390 | 1% |
| Other chemical (all) | 3,773 | 6% | 581 | 13% | 69 | 9% | 54 | 5% | 374 | 6% | 4,851 | 7% |
| No chemical | 6,382 | 10% | 226 | 5% | 79 | 10% | 147 | 13% | 748 | 13% | 7,582 | 10% |
| Foot pump | 17,229 | 28% | 1,578 | 36% | 297 | 39% | 354 | 32% | 1,555 | 27% | 21,013 | 29% |
| Intermittent calf compression | 19,069 | 31% | 1,470 | 33% | 199 | 26% | 323 | 30% | 1,820 | 31% | 22,881 | 31% |
| TED stockings | 41,313 | 68% | 2,954 | 66% | 543 | 72% | 733 | 67% | 4,045 | 70% | 49,588 | 68% |
| Other | 839 | 1% | 13 | <1% | 5 | 1% | 33 | 3% | 78 | 1% | 968 | 1% |
| No mechanical | 5,400 | 9% | 250 | 6% | 59 | 8% | 79 | 7% | 355 | 6% | 6,143 | 8% |
| Both mechanical and chemical | 48,587 | 80% | 3,712 | 84% | 619 | 82% | 873 | 80% | 4,630 | 80% | 58,421 | 80% |
| Neither mechanical nor chemical | 204 | <1% | 20 | <1% | 2 | <1% | 5 | <1% | 8 | <1% | 239 | <1% |

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2.3.1.4 Untoward intra-operative events

Table 2.18 shows that untoward intra-operative events were rare, reported in less than 1% of knee procedures, an increase of 0.7% compared with 2008. Completion of the data field within the MDSv3 dataset version is mandatory, thus explaining the greater volume of information supplied.

Table 2.18 Reported untoward intra-operative events for primary knee replacement patients in 2009, according to procedure type.

| | Primary total prosthetic replacement using cement | Primary total prosthetic replacement not using cement | Primary total prosthetic replacement not classified elsewhere (e.g. hybrid) | Patello-femoral replacement | Unicondylar knee replacement | Total |
|-------------------------|---------------------------------------------------|-------------------------------------------------------|-----------------------------------------------------------------------------|-----------------------------|------------------------------|---------------|
| | No. | No. | No. | No. | No. | No. |
| Total | 60,882 | 4,445 | 759 | 1,094 | 5,800 | 72,980 |
| Not selected | 636 | 281 | 4 | 0 | 71 | 992 |
| None | 59,806 | 4,152 | 747 | 1,092 | 5,711 | 71,508 |
| Total specified | 440 | 12 | 8 | 2 | 18 | 480 |
| Fracture | 89 | 2 | 1 | 0 | 9 | 101 |
| Patella tendon avulsion | 25 | 3 | 1 | 0 | 2 | 31 |
| Ligament injury | 40 | 1 | 0 | 0 | 0 | 41 |
| Other | 286 | 6 | 6 | 2 | 7 | 307 |

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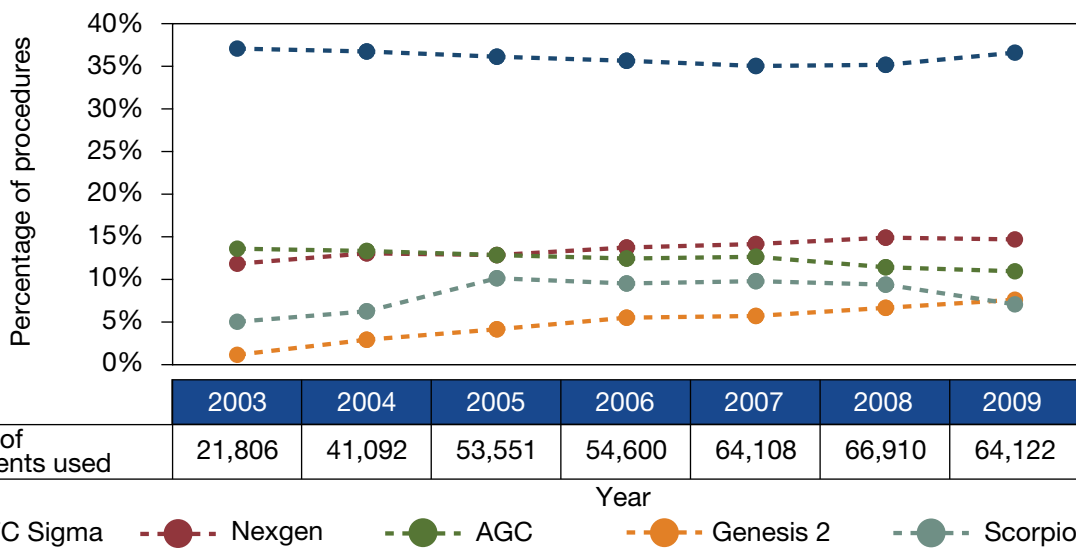
2.3.1.5 Knee primary components

Figure 2.20 shows the leading brands of total condylar knees in England and Wales. The PFC Sigma knee,

marketed by DePuy, continues to dominate the market. The other brand appearing to be increasing in popularity is the Genesis 2 knee, marketed by Smith and Nephew.

Figure 2.20

Top five total condylar knee brands, usage trends 2003 to 2009.



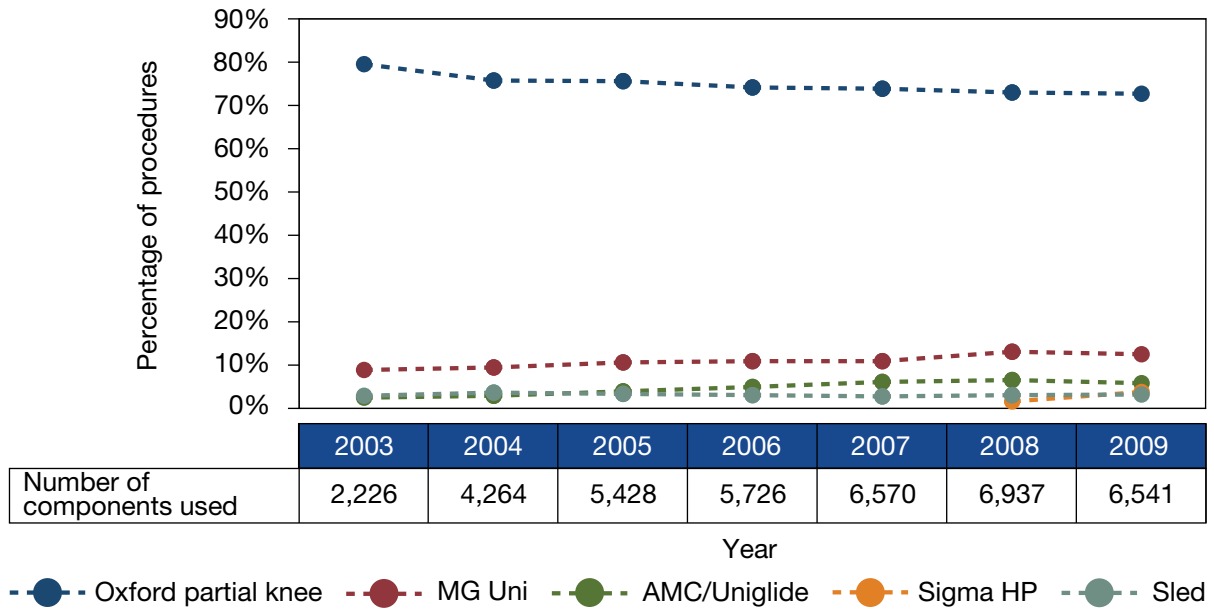
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Likewise, the market for unicondylar knees is dominated by one product, the Oxford Partial Knee

(Figure 2.21). The relative market shares of all available brands are largely unchanged.

Figure 2.21

Top five unicondylar knee brands, usage trends 2003 to 2009.



The brand sales for patello-femoral prostheses are shown in Figure 2.22 and the equivalent graph for

highly constrained and hinged revision knees is shown in Figure 2.23.

Figure 2.22

Top five patello-femoral knee brands, usage trends 2003 to 2009.

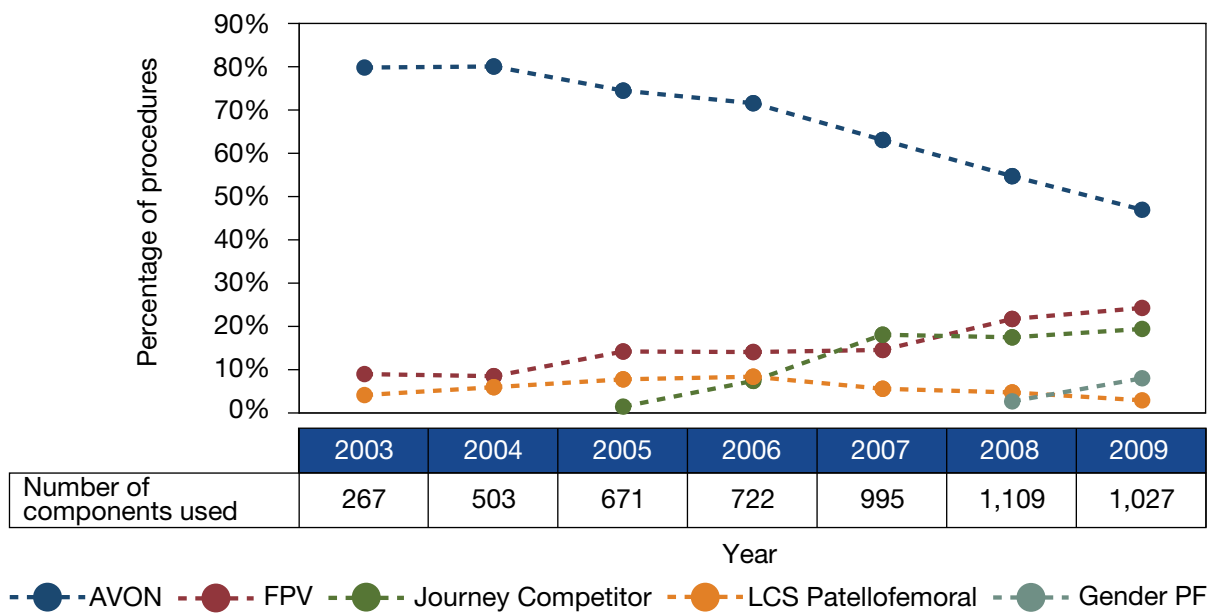
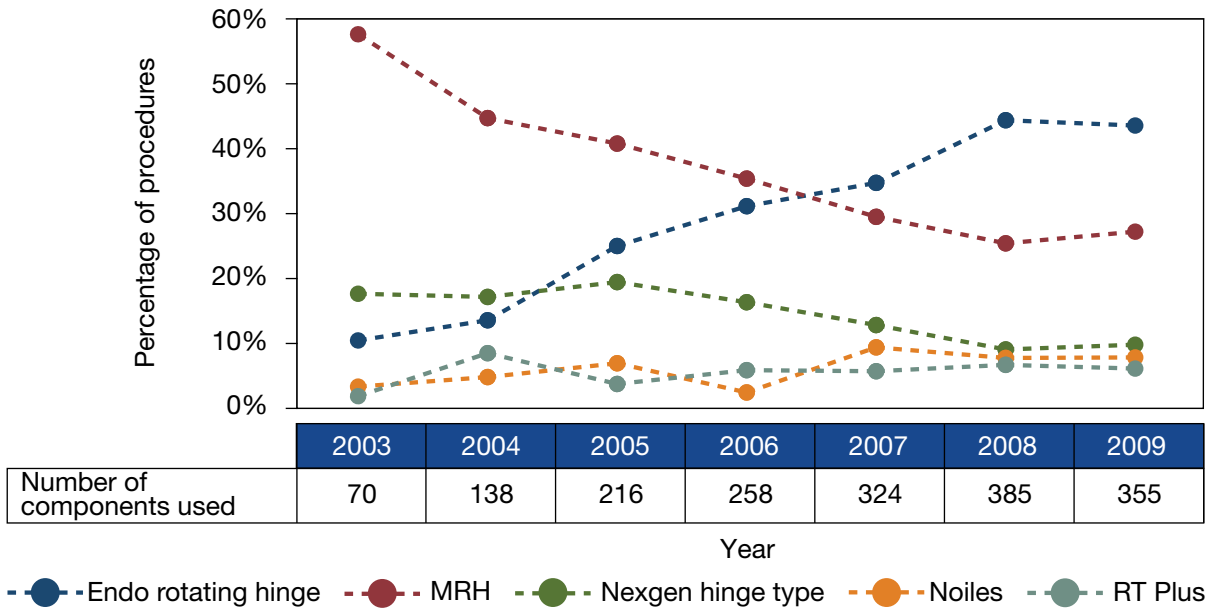


Figure 2.23

Top five fixed hinged knee brands, usage trends 2003 to 2009.



2.3.2 Knee revision procedures, 2009

A total of 4,565 knee revision procedures were reported, an increase of 12% on 2008. Of these, 3,355 (75%) were single stage revision procedures, 538 (12%) were stage one of a two stage revision and 580 (13%) were stage two of a two stage revision (Table 2.19). MDSv2 re-operations, other than revision, are not included in any of the tables below. A further 20 procedures were recorded, comprising 15 conversions of previous knee replacements to arthrodesis and five knee amputations. Compared with previous years, there has been no change in the types of revision procedures carried out.

Table 2.19 Patient characteristics for knee revision procedures in 2009, according to procedure type.

| | Knee single stage revision | | Knee stage one of two stage revision | | Knee stage two of two stage revision | | Knee conversion to arthrodesis | | Amputation | | Total | |
|---------------------------------------|----------------------------|------------|--------------------------------------|------------|--------------------------------------|------------|--------------------------------|---------------|-------------|---------------|--------------|------------|
| | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % |
| Total | 3,355 | 75% | 538 | 12% | 580 | 13% | 15 | <1% | 5 | <1% | 4,493 | |
| Number with patient data | 3,168 | | 496 | | 545 | | 12 | | 4 | | 4,225 | 94% |
| Average age | 68.90 | | 69.21 | | 70.10 | | 74.27 | | 72.58 | | 68.94 | |
| SD | 10.48 | | 10.25 | | 9.31 | | 10.01 | | 5.64 | | 10.56 | |
| Interquartile range | 62.0 - 76.6 | | 62.5 - 76.6 | | 63.6 - 76.9 | | 68.0 - 79.9 | | 72.3 - 75.5 | | 62.2 - 76.6 | |
| Gender | | | | | | | | | | | | |
| Female | 1,724 | 54% | 225 | 45% | 250 | 46% | 7 | 58% | 2 | 50% | 2,208 | 52% |
| Male | 1,444 | 46% | 271 | 55% | 295 | 54% | 5 | 42% | 2 | 50% | 2,017 | 48% |
| Patient physical status | | | | | | | | | | | | |
| P1 – fit and healthy | 330 | 10% | 43 | 8% | 41 | 7% | 0 | 0% | 0 | 0% | 414 | 9% |
| P2 – mild disease not incapacitating | 2,309 | 69% | 351 | 65% | 357 | 62% | 7 | 47% | 0 | 0% | 3,024 | 67% |
| P3 – incapacitating systemic disease | 696 | 21% | 139 | 26% | 177 | 31% | 7 | 47% | 5 | 100% | 1,024 | 23% |
| P4 – life threatening disease | 20 | 1% | 5 | 1% | 5 | 1% | 1 | 7% | 0 | 0% | 31 | 1% |
| P5 – not expected to survive 24 hours | 0 | 0% | 0 | 0% | 0 | 0% | 0 | 0% | 0 | 0% | 0 | 0% |
| BMI | | | | | | | | | | | | |
| Average | 30.98 | | 31.15 | | 30.39 | | 34.20 | | 32.60 | | 30.90 | |
| SD | 5.66 | | 5.71 | | 6.07 | | 6.02 | | 4.84 | | 5.70 | |
| Indications for surgery | | | | | | | | | | | | |
| Aseptic loosening | 1,387 | 41% | 79 | 15% | 87 | 15% | 1 | 7% | 0 | 0% | 1,554 | 35% |
| Pain | 728 | 22% | 46 | 9% | 42 | 7% | 1 | 7% | 0 | 0% | 817 | 18% |
| Lysis | 357 | 11% | 54 | 10% | 34 | 6% | 3 | 20% | 0 | 0% | 448 | 10% |
| Wear of polyethylene component | 480 | 14% | 18 | 3% | 10 | 2% | 1 | 7% | 0 | 0% | 509 | 11% |
| Instability | 612 | 18% | 20 | 4% | 32 | 6% | 0 | 0% | 0 | 0% | 664 | 15% |
| Infection | 147 | 4% | 444 | 83% | 418 | 72% | 14 | 93% | 3 | 60% | 1,026 | 23% |
| Malalignment | 303 | 9% | 11 | 2% | 12 | 2% | 0 | 0% | 0 | 0% | 326 | 7% |
| Dislocation/subluxation | 140 | 4% | 8 | 1% | 3 | 1% | 0 | 0% | 0 | 0% | 151 | 3% |
| Periprosthetic fracture | 104 | 3% | 9 | 2% | 7 | 1% | 0 | 0% | 1 | 20% | 121 | 3% |
| Stiffness | 228 | 7% | 17 | 3% | 9 | 2% | 1 | 7% | 0 | 0% | 255 | 6% |
| Implant fracture | 40 | 1% | 2 | <1% | 3 | 1% | 0 | 0% | 0 | 0% | 45 | 1% |
| Component dissociation | 72 | 2% | 4 | 1% | 5 | 1% | 0 | 0% | 0 | 0% | 81 | 2% |
| Other | 456 | 14% | 17 | 3% | 38 | 7% | 0 | 0% | 1 | 20% | 512 | 11% |
| Side | | | | | | | | | | | | |
| Bilateral | 3 | <1% | 0 | 0% | 0 | 0% | 0 | 0% | 0 | 0% | 3 | <1% |
| Left, unilateral | 1,584 | 47% | 253 | 47% | 273 | 47% | 5 | 33% | 3 | 60% | 2,118 | 47% |
| Right, unilateral | 1,768 | 53% | 285 | 53% | 307 | 53% | 10 | 67% | 2 | 40% | 2,372 | 53% |

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2.3.2.1 Patient characteristics

The mean age of knee revision patients was 68.9 years (Table 2.19). The average has decreased by 0.8 years compared with 2008. There were more female (52%) than male patients (48%), compared with 56% female and 44% male in 2004. Aseptic loosening was the most common indication for single stage revision and infection was the most common indication for two stage revision.

Compared with previous years, the patient characteristics described above have largely remained the same. However, there was a decrease in patients who are fit and healthy (ASA grade 1) and a corresponding increase in patients with incapacitating systemic disease (ASA grade 3) compared with 2008.

Part 3

Implant survivorship 2003 to 2009

3.1 Introduction



3.1.1 Summary

For the first time, NJR data could be linked to PEDW. This implies that both HES data and that from PEDW could be used to improve the follow up of the patients whose hip or knee replacement was reported to the NJR. The revision rates for primary hip and knee replacements presented in this Annual Report therefore include patients treated in England and in Wales between 1st April 2003 and 31st December 2009.

The completeness of NJR data is constantly improving. This is reflected in an increase in the percentage of NJR records that could be linked to HES or PEDW. The linkage percentage increased from 69% for 6th Annual Report of 2009 to 76% for this report.

Additional analysis using a capture-recapture approach suggests that the revision rates reported in this Annual Report may underestimate the 'true' revision rate by 10% (an improvement of 5% on 2008 – see section 1.4.7 Special Topic C).

Also for the first time, results up to five years after the primary hip and knee replacement can be reported. In another first, the results for primary hip replacement include a separate presentation of outcomes for patients who had a resurfacing metal acetabular component with a large modular head on a conventional cemented or cementless stem (i.e. a LHMoM THR).

Hip replacements

Overall, 2.9% of the patients had a revision of their hip replacement within five years. The lowest revision rates were seen in patients who received a cemented prosthesis (five year revision rate of 2.0%) and the highest in those who had a LHMoM THR (five year revision rate of 7.8%).

The type of prosthesis used depended strongly on the age and gender of the patients. Most patients who had hip resurfacing were men and younger than 65 years, while most patients receiving a cemented prosthesis were women and older than 65 years. The pattern of revision rates according to prosthesis type

varied according to age and gender. This is especially true for hip resurfacing.

Within each prosthesis type, revision rates varied according to brand, most notably among brands of hip resurfacing cups.

Knee replacements

The overall five year revision rate following primary knee replacement was 3.6%. Patients with cemented knee prostheses had the lowest five year rates (3.0%), while those with a unicondylar knee replacement (9.4%) or patello-femoral replacement (11.6%) had the highest rates.

The type of prosthesis was more strongly related to the patients' age than to their gender. The majority of patients who had a cemented prosthesis were 65 years or older, while most of those patients who had unicondylar or patello-femoral replacements were younger than 65 years.

Revision rates varied according to brand, both for prostheses used for total knee replacement and those used for unicondylar knee replacement.

3.1.2 Introduction

Part 3 of the 7th Annual Report describes the revision rates of hip and knee replacements that were entered into the NJR between 1st April 2003 and 31st December 2009.

The analysis of these outcomes is based on linkage of procedures entered into the NJR with records from HES and PEDW. These are administrative databases that contain records of NHS and privately funded admissions to NHS hospitals in England and in Wales, as well as admissions of NHS-funded patients to the independent sector. This year, PEDW data were available for the first time. The analysis of outcomes, therefore, includes patients treated in both England and Wales.

This is the fourth time that linkage between the NJR and HES has been undertaken and – as indicated above – the first time that it has been done between the NJR and PEDW for patients treated in Wales. Although the methods of linking the NJR to HES and PEDW are continuously being improved, not all hip and knee replacement procedures entered into the NJR could be linked. As a result, care should be taken in generalising the results of the analyses to all hip and knee replacement procedures in England and Wales, particularly when comparing types of provider.

The NJR provides information about the characteristics of the patient, the type and brand of prosthesis and the surgical procedure. In Part 3, revision procedures identified through linkage within the NJR as well as to HES/PEDW are presented according to patient characteristics as well as type and brand of prosthesis.

Part 3

3.2 Linkage of NJR procedures to the HES and PEDW databases

In this section, the linkage of NJR procedures to HES/PEDW records is presented. Linkage of hip and knee replacements to these databases is possible if they are reported to the NJR and if the reported records contain patient details that enable linkage to be made. Information about compliance and linkability is presented in Part 1 of this Annual Report.

3.2.1 Linkage of NJR procedures to HES and PEDW records

At the time of analysis, final data from HES and PEDW were available for hospital admissions up to 31st March 2009. Provisional HES and PEDW data for admissions from 1st April 2009 to 31st December 2009 were also available. Therefore, the procedures considered for linkage in this Annual Report were those undertaken in the NHS, or undertaken in the independent sector and funded by the NHS, between 1st April 2003 and 31st December 2009.

3.2.1.1 Linkage process

Figure 3.1 is a flowchart showing the way in which linkage was made between NJR procedures and HES and PEDW records. Such linkage was attempted using a hierarchical linkage algorithm, based on combinations of NHS number, date of birth, gender, hospital identifier and local hospital number.

This implies that in cases where an NJR procedure was linked to more than one record in HES/PEDW, the link chosen was that with the highest likelihood of being correct according to this hierarchy. The

hierarchical linkage algorithm, in descending order of likelihood to be correct, was as follows:

- linkage based on NHS number, year of birth and gender
- linkage based on local hospital, local hospital number, date of birth and gender
- linkage based on local hospital, local hospital number and date of birth
- linkage based on local hospital, date of birth and gender
- linkage based on NHS number, local hospital and local hospital number.

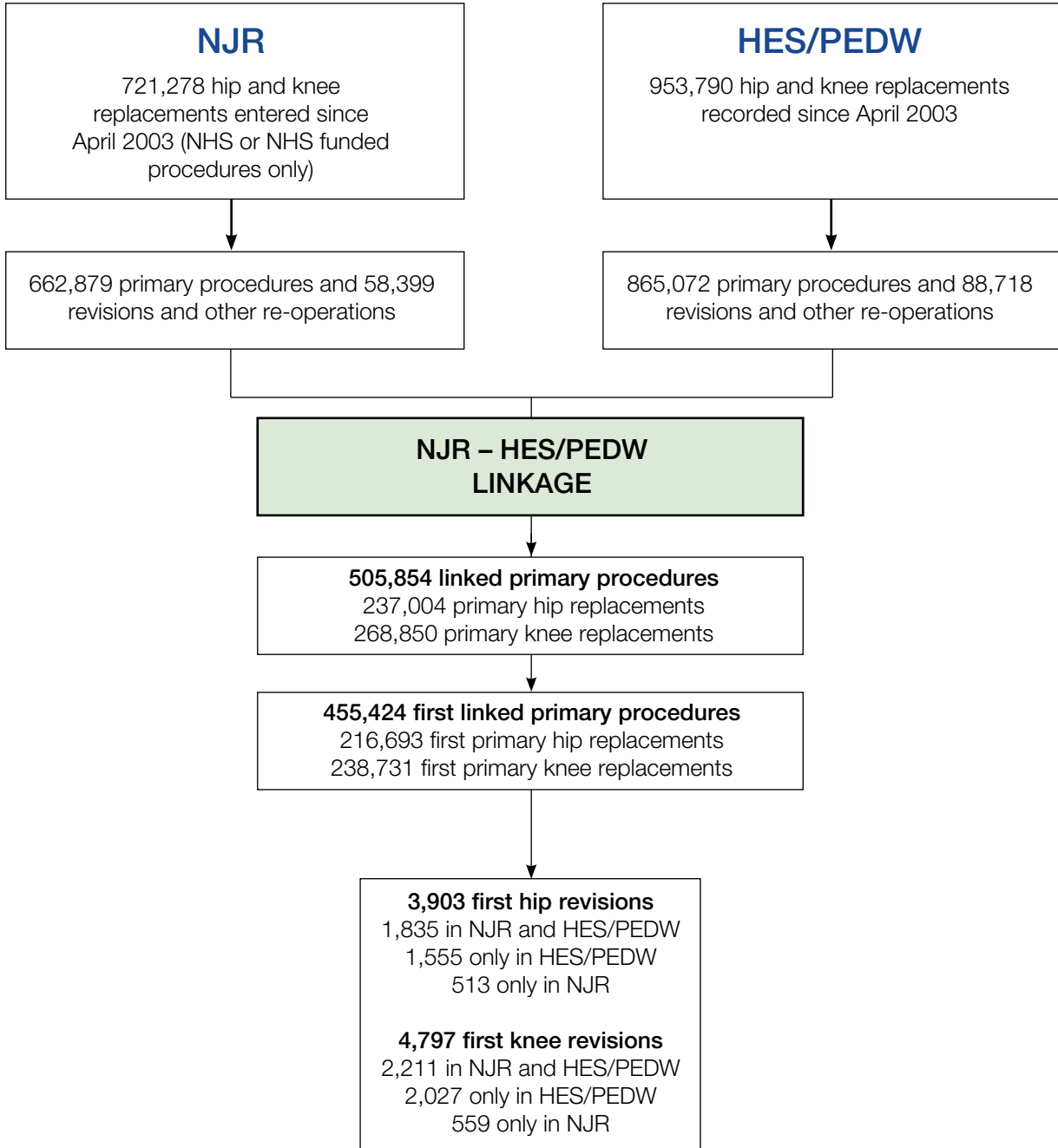
An NJR procedure was classified as being HES/PEDW-linked if:

- linkage to such a record episode was achieved
- the operation recorded in the NJR was within the episode start and end dates in HES/PEDW (the period that an admitted patient was under the care of an identified consultant)
- the OPCS procedure codes in HES/PEDW corresponded to a hip or knee procedure.

Details of the OPCS procedure codes used are available on request from the RCS CEU.

Figure 3.1

Flowchart illustrating linkage of NJR procedures to HES/PEDW records.



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3.2.1.2 Coverage of linked procedures

All analyses of revision rates include only primary hip and knee procedures for which there was an NJR-HES/PEDW linked record. Of all the 662,879 primary hip or knee replacement procedures carried out in the NHS, or which were NHS-funded in the independent sector, between 1st April 2003 and 31st December 2009 and reported to the NJR, 237,004 primary hip procedures and 268,850 primary knee procedures could be linked to HES or PEDW (Figure 3.1). This gives a linkage percentage of 76%. Of these, 216,693 were first primary hip replacements (20,311 patients had a linked NJR-HES/PEDW record of a subsequent primary hip replacement) and 238,731 were first primary knee replacements (29,412 patients had a record of a subsequent primary knee replacement).

However, the proportion of primary procedures reported to the NJR that could be linked differed between types of provider. On average, 82% of hip or knee replacement procedures undertaken at NHS hospitals or NHS treatment centres could be linked to a HES/PEDW record. Fewer procedures were linked for ISTCs (69%) and independent hospitals (42%). Therefore, the NJR-HES/PEDW linked procedures are more representative of procedures undertaken at NHS hospitals and NHS treatment centres.

There is potential for systematic differences between the characteristics of patients whose NJR procedures were HES/PEDW-linked and those whose were not. However, as demonstrated in earlier reports, differences in the patient characteristics were small.

The proportion of procedures carried out since 1st April 2003 and reported to the NJR which could be linked to a HES record has increased, from 53% in the 4th Annual Report (2007) and 69% in 6th Annual Report (2009), to 76% in this report.

3.2.2 Identification of revisions

In patients with linked NJR-HES/PEDW records of primary hip and knee replacements, revisions were identified through longitudinal linkage within the NJR, based on NHS number, and, within HES/PEDW, a unique patient identifier derived from the NHS number or patient surname, date of birth and postcode. 3,903 revisions associated with the 216,693 linked primary hip replacements were identified: 513 (13%) only

within the NJR; 1,555 (40%) only within HES/PEDW and 1,835 (47%) within both. Similarly, 4,797 revisions of 238,731 linked primary knee replacements were identified: 559 (12%) only within the NJR; 2,027 (42%) only within HES/PEDW and 2,211 (46%) within both (Figure 3.1).

3.2.2.1 Capture-recapture analysis

A capture-recapture approach was used to evaluate the completeness of the identification of revisions. This method used the results described above to estimate the number of revisions that were not found in either the NJR or in HES/PEDW. An analysis of reasons why HES/PEDW failed to identify a known NJR revision and why the NJR failed to identify a known HES/PEDW revision was also carried out.

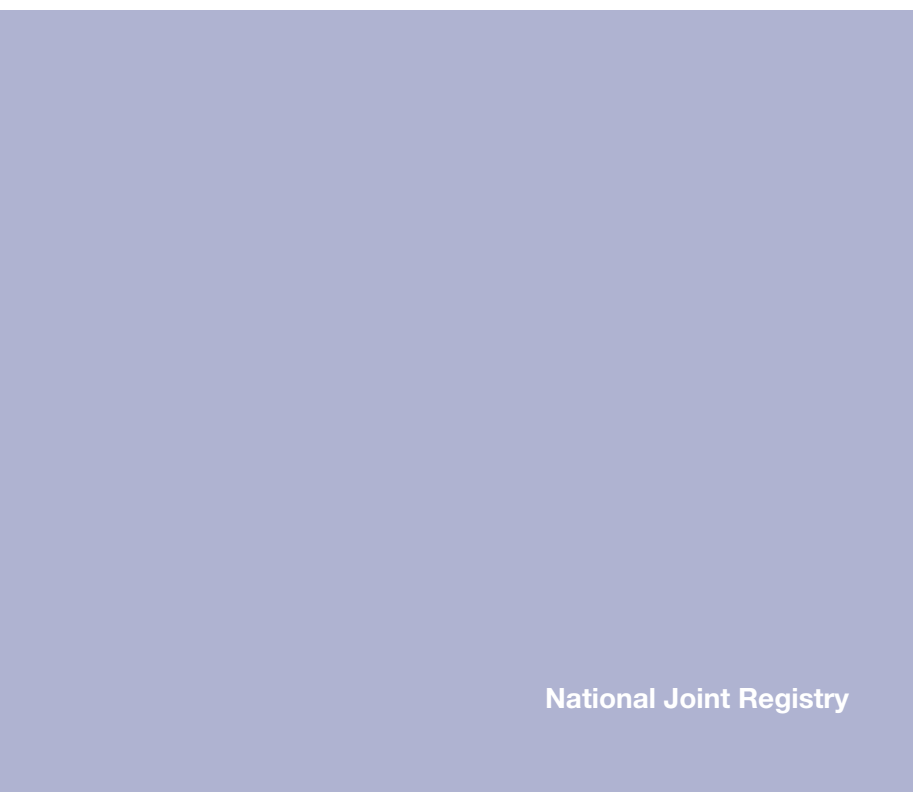
Capture-recapture analysis estimated that 435 hip revisions and 451 knee revisions had not been identified within either source. As a result, the revision rates of primary hip and knee replacements based on the NJR, HES and PEDW are likely to underestimate the 'true' revision rate by about 10%.

The reason why revisions were identified within the NJR and not within HES/PEDW were also examined. In about 50% of the hip cases and about 90% of the knee cases, this was due to coding issues. In about 43% of the hip cases and 10% of the knee cases, this was due to linkage issues. Coding issues seemed to have occurred if there was a HES/PEDW record of a matching episode but without a procedure code that represented a revision, with a revision code for another joint or with a revision code for the same joint on the other side. Linkage issues were likely if there was no HES/PEDW record of a matching episode or if the revision fell in the same episode as the primary replacement.

An examination of why revisions were identified within HES/PEDW and not within the NJR revealed that in about 20% of hip and knee cases this was due to coding issues (such as a matching NJR record, but revision not on same side; a matching NJR record, but the procedure recorded as a primary; a matching NJR record, but recorded as a re-operation other than revision). Linkage issues were the cause in about 80% of hip and knee cases (such as no matching NJR record; a matching NJR record of a revision but not linked to primary procedure).

Part 3

3.3 Hip replacement procedures



3.3.1 Outcomes following primary hip replacement, 2003 to 2009

This section presents analyses of revision rates according to prosthesis type, with special attention given to frequently used brands. The analyses are based on data for the 216,693 patients who had primary hip replacement procedures, undertaken in the NHS or NHS-funded in the independent sector, between 1st April 2003 and 31st December 2009, that were linked to an episode recorded in HES/PEDW (see Figure 3.1).

3.3.2 Revisions

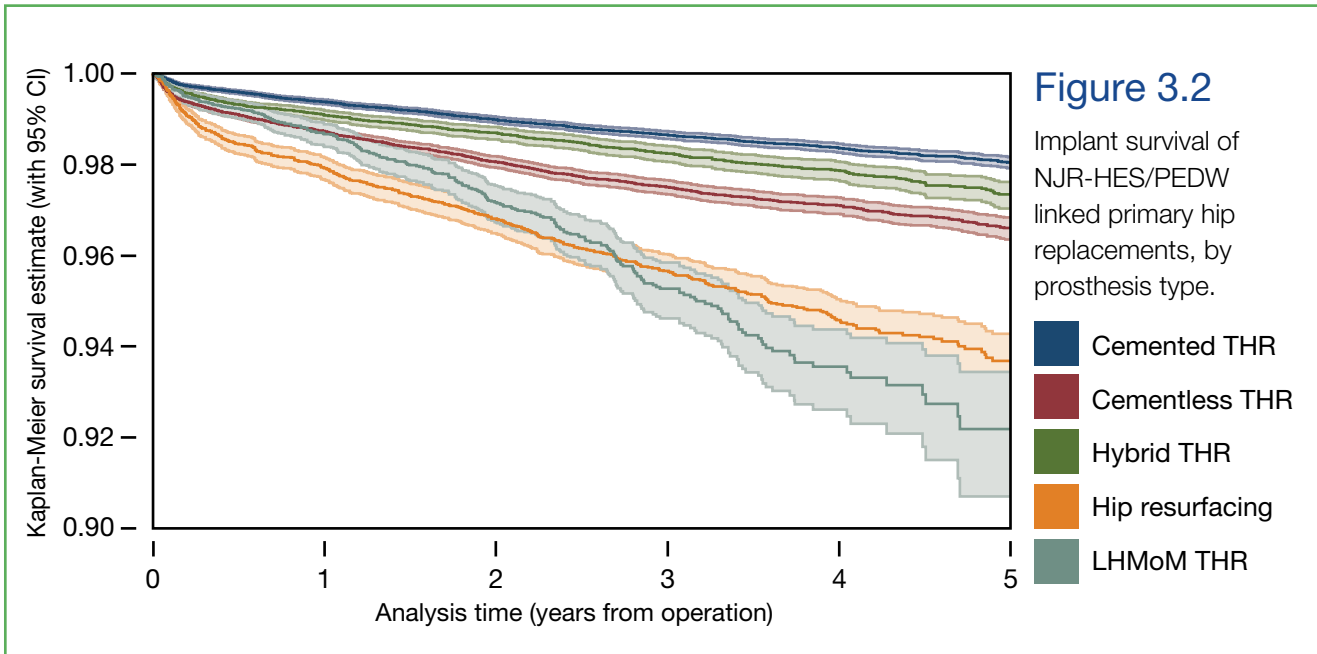
As explained previously, revisions were identified through longitudinal linkage within the NJR and within HES/PEDW data (see 3.2). If the side of the primary replacement or the revision was not recorded, the first revision that occurred after the primary procedure was assumed to be a revision of that primary. Some patients had two primary hip replacement procedures, one on each side, which occurred on different dates and were both linked to a HES record. To avoid including a patient twice in the linked database, in such cases only the earliest primary procedure was retained. Patients who underwent a bilateral procedure on the same day were entered once.

Revision rates for primary hip replacement were estimated using the Kaplan-Meier survival analysis according to prosthesis type, patient characteristics, procedure type and provider. Date of death or 31st December 2009 were considered as end of follow up. Cox regression was used to estimate risk factors for revision, adjusted for case mix differences.

3.3.2.1 Prosthesis type

The overall revision rate following primary hip replacement was 1.0% (0.9% to 1.0%; CI 95%) at one year, 2.1% (2.0% to 2.1%) at three years and 2.9% (2.8% to 3.0%) at five years. Figure 3.2 and Table 3.1 show estimates of implant survival, with 95% CI, up to five years after primary replacement, according to prosthesis type.

A breakdown of whether the primary hip replacement was carried out in England or Wales demonstrates that there was little variation. In the 203,213 patients treated in England, the revision rate at one year was 1.0%, at three years 2.0% and at five years 2.9%. In the 13,480 patients treated in Wales, the revision rate at one year was 1.1%, at three years 2.2% and at five years 3.0%.



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Table 3.1 Revision rates by prosthesis type at one, three and five years for primary hip replacement procedures, undertaken between 1st April 2003 and 31st December 2009, which were linked to a HES/PEDW episode.

| Prosthesis type | Number of patients | Revision rates (95% CI) | | |
|-----------------|--------------------|-------------------------|---------------------|---------------------|
| | | One year | Three years | Five years |
| Cemented | 99,359 | 0.6% (0.6% to 0.7%) | 1.4% (1.3% to 1.5%) | 2.0% (1.8% to 2.1%) |
| Cementless | 62,937 | 1.3% (1.2% to 1.4%) | 2.5% (2.4% to 2.7%) | 3.4% (3.2% to 3.7%) |
| Hybrid | 31,662 | 0.9% (0.8% to 1.0%) | 1.8% (1.6% to 1.9%) | 2.7% (2.4% to 3.0%) |
| Resurfacing | 13,853 | 2.1% (1.9% to 2.3%) | 4.3% (4.0% to 4.8%) | 6.3% (5.7% to 7.0%) |
| LHMoM THR | 8,882 | 1.3% (1.1% to 1.6%) | 4.7% (4.2% to 5.4%) | 7.8% (6.6% to 9.3%) |
| All | 216,693 | 1.0% (0.9% to 1.0%) | 2.1% (2.0% to 2.1%) | 2.9% (2.8% to 3.0%) |

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Revision rates varied according to type of prosthesis ($p < 0.0001$). The five year revision rate was lowest in patients who received a cemented prosthesis (2.0%; 1.8% to 2.1%) and highest after LHMoM THR (7.8%; 6.6% to 9.3%). The five year revision rate was 3.4% (3.2% to 3.7%) in patients who received a cementless prosthesis and 2.7% (2.4% to 3.0%) in patients who received a hybrid prosthesis. In patients who received a resurfacing prosthesis the five year revision rate was 6.3% (5.7% to 7.0%). Figure 3.2 demonstrates that the differences among the prosthesis types were already apparent within three years of the primary procedures.

3.3.2.2 Age and gender

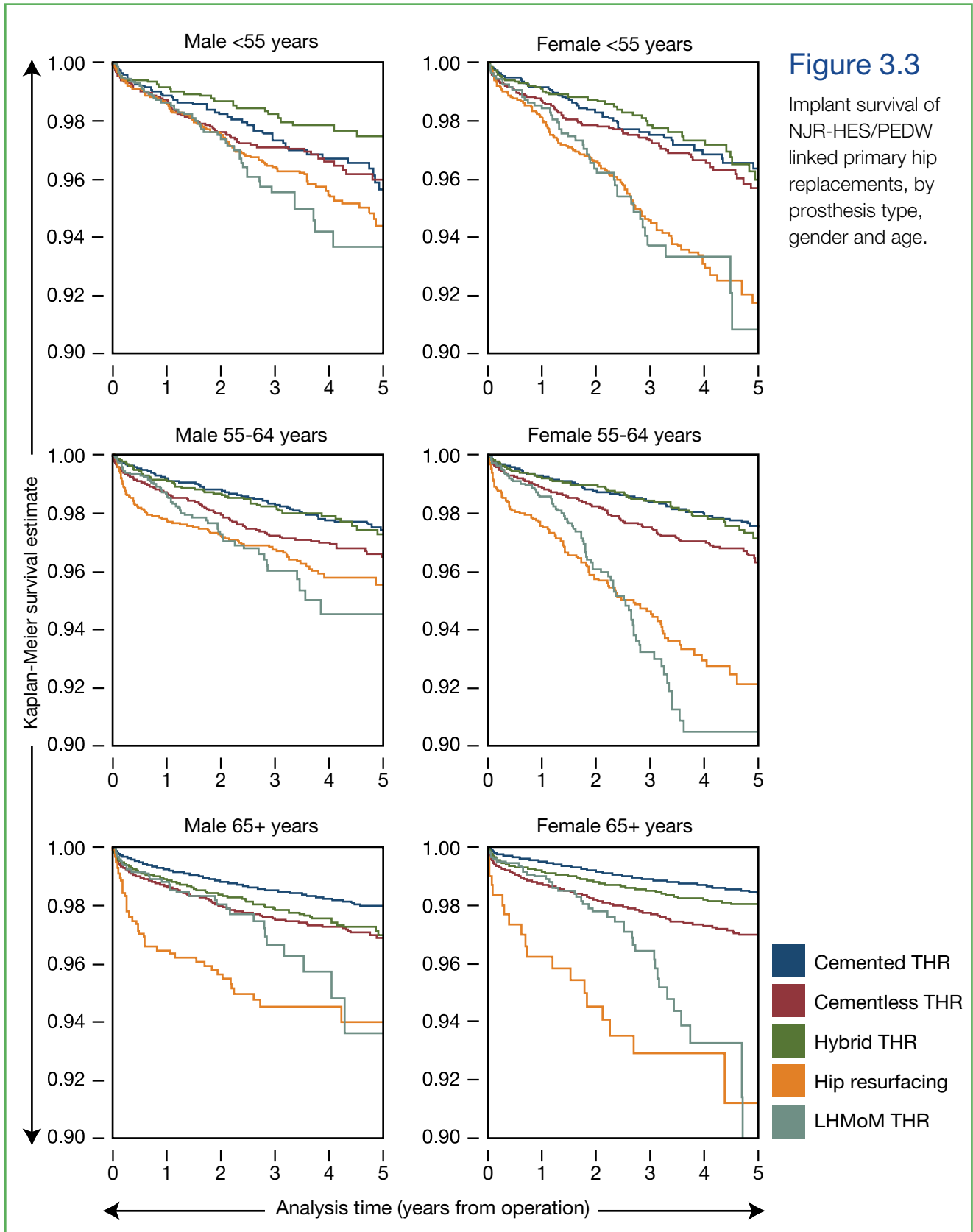
The age and gender of the patients and the type of prostheses used were strongly associated. For example, about 90% of the patients who underwent resurfacing were younger than 65 years and about two thirds were men, whereas about 80% of those who received a cemented prosthesis were 65 years or older and about two thirds were women. The influence of age and gender on revision rates following primary hip replacement is explored overleaf.

Table 3.2 Revision at three and five years for primary hip replacement procedures, undertaken between 1st April 2003 and 31st December 2009, which were linked to a HES/PEDW episode.

| Category | Number of patients | Revision rate at three years ²³ (95% CI) | Revision rate at five years ²³ (95% CI) | Hazard ratio ²⁴ (95% CI) |
|------------------------------------------------|--------------------|-----------------------------------------------------|----------------------------------------------------|-------------------------------------|
| Prosthesis type | | | | |
| Males <55 years | | | | |
| Total replacement using cement | 1,669 | 2.7% (1.9% to 3.8%) | 4.4% (3.2% to 6.0%) | 1 |
| Total replacement not using cement | 3,858 | 2.9% (2.3% to 3.6%) | 4.0% (3.1% to 5.1%) | 1.10 (0.77 to 1.57) |
| Hybrid total replacement | 1,498 | 1.8% (1.2% to 2.7%) | 2.6% (1.7% to 3.8%) | 0.68 (0.42 to 1.09) |
| Hip resurfacing | 4,215 | 3.6% (3.0% to 4.3%) | 5.6% (4.5% to 6.9%) | 1.37 (0.98 to 1.92) |
| LHMoM THR | 1,564 | 4.5% (3.3% to 6.1%) | 6.4% (4.5% to 8.9%) | 1.52 (1.01 to 2.28) |
| Males 55 - 64 years | | | | |
| Total replacement using cement | 5,560 | 1.7% (1.3% to 2.1%) | 2.6% (2.1% to 3.2%) | 1 |
| Total replacement not using cement | 8,035 | 2.8% (2.3% to 3.2%) | 3.5% (2.9% to 4.2%) | 1.56 (1.22 to 2.01) |
| Hybrid total replacement | 2,990 | 1.8% (1.3% to 2.4%) | 2.7% (2.0% to 3.7%) | 1.09 (0.78 to 1.52) |
| Hip resurfacing | 3,852 | 3.3% (2.7% to 3.9%) | 4.5% (3.6% to 5.6%) | 2.14 (1.63 to 2.80) |
| LHMoM THR | 1,857 | 4.0% (2.9% to 5.4%) | 5.5% (3.9% to 7.8%) | 2.19 (1.56 to 3.07) |
| Males 65+ years | | | | |
| Total replacement using cement | 27,694 | 1.5% (1.3% to 1.7%) | 2.0% (1.8% to 2.3%) | 1 |
| Total replacement not using cement | 14,499 | 2.5% (2.2% to 2.8%) | 3.1% (2.7% to 3.6%) | 1.73 (1.48 to 2.02) |
| Hybrid total replacement | 7,748 | 2.2% (1.9% to 2.6%) | 3.0% (2.4% to 3.7%) | 1.48 (1.22 to 1.80) |
| Hip resurfacing | 980 | 5.4% (4.1% to 7.3%) | 6.0% (4.4% to 8.2%) | 3.85 (2.83 to 5.23) |
| LHMoM THR | 1,444 | 3.4% (2.2% to 5.1%) | 6.4% (3.7% to 11.0%) | 2.21 (1.55 to 3.16) |
| Females <55 | | | | |
| Total replacement using cement | 2,174 | 2.5% (1.8% to 3.4%) | 3.6% (2.7% to 4.8%) | 1 |
| Total replacement not using cement | 5,082 | 2.7% (2.2% to 3.3%) | 4.3% (3.4% to 5.5%) | 1.22 (0.89 to 1.71) |
| Hybrid total replacement | 1,840 | 2.2% (1.5% to 3.1%) | 4.0% (2.8% to 5.8%) | 0.97 (0.64 to 1.48) |
| Hip resurfacing | 2,647 | 5.4% (4.5% to 6.5%) | 8.3% (6.8% to 10%) | 2.32 (1.67 to 3.21) |
| LHMoM THR | 1,037 | 6.3% (4.6% to 8.6%) | 9.2% (5.9% to 14.1%) | 2.22 (1.48 to 3.32) |
| Females 55-64 | | | | |
| Total replacement using cement | 8,239 | 1.6% (1.3% to 2.0%) | 2.5% (2.1% to 3.0%) | 1 |
| Total replacement not using cement | 10,735 | 2.5% (2.2% to 2.9%) | 3.7% (3.1% to 4.4%) | 1.54 (1.24 to 1.91) |
| Hybrid total replacement | 4,474 | 1.6% (1.2% to 2.1%) | 2.9% (2.2% to 3.8%) | 1.06 (0.79 to 1.43) |
| Hip resurfacing | 1,854 | 5.4% (4.4% to 6.6%) | 7.9% (6.3% to 9.8%) | 3.61 (2.78 to 4.68) |
| LHMoM THR | 1,526 | 6.7% (5.2% to 8.7%) | 9.5% (7.4% to 12.3%) | 3.73 (2.80 to 4.96) |
| Females 65+ | | | | |
| Total replacement using cement | 54,023 | 1.1% (1.0% to 1.2%) | 1.6% (1.5% to 1.8%) | 1 |
| Total replacement not using cement | 20,728 | 2.3% (2.0% to 2.5%) | 3.0% (2.7% to 3.4%) | 2.21 (1.94 to 2.53) |
| Hybrid total replacement | 13,112 | 1.5% (1.3% to 1.8%) | 2.0% (1.6% to 2.4%) | 1.43 (1.20 to 2.53) |
| Hip resurfacing | 305 | 7.1% (4.5% to 11.1%) | 8.8% (5.2% to 14.7%) | 6.59 (4.17 to 10.41) |
| LHMoM THR | 1,454 | 3.6% (2.5% to 5.2%) | 10.5% (6.1% to 17.8%) | 3.65 (2.67 to 5.00) |
| Patient physical status | | | | |
| P1 – fit and healthy | 37,244 | 2.3% (2.2% to 2.5%) | 3.4% (3.1% to 3.7%) | 1 |
| P2 – mild disease not incapacitating | 138,701 | 1.9% (1.9% to 2.0%) | 2.8% (2.6% to 2.9%) | 1.06 (0.98 to 1.16) |
| P3+ – incapacitating systemic disease or worse | 40,748 | 2.1% (2.0% to 2.3%) | 2.8% (2.6% to 3.1%) | 1.29 (1.16 to 1.43) |
| Type of provider | | | | |
| NHS hospital | 180,937 | 2.1% (2.0% to 2.2%) | 2.9% (2.8% to 3.0%) | 1 |
| NHS treatment centre | 13,554 | 1.8% (1.5% to 2.1%) | 2.9% (2.4% to 3.4%) | 0.83 (0.73 to 0.96) |
| Independent hospital | 13,378 | 2.0% (1.7% to 2.4%) | 2.6% (2.2% to 3.1%) | 0.85 (0.73 to 1.00) |
| ISTC | 8,824 | 2.3% (1.8% to 2.8%) | 2.9% (2.2% to 3.9%) | 1.09 (0.91 to 1.31) |

²³ Calculated using the Kaplan-Meier survival analysis method.

²⁴ Relative hazard of revision within five years of primary hip replacement, compared with a patient with a reference level of the factor (hazard ratio=1), adjusted for all other factors included in the analyses.



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In men younger than 55 years, the five year revision rates were lowest in those who had a hybrid prosthesis (2.6%) and highest in those with hip resurfacing (5.6%) and with a LHMOM THR (6.4%). In women younger than 55 years, the lowest five year rates were seen in those who had a cemented prosthesis (3.6%) and the highest in those with resurfacing (8.3%) and a LHMOM THR (9.2%).

In men aged 55 to 64 years, the lowest five year revision rates were seen in patients with a cemented prosthesis (2.6%) or a hybrid prosthesis (2.7%) and the highest after resurfacing (4.5%) and a LHMOM THR (5.5%). In women aged 55-64 years, five year revision rates were lowest in those with a cemented prosthesis (2.5%) and highest in those with resurfacing (7.9%) and a LHMOM THR (9.5%).

In men of 65 years and above, the five year revision rates were lowest in those who had a cemented prosthesis (2.0%) and highest in those who had a resurfacing prosthesis (6.0%) or a LHMOM THR (6.4%). In women in the corresponding age group, the lowest five year revision rate was 1.6% with a cemented prosthesis and the highest 8.8% with resurfacing and 10.5% with a LHMOM THR.

These results demonstrate that the impact of prosthesis type depends on the age and gender of the patients. For example, Table 3.2 demonstrates that the hazard ratios for hip resurfacing are higher in older patients than in younger ones and also higher in women than in men.

3.3.2.3 Revision rates for the most frequently used implant brands

Tables 3.3, 3.4 and 3.5 show revision rates for the cemented and cementless stems and cemented, cementless and resurfacing cups that were most frequently used according to the NJR and of which at least 1,000 were entered. The five year revision rates for the cemented stems varied between 1.3% and 3.3% (p value adjusted for age, gender, physical status and type of provider <0.0001). For cementless stems, the five year revision rates varied between 2.8% and 5.9% according to brand (adjusted p value = 0.02).

Table 3.3 Revision rates according to stem brands for primary hip replacement procedures, undertaken between 1st April 2003 and 31st December 2009, which were linked to a HES/PEDW episode.

| Brand | Number of patients | Revision rate at three years ²³ (95% CI) | Revision rate at five years ²³ (95% CI) |
|-------------------------|--------------------|-----------------------------------------------------|----------------------------------------------------|
| Cemented stems | | | |
| Exeter V40 | 67,015 | 1.3% (1.2% to 1.4%) | 1.9% (1.7% to 2.0%) |
| Charnley | 13,565 | 1.3% (1.1% to 1.5%) | 2.1% (1.8% to 2.4%) |
| CPT | 10,226 | 1.8% (1.5% to 2.1%) | 2.5% (2.1% to 3.0%) |
| C-stem | 8,372 | 1.3% (1.1% to 1.6%) | 1.6% (1.3% to 1.9%) |
| Stanmore modular | 2,938 | 1.0% (0.6% to 1.6%) | 1.4% (0.9% to 2.3%) |
| C-stem AMT | 2,260 | 1.0% (0.6% to 1.7%) | N/A |
| CPS Plus | 1,474 | 1.4% (0.8% to 2.3%) | 2.3% (1.2% to 4.3%) |
| Muller-Biomet | 1,469 | 2.4% (1.5% to 3.5%) | 3.3% (1.8% to 6.0%) |
| MS-30 | 1,425 | 0.9% (0.4% to 1.7%) | 1.3% (0.6% to 2.6%) |
| SP II | 1,271 | 2.4% (1.7% to 3.5%) | 2.9% (2.0% to 4.1%) |
| Elite Plus | 1,188 | 1.2% (0.7% to 2.0%) | 1.8% (1.1% to 2.8%) |
| Muller STR | 1,177 | 1.4% (0.9% to 2.4%) | 2.6% (1.6% to 4.3%) |
| Omnifit | 1,078 | 1.5% (0.9% to 2.5%) | 3.0% (1.9% to 4.7%) |
| All | 113,458 | 1.3% (1.3% to 1.4%) | 2.0% (1.9% to 2.1%) |
| Cementless stems | | | |
| Corail | 30,093 | 2.6% (2.4% to 2.9%) | 3.8% (3.3% to 4.3%) |
| Furlong HAC | 13,977 | 2.5% (2.2% to 2.8%) | 3.1% (2.7% to 3.5%) |
| Accolade | 4,184 | 2.5% (1.8% to 3.4%) | 2.8% (2.0% to 4.0%) |
| SL-plus | 4,161 | 3.3% (2.7% to 4.0%) | 4.4% (3.6% to 5.5%) |
| Taperloc | 3,689 | 2.3% (1.8% to 3.1%) | 3.4% (2.1% to 5.6%) |
| CLS | 2,332 | 3.1% (2.3% to 4.1%) | 5.9% (3.8% to 9.0%) |
| Synergy | 2,156 | 2.1% (1.5% to 3.0%) | 3.7% (2.2% to 6.1%) |
| Bimetric | 1,834 | 2.8% (2.0% to 3.8%) | 3.4% (2.5% to 4.6%) |
| ABG II | 1,565 | 2.9% (2.1% to 3.9%) | 3.8% (2.8% to 5.0%) |
| Versys | 1,064 | 3.5% (2.5% to 5.0%) | 4.8% (3.4% to 6.8%) |
| S-ROM | 1,018 | 4.0% (2.8% to 5.7%) | 5.5% (4.0% to 7.7%) |
| Profemur | 1,004 | 3.1% (2.0% to 4.6%) | 3.1% (2.0% to 4.6%) |
| All | 67,077 | 2.6% (2.5% to 2.8%) | 3.6% (2.4% to 3.8%) |

Table 3.4 Revision rates according to cup brands for primary hip replacement procedures, undertaken between 1st April 2003 and 31st December 2009, which were linked to a HES/PEDW episode.

| Brand | Number of patients | Revision rate at three years ²³ (95%CI) | Revision rate at five years ²³ (95% CI) |
|------------------------|--------------------|----------------------------------------------------|----------------------------------------------------|
| Cemented cups | | | |
| Contemporary | 23,320 | 1.2% (1.0% to 1.4%) | 1.9% (1.6% to 2.3%) |
| Elite Plus Ogee | 13,730 | 1.0% (0.8% to 1.2%) | 1.3% (1.0% to 1.5%) |
| Charnley | 7,709 | 1.2% (1.0% to 1.5%) | 2.1% (1.7% to 2.5%) |
| Exeter Duration | 7,519 | 1.6% (1.3% to 1.9%) | 2.2% (1.8% to 2.8%) |
| Charnley Ogee | 7,254 | 1.5% (1.3% to 1.9%) | 2.2% (1.8% to 2.6%) |
| Elite Plus | 6,466 | 0.9% (0.7% to 1.3%) | 1.3% (0.9% to 1.7%) |
| Opera | 4,758 | 1.1% (0.8% to 1.5%) | 1.5% (1.1% to 2.2%) |
| ZCA | 4,553 | 1.6% (1.2% to 2.1%) | 2.4% (1.8% to 3.1%) |
| Low Profile Muller | 2,316 | 0.7% (0.4% to 1.3%) | 1.2% (0.6% to 2.2%) |
| Cenator | 1,896 | 2.0% (1.4% to 2.9%) | 2.8% (2.0% to 3.9%) |
| Ultima | 1,567 | 1.8% (1.2% to 2.7%) | 2.5% (1.6% to 3.7%) |
| Stanmore-Arcom | 1,554 | 0.9% (0.5% to 1.7%) | 1.4% (0.7% to 2.5%) |
| Wroblewski Golf Ball | 1,405 | 0.7% (0.3% to 1.3%) | 0.9% (0.4% to 1.8%) |
| Apollo | 1,346 | 2.8% (1.9% to 4.0%) | 3.7% (2.1% to 6.4%) |
| Furlong | 1,066 | 1.1% (0.6% to 2.0%) | 1.1% (0.6% to 2.0%) |
| All | 86,459 | 1.3% (1.2% to 1.4%) | 1.8% (1.7% to 2.0%) |
| Cementless cups | | | |
| Pinnacle | 24,581 | 2.2% (1.9% to 2.4%) | 2.9% (2.4% to 3.5%) |
| Trident | 16,079 | 1.7% (1.5% to 2.0%) | 2.4% (2.1% to 3.1%) |
| Trilogy | 11,652 | 2.0% (1.8% to 2.3%) | 2.5% (2.1% to 2.9%) |
| CSF | 10,399 | 2.6% (2.3% to 2.9%) | 3.2% (2.8% to 3.6%) |
| Duraloc | 4,911 | 2.4% (2.0% to 2.9%) | 3.2% (2.7% to 3.9%) |
| EPF-Plus | 3,734 | 3.1% (2.5% to 3.8%) | 4.7% (3.6% to 6.1%) |
| Exceed | 3,396 | 1.8% (1.3% to 2.4%) | 3.3% (1.7% to 6.2%) |
| CSF-Plus | 2,957 | 2.3% (1.3% to 4.2%) | N/A |
| Reflection | 2,730 | 1.2% (0.8% to 1.7%) | 2.5% (1.7% to 3.7%) |
| ABG II | 2,064 | 1.8% (1.3% to 2.5%) | 2.6% (1.9% to 3.5%) |
| Allofit | 1,703 | 2.3% (1.5% to 3.4%) | 3.6% (2.0% to 6.3%) |
| Plasmacup | 1,296 | 2.6% (1.8% to 3.8%) | 3.3% (2.2% to 4.8%) |
| All | 85,502 | 2.1% (2.0% to 2.3%) | 2.9% (2.7% to 3.1%) |

Table 3.5 Revision rates according to resurfacing cup brands for primary hip resurfacing procedures, undertaken between 1st April 2003 and 31st December 2009, which were linked to a HES/PEDW episode.

| Brand | Number of patients | Revision rate at three years ²³ (95%CI) | Revision rate at five years ²³ (95% CI) |
|--------------------|--------------------|----------------------------------------------------|----------------------------------------------------|
| Resurfacing | | | |
| BHR | 8,213 | 3.2% (2.8% to 3.6%) | 4.3% (3.8% to 4.9%) |
| Cormet 2000 | 2,036 | 6.1% (5.0% to 7.4%) | 10.0% (8.2% to 12.1%) |
| ASR | 1,599 | 6.9% (5.7% to 8.5%) | 12.0% (9.3% to 15.4%) |
| Adept | 1,197 | 4.1% (2.8% to 5.8%) | 5.0% (3.1% to 8.0%) |
| All | 13,045 | 4.2% (3.8% to 4.6%) | 6.0% (5.5% to 6.6%) |

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The five year revision rates for cemented cups varied from 0.9% to 3.7% (adjusted p value <0.0001). The corresponding rates for cementless cups varied from 2.4% to 4.7% (adjusted p value = 0.0001).

Four hip resurfacing cup brands were entered at least 1,000 times (Table 3.5). The five year revision rate varied from 4.3% to 12.0% (adjusted p value < 0.0001).

3.3.3 Mortality

The overall mortality rate after primary hip replacement was 0.6% at 90 days and 9.9% at five years. There was no difference in 90 day mortality between those patients treated in England (0.6%) and those treated in Wales (0.6%). There was a small difference in the five year mortality of patients treated in England (10.0%) and in Wales (8.8%). Table 3.6 shows the results of a multivariable analysis of mortality in the first 90 days and Table 3.7 the corresponding results for mortality in the first five years. According to these analyses, mortality at 90 days as well as at five years is higher in older people, in men and in those with a poorer physical status, with adjustment for all factors included in the tables.

As demonstrated in earlier reports, even with multivariable adjustment tables mortality is lower in patients who underwent hip resurfacing than in those who received another type of prosthesis. Similarly, patients treated in a treatment centre or in an independent hospital had a lower mortality than those treated in an NHS hospital. A likely explanation for these observations is residual confounding (e.g. differences between the groups that are not, or only partially, represented in the multivariable analysis).

Table 3.6 Mortality within 90 days for patients who received a primary hip replacement between 1st April 2003 and 31st December 2009, which were linked to a HES/PEDW episode.

| Category | Number of patients | Mortality rates ^{23,25} (95% CI) | Hazard ratio ²⁴ (95% CI) |
|------------------------------------------------|--------------------|-------------------------------------------|-------------------------------------|
| Age | | | |
| <55 years | 25,584 | 0.20% (0.15% to 0.27%) | 1 |
| 55 - 64 years | 49,122 | 0.20% (0.17% to 0.25%) | 0.85 (0.60 to 1.20) |
| 65 - 74 years | 77,181 | 0.39% (0.35% to 0.44%) | 1.35 (0.99 to 1.85) |
| 75+ | 64,806 | 1.29% (1.21% to 1.38%) | 3.89 (2.87 to 5.29) |
| Gender | | | |
| Male | 87,463 | 0.66% (0.61% to 0.72%) | 1 |
| Female | 129,230 | 0.56% (0.52% to 0.60%) | 0.70 (0.63 to 0.78) |
| Patient physical status | | | |
| P1 – fit and healthy | 37,244 | 0.18% (0.15% to 0.24%) | 1 |
| P2 – mild disease not incapacitating | 138,701 | 0.43% (0.40% to 0.47%) | 1.60 (1.24 to 2.06) |
| P3+ – incapacitating systemic disease or worse | 40,748 | 1.54% (1.42% to 1.67%) | 4.52 (3.50 to 5.83) |
| Prosthesis type | | | |
| Total replacement using cement | 99,359 | 0.80% (0.75% to 0.86%) | 1 |
| Total replacement not using cement | 62,937 | 0.46% (0.41% to 0.52%) | 0.90 (0.78 to 1.03) |
| Hybrid total replacement | 31,662 | 0.54% (0.47% to 0.63%) | 0.87 (0.74 to 1.03) |
| Hip resurfacing | 13,853 | 0.12% (0.07% to 0.19%) | 0.46 (0.27 to 0.77) |
| LHMoM THR | 8,882 | 0.24% (0.16% to 0.37%) | 0.69 (0.44 to 1.08) |
| Type of provider | | | |
| NHS hospital | 180,937 | 0.65% (0.62% to 0.69%) | 1 |
| NHS treatment centre | 13,554 | 0.45% (0.35% to 0.57%) | 0.81 (0.63 to 1.06) |
| Independent hospital | 13,378 | 0.28% (0.21% to 0.39%) | 0.56 (0.40 to 0.78) |
| ISTC | 8,824 | 0.16% (0.10% to 0.28%) | 0.31 (0.18 to 0.52) |
| Country | | | |
| England | 203,213 | 0.60% (0.56% to 0.63%) | 1 |
| Wales | 13,480 | 0.60% (0.49% to 0.75%) | 0.94 (0.76 to 1.19) |

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²⁵ Mortality rates are given to two decimal places in this table.

Table 3.7 Mortality within five years for patients who received a primary hip replacement between 1st April 2003 and 31st December 2009, which were linked to a HES/PEDW episode.

| Category | Number of patients | Mortality rates ²³ (95% CI) | Hazard ratio ²⁴ (95% CI) |
|------------------------------------------------|--------------------|----------------------------------------|-------------------------------------|
| Age | | | |
| <55 years | 25,584 | 2.3% (2.1% to 2.6%) | 1 |
| 55 - 64 years | 49,122 | 4.1% (3.8% to 4.4%) | 1.29 (1.14 to 1.46) |
| 65 - 74 years | 77,181 | 7.7% (7.4% to 8.1%) | 2.14 (1.91 to 2.41) |
| 75+ | 64,806 | 20.2% (19.7% to 20.8%) | 5.46 (4.87 to 6.13) |
| Gender | | | |
| Male | 87,463 | 10.6% (10.3% to 11.0%) | 1 |
| Female | 129,230 | 9.5% (9.2% to 9.7%) | 0.70 (0.68 to 0.73) |
| Patient physical status | | | |
| P1 – fit and healthy | 37,244 | 4.8% (4.5% to 5.2%) | 1 |
| P2 – mild disease not incapacitating | 138,701 | 8.4% (8.1% to 8.7%) | 1.28 (1.19 to 1.38) |
| P3+ – incapacitating systemic disease or worse | 40,748 | 17.5% (17.0% to 18.0%) | 2.52 (2.34 to 2.71) |
| Prosthesis type | | | |
| Total replacement using cement | 99,359 | 12.5% (12.2% to 12.8%) | 1 |
| Total replacement not using cement | 62,937 | 7.5% (7.1% to 7.9%) | 0.90 (0.86 to 0.95) |
| Hybrid total replacement | 31,662 | 8.5% (8.0% to 9.0%) | 0.95 (0.89 to 1.00) |
| Hip resurfacing | 13,853 | 1.8% (1.5% to 2.2%) | 0.41 (0.34 to 0.49) |
| LHMoM THR | 8,882 | 5.5% (4.4% to 6.9%) | 0.89 (0.77 to 1.03) |
| Type of provider | | | |
| NHS hospital | 180,937 | 10.3% (10.1% to 10.6%) | 1 |
| NHS treatment centre | 13,554 | 8.0% (7.2% to 9.0%) | 0.85 (0.78 to 1.93) |
| Independent hospital | 13,378 | 6.4% (5.7% to 7.3%) | 0.67 (0.60 to 0.75) |
| ISTC | 8,824 | 8.7% (5.2% to 14.1%) | 0.61 (0.52 to 0.71) |
| Country | | | |
| England | 203,213 | 10.0% (9.8% to 10.2%) | 1 |
| Wales | 13,480 | 8.8% (8.0% to 9.7%) | 0.87 (0.80 to 0.95) |

3.3.4 Length of stay

The overall mean length of stay after primary hip replacement was 6.9 days. Mean length of stay was 6.8 days for patients who were treated in England and 8.6 days for patients treated in Wales.

Older patients, females and those in a poor physical condition stayed longer (Table 3.8). Length of

stay was shorter in patients who underwent a hip resurfacing than in those who received a different type of prosthesis. Length of stay of patients in treatment centres and independent hospitals was shorter than those treated in an NHS hospital, even after adjustment for age, gender, physical status, prosthesis type and country. As indicated above, there may be some differences in groups that cannot be fully accounted for in this multivariable analysis.

Table 3.8 Length of hospital stay for patients who received a primary hip replacement between 1st April 2003 and 31st December 2009, which were linked to a HES/PEDW episode.

| Category | Number of patients | Average length of stay (days) (95% CI) | Adjusted difference in average length of stay (days) (95% CI) |
|------------------------------------------------|--------------------|----------------------------------------|---------------------------------------------------------------|
| Age | | | |
| < 55 years | 25,584 | 5.4 (5.3 to 5.4) | 0 |
| 55 - 64 years | 49,122 | 5.7 (5.6 to 5.7) | 0.07 (-0.03 to 0.17) |
| 65 - 74 years | 77,181 | 6.5 (6.4 to 6.5) | 0.59 (0.49 to 0.68) |
| 75+ years | 64,806 | 9.1 (9.0 to 9.1) | 2.83 (2.73 to 2.93) |
| Gender | | | |
| Male | 87,463 | 6.4 (6.4 to 6.5) | 0 |
| Female | 129,228 | 7.3 (7.2 to 7.3) | 0.52 (0.47 to 0.58) |
| Patient physical status | | | |
| P1 – fit and healthy | 37,244 | 5.5 (5.5 to 5.6) | 0 |
| P2 – mild disease not incapacitating | 138,701 | 6.6 (6.6 to 6.6) | 0.40 (0.32 to 0.47) |
| P3+ – incapacitating systemic disease or worse | 40,748 | 9.4 (9.3 to 9.5) | 2.60 (2.51 to 2.70) |
| Prosthesis type | | | |
| Total replacement using cement | 99,359 | 7.6 (7.6 to 7.7) | 0 |
| Total replacement not using cement | 62,937 | 6.3 (6.3 to 6.4) | -0.34 (-0.41 to -0.28) |
| Hybrid total replacement | 31,662 | 7.0 (7.0 to 7.1) | -0.15 (-0.23 to -0.07) |
| Hip resurfacing | 13,853 | 5.0 (4.9 to 5.0) | -0.75 (-0.88 to -0.63) |
| LHMoM THR | 8,882 | 6.0 (5.9 to 6.2) | -0.27 (-0.42 to -0.13) |
| Type of provider | | | |
| NHS hospital | 180,937 | 7.3 (7.3 to 7.3) | 0 |
| NHS treatment centre | 13,554 | 5.8 (5.7 to 5.8) | -1.17 (-1.28 to -1.06) |
| Independent hospital | 13,378 | 4.9 (4.9 to 5.0) | -1.91 (-2.02 to -1.80) |
| ISTC | 8,824 | 4.5 (4.4 to 4.7) | -2.36 (-2.50 to -2.23) |
| Country | | | |
| England | 203,213 | 6.8 (6.8 to 6.8) | 0 |
| Wales | 13,480 | 8.6 (8.5 to 8.8) | 1.56 (1.45 to 1.67) |

Part 3

3.4 Knee replacement procedures

3.4.1 Outcomes following primary knee replacement, 2003 to 2009

This report also presents revision rates for knee replacements, according to prosthesis type and frequently used brands. The analyses include 238,731 patients who had a primary knee replacement undertaken in the NHS, or who were NHS-funded in the independent sector, between 1st April 2003 and 31st December 2009, linked to an episode in HES/PEDW.

3.4.2 Revisions

The methods that were used to identify revisions are similar to those described for primary hip replacement (see 3.3.2).

3.4.2.1 Prosthesis type

The overall revision rate following primary knee replacement was 0.7% (0.6% to 0.7%, CI 95%) at one year, 2.5% (2.5% to 2.6%) at three years and 3.6% (3.5% to 3.7%) at five years. Figure 3.4 and Table 3.9 give results according to prosthesis type.

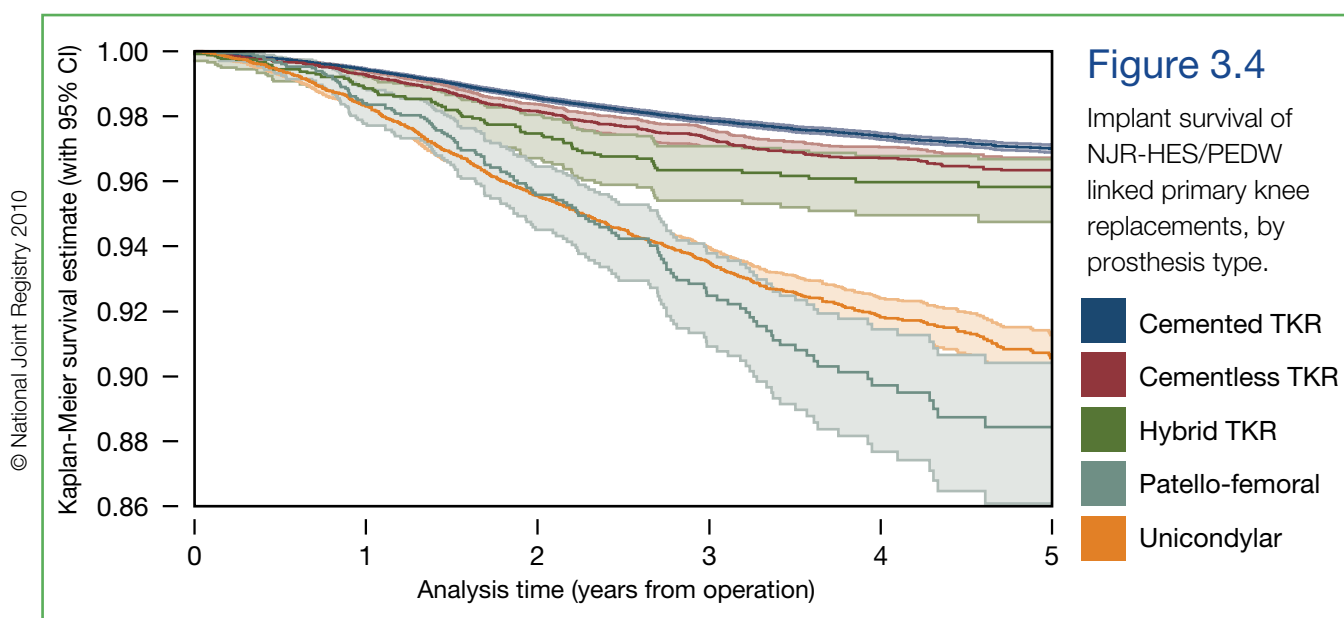


Table 3.9 Revision rates by prosthesis type at one, three and five years for primary knee replacement procedures, undertaken between 1st April 2003 and 31st December 2009, which were linked to a HES/PEDW episode.

| Prosthesis Type | Number of patients | Revision rates (95% CI) | | |
|-----------------|--------------------|----------------------------|----------------------------|----------------------------|
| | | One year | Three years | Five years |
| Cemented | 201,244 | 0.6% (0.5% to 0.6%) | 2.1% (2.1% to 2.2%) | 3.0% (2.9% to 3.1%) |
| Cementless | 15,831 | 0.7% (0.6% to 0.9%) | 2.7% (2.4% to 3.0%) | 3.7% (3.3% to 4.1%) |
| Hybrid | 2,702 | 1.2% (0.8% to 1.7%) | 3.7% (2.9% to 4.6%) | 4.2% (3.3% to 5.2%) |
| Patello-femoral | 2,561 | 1.6% (1.1% to 2.2%) | 7.5% (6.2% to 9.1%) | 11.6% (9.6% to 13.9%) |
| Unicondylar | 16,393 | 1.7% (1.5% to 1.9%) | 6.5% (6.0% to 7.0%) | 9.4% (8.7% to 10.2%) |
| All | 238,731 | 0.7% (0.6% to 0.7%) | 2.5% (2.5% to 2.6%) | 3.6% (3.5% to 3.7%) |

A breakdown of whether the primary knee replacement was carried out in England or Wales demonstrated that there were no differences. In the 223,745 patients treated in England, the revision rate was 0.7% at one year, 2.5% at three years and 3.6% at five years. The corresponding rates in the 14,986 patients treated in Wales were 0.6% at one year, 2.7% at three years and 3.2% at five years.

There were large differences between the revision rates of the prosthesis types ($p < 0.0001$). The five year revision rate was lowest in the patients who had received a cemented prosthesis (3.0%; 2.9% to 3.1%) and highest after unicondylar knee replacement (9.4%; 8.7% to 10.2%) and patello-femoral replacement (11.6%; 9.6% to 13.9%). The five year revision rates were 3.7% (3.3% to 4.1%) in patients who received a cementless prosthesis and 4.2% (3.3% to 5.2%) in those who received a hybrid.

3.4.2.2 Age and gender

The type of prosthesis was more strongly related to the patients' age than to their gender. About three quarters of patients who had a cemented prosthesis were 65 years or older, whereas only about half of those who had a unicondylar replacement fell in this age group and only one third of those who had a patello-femoral replacement.

Table 3.10 and Figure 3.5 show that the pattern of revision rates for the different prosthesis types are similar between men and women, except for the revision rates with a hybrid prosthesis for which men have higher five year revision rates (5.3%) than women (3.3%).

Younger patients have higher revision rates than those who are older. This pattern is observed across all types of prostheses (Figure 3.6).

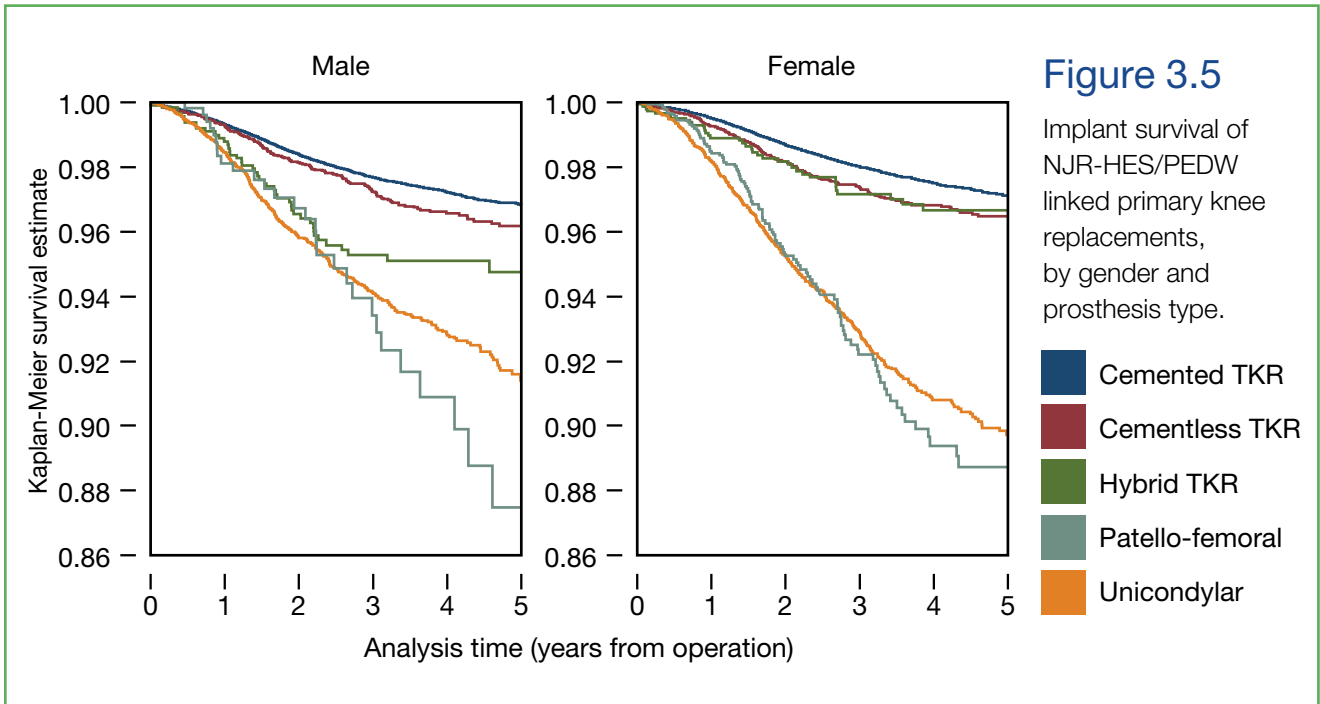
Table 3.10 Revision at three and five years for primary knee replacement procedures, undertaken between 1st April 2003 and 31st December 2009, which were linked to a HES/PEDW episode.

| Category | Number of patients | Revision rate at three years ²³ (95% CI) | Revision rate at five years ²³ (95% CI) | Hazard ratio ²⁶ (95% CI) |
|------------------------------------------------|--------------------|-----------------------------------------------------|----------------------------------------------------|-------------------------------------|
| Age | | | | |
| <55 years | 15,237 | 6.0% (5.5% to 6.5%) | 9.1% (8.4% to 10.0%) | 1 |
| 55-64 years | 55,123 | 3.7% (3.5% to 3.9%) | 5.3% (5.0% to 5.6%) | 0.68 (0.63 to 0.75) |
| 65+ years | 168,371 | 1.9% (1.8% to 2.0%) | 2.6% (2.4% to 2.7%) | 0.38 (0.35 to 0.41) |
| Patient physical status | | | | |
| P1 – fit and healthy | 31,168 | 3.0% (2.8% to 3.3%) | 4.4% (4.1% to 4.7%) | 1 |
| P2 – mild disease not incapacitating | 161,459 | 2.4% (2.4% to 2.5%) | 3.5% (3.3% to 3.6%) | 0.99 (0.92 to 1.08) |
| P3+ – incapacitating systemic disease or worse | 46,104 | 2.5% (2.3% to 2.7%) | 3.4% (3.2% to 3.6%) | 1.10 (1.00 to 1.21) |
| Prosthesis type - males | | | | |
| Total replacement using cement | 84,203 | 2.3% (2.2% to 2.5%) | 3.2% (3.0% to 3.4%) | 1 |
| Total replacement not using cement | 7,296 | 2.8% (2.3% to 3.3%) | 3.8% (3.2% to 4.5%) | 1.15 (0.98 to 1.35) |
| Hybrid total replacement | 1,199 | 4.7% (4.5% to 6.4%) | 5.3% (3.9% to 7.1%) | 1.78 (1.32 to 2.41) |
| Patello-femoral replacement | 581 | 6.6% (4.3% to 10.0%) | 12.5% (8.3% to 18.9%) | 2.33 (1.61 to 2.37) |
| Unicondylar | 8,395 | 5.9% (5.3% to 6.6%) | 8.6% (7.7% to 9.7%) | 2.20 (1.96 to 2.47) |
| Prosthesis type - females | | | | |
| Total replacement using cement | 117,041 | 2.0% (1.9% to 2.1%) | 2.9% (2.7% to 3.0%) | 1 |
| Total replacement not using cement | 8,535 | 2.6% (2.3% to 3.1%) | 3.5% (3.0% to 4.1%) | 1.25 (1.08 to 1.46) |
| Hybrid total replacement | 1,503 | 2.8% (2.0% to 4.0%) | 3.3% (2.4% to 4.7%) | 1.28 (0.91 to 1.79) |
| Patello-femoral replacement | 1,980 | 7.8% (6.3% to 9.6%) | 11.3% (9.1% to 13.8%) | 2.74 (2.24 to 3.34) |
| Unicondylar | 7,998 | 7.1% (6.5% to 7.9%) | 10.2% (9.3% to 11.4%) | 2.97 (2.67 to 3.30) |
| Type of provider²⁷ | | | | |
| NHS hospital | 195,923 | 2.6% (2.5% to 2.6%) | 3.6% (3.4% to 3.7%) | 1 |
| NHS treatment centre | 16,039 | 2.5% (2.2% to 2.8%) | 3.8% (3.3% to 4.3%) | 1.06 (0.94 to 1.18) |
| Independent hospital | 16,049 | 2.4% (2.1% to 2.8%) | 3.7% (3.2% to 4.2%) | 0.95 (0.84 to 1.08) |
| ISTC | 10,719 | 2.4% (2.0% to 3.0%) | 2.7% (2.2% to 3.4%) | 1.01 (0.85 to 1.20) |

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²⁶ Relative hazard of revision within three years of primary knee replacement, compared with a patient with a reference level of the factor (hazard ratio=1), adjusted for all other factors included in the analyses.

²⁷ Type of provider missing for one patient.



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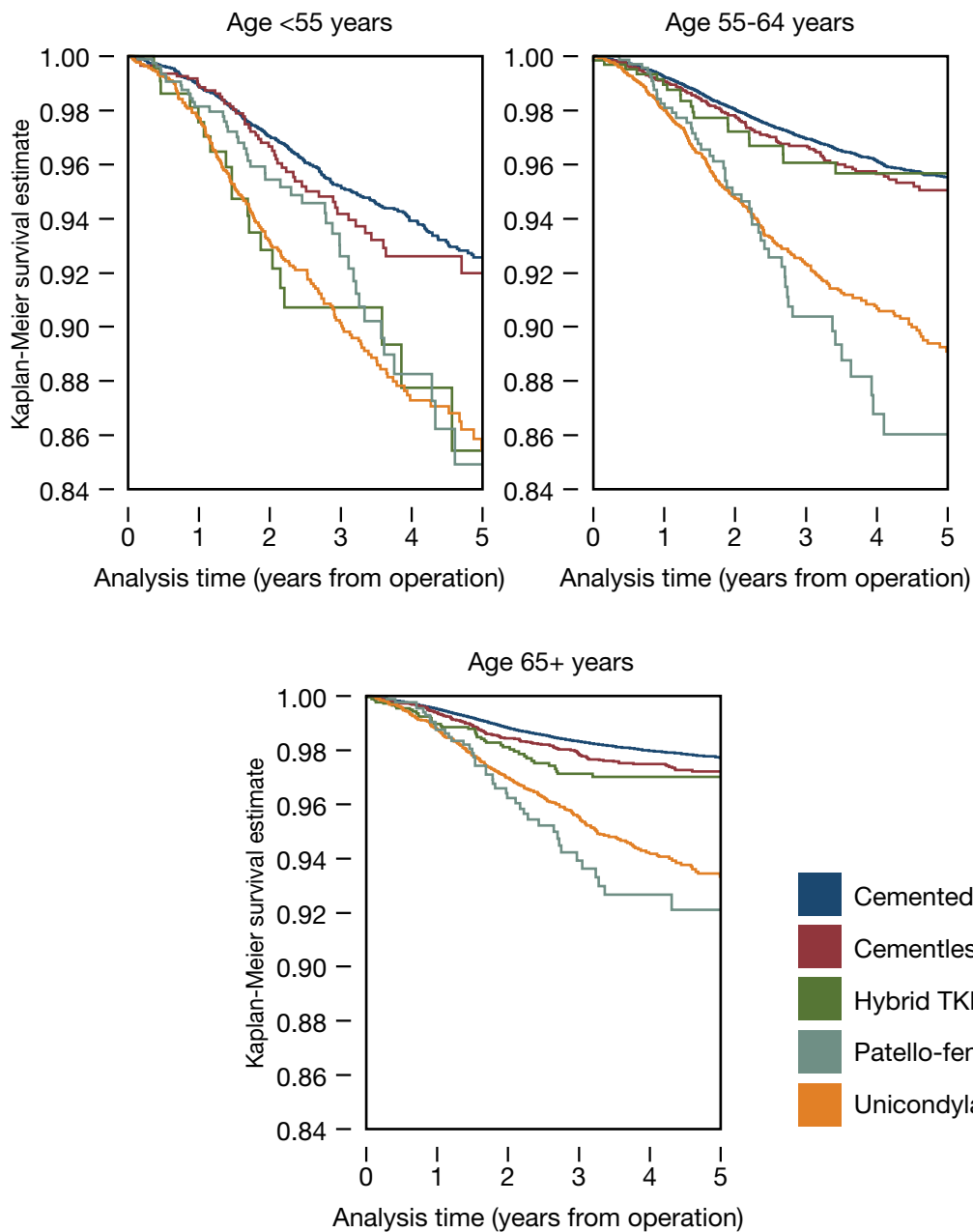


Figure 3.6

Implant survival of NJR-HES/PEDW linked primary knee replacements, by age and prosthesis type.

3.4.2.3 Revision rates for the most frequently used implant brands

Table 3.11 presents revision rates according to brands that had at least 1,000 entries on the NJR. The five year revision rates varied according to brand from 1.6% to 4.8% in patients who received a total knee replacement (p value adjusted for age, gender, physical status and type of provider < 0.0001).

Two brands of unicondylar prostheses were reported to the NJR more than 1,000 times and revision rates varied from 6.3% to 9.1% (adjusted p values = 0.004). There was one patello-femoral brand that was reported for more than 1,000 patients and its five year revision rate was 10.2%.

Table 3.11 Revision rates at three and five years according to the most frequently used brands for knee replacement procedures, undertaken between 1st April 2003 and 31st December 2009, which were linked to a HES/PEDW episode.

| Brand | Number of patients | Revision rate at three years ²³ (95%CI) | Revision rate at five years ²³ (95% CI) |
|------------------------|--------------------|----------------------------------------------------|----------------------------------------------------|
| Total knee | | | |
| PFC Sigma | 77,195 | 1.8% (1.7% to 1.9%) | 2.4% (2.2% to 2.5%) |
| Nexgen | 29,730 | 1.9% (1.5% to 2.1%) | 2.6% (2.3% to 2.9%) |
| AGC | 26,013 | 2.1% (1.9% to 2.3%) | 3.0% (2.7% to 3.3%) |
| Scorpio | 15,200 | 2.3% (2.1% to 2.6%) | 3.3% (2.9% to 3.8%) |
| Genesis 2 | 10,886 | 2.1% (1.7% to 2.5%) | 2.4% (2.0% to 2.9%) |
| Kinemax | 7,702 | 2.7% (2.4% to 3.2%) | 4.1% (3.6% to 4.7%) |
| LCS complete | 7,375 | 2.2% (1.9% to 2.8%) | 3.5% (2.8% to 4.2%) |
| Endoplus | 7,041 | 2.1% (1.7% to 2.6%) | 3.2% (2.5% to 4.2%) |
| Triathlon | 5,354 | 1.0% (0.6% to 1.6%) | Insufficient follow up |
| Profix | 3,359 | 2.5% (1.9% to 3.2%) | 2.9% (2.2% to 3.7%) |
| Advanced | 2,943 | 2.1% (1.5% to 2.8%) | 2.9% (2.1% to 4.0%) |
| MRK | 2,411 | 1.3% (0.8% to 2.2%) | 1.6% (0.9% to 2.9%) |
| Vanguard | 2,319 | 2.2% (1.4% to 3.7%) | Insufficient follow up |
| Insall – Burstein 2 | 2,227 | 2.5% (1.9% to 3.3%) | 4.1% (3.2% to 5.3%) |
| LCS | 1,687 | 2.5% (1.9% to 3.4%) | 3.5% (2.7% to 4.5%) |
| Rotaglide + | 1,497 | 3.4% (2.5% to 4.5%) | 4.8% (3.7% to 6.3%) |
| Columbus | 1,435 | 2.5% (1.6% to 4.0%) | 2.5% (1.6% to 4.0%) |
| Maxim | 1,395 | 2.7% (1.9% to 3.9%) | 3.7% (2.5% to 5.4%) |
| NK2 | 1,330 | 1.7% (1.1% to 2.8%) | 2.6% (1.6% to 4.2%) |
| All | 207,099 | 2.0% (2.0% to 2.1%) | 2.8% (2.7% to 3.0%) |
| Patello-femoral | | | |
| Avon | 1,355 | 5.8% (4.4% to 7.7%) | 10.2% (7.9% to 13.2%) |
| Unicondylar | | | |
| Oxford Partial Knee | 11,936 | 6.3% (5.7% to 6.8%) | 9.1% (8.3% to 10.0%) |
| MG Uni | 1,746 | 4.8% (3.7% to 6.3%) | 6.3% (4.6% to 8.4%) |

3.4.3 Mortality

The overall mortality rate at 90 days and five years after knee replacement was 0.4% and 9.4% respectively.

Over the whole five year period there were some differences in mortality between patients treated in England and Wales (p<0.01). The five year revision rates in England and Wales were 9.5% (9.3% to 9.7%) and 9.1% (8.2% to 10.1%) respectively. Tables 3.12 and 3.13 present the results of multivariable analysis.

With adjustment for all the factors included in this table, mortality was found to be higher in older people, in men and in those with a poorer physical status. Just as with patients who had a hip replacement, mortality varied according to prosthesis type and type of provider. Even with adjustment, the lowest mortality rates were seen in those receiving a unicondylar knee replacement. Mortality was also lower in those treated in an independent hospital or ISTC.

Table 3.12 Mortality within 90 days for patients who received a primary knee replacement between 1st April 2003 and 31st December 2009, which were linked to a HES/PEDW episode.

| Category | Number of patients | Mortality rates ^{23,25} (95% CI) | Hazard ratio ²⁶ (95% CI) |
|------------------------------------------------|--------------------|-------------------------------------------|-------------------------------------|
| Age | | | |
| < 55 years | 15,237 | 0.05% (0.02% to 0.10%) | 1 |
| 55 - 64 years | 55,123 | 0.14% (0.11% to 0.17%) | 2.52 (1.15 to 5.49) |
| 65 - 74 years | 91,009 | 0.27% (0.23% to 0.30%) | 4.80 (2.26 to 10.20) |
| 75+ | 77,362 | 0.93% (0.87% to 1.00%) | 16.1 (7.61 to 34.00) |
| Gender | | | |
| Male | 101,674 | 0.55% (0.50% to 0.60%) | 1 |
| Female | 137,057 | 0.36% (0.33% to 0.39%) | 0.59 (0.52 to 0.66) |
| Patient physical status | | | |
| P1 – fit and healthy | 31,168 | 0.24% (0.19% to 0.30%) | 1 |
| P2 – mild disease not incapacitating | 161,459 | 0.36% (0.33% to 0.39%) | 1.14 (0.89 to 1.46) |
| P3+ – incapacitating systemic disease or worse | 46,104 | 0.84% (0.76% to 0.93%) | 2.15 (1.67 to 2.78) |
| Prosthesis type | | | |
| Total replacement using cement | 201,244 | 0.47% (0.44% to 0.50%) | 1 |
| Total replacement not using cement | 15,831 | 0.48% (0.39% to 0.61%) | 1.10 (0.87 to 1.40) |
| Hybrid total replacement | 2,702 | 0.38% (0.20% to 0.70%) | 0.79 (0.41 to 1.52) |
| Patello-femoral | 2,561 | 0.24% (0.11% to 0.53%) | 1.05 (0.47 to 2.35) |
| Unicondylar | 16,393 | 0.11% (0.07% to 0.17%) | 0.36 (0.22 to 0.58) |
| Type of provider | | | |
| NHS hospital | 195,923 | 0.47% (0.44% to 0.50%) | 1 |
| NHS treatment centre | 16,039 | 0.53% (0.43% to 0.66%) | 1.2 (0.96 to 1.51) |
| Independent hospital | 16,049 | 0.20% (0.14% to 0.29%) | 0.51 (0.36 to 0.72) |
| ISTC | 10,719 | 0.15% (0.09% to 0.25%) | 0.37 (0.23 to 0.61) |
| Country | | | |
| England | 223,745 | 0.44% (0.41% to 0.47%) | 1 |
| Wales | 14,986 | 0.42% (0.05% to 0.53%) | 0.89 (0.69 to 1.16) |

Table 3.13 Mortality within five years for patients who received a primary knee replacement between 1st April 2003 and 31st December 2009, which were linked to a HES/PEDW episode.

| Category | Number of patients | Mortality rates ²³ (95% CI) | Hazard ratio ²⁶ (95% CI) |
|------------------------------------------------|--------------------|----------------------------------------|-------------------------------------|
| Age | | | |
| <55 years | 15,237 | 1.7% (1.3% to 2.1%) | 1 |
| 55 - 64 years | 55,123 | 3.2% (3.0% to 3.5%) | 1.87 (1.53 to 2.29) |
| 65 - 74 years | 91,009 | 6.7% (6.5% to 7.0%) | 3.62 (2.99 to 4.39) |
| 75+ | 77,362 | 18.0% (17.6% to 18.5%) | 9.87 (8.16 to 11.9) |
| Gender | | | |
| Male | 101,674 | 11.1% (10.8% to 11.4%) | 1 |
| Female | 137,057 | 8.3% (8.0% to 8.5%) | 0.64 (0.62 to 0.67) |
| Patient physical status | | | |
| P1 – fit and healthy | 31,168 | 5.8% (5.4% to 6.3%) | 1 |
| P2 – mild disease not incapacitating | 161,459 | 8.1% (7.9% to 8.4%) | 1.14 (1.07 to 1.23) |
| P3+ – incapacitating systemic disease or worse | 46,104 | 14.6% (14.1% to 15.1%) | 1.93 (1.79 to 2.08) |
| Prosthesis type | | | |
| Total replacement using cement | 201,244 | 9.9% (9.7% to 10.2%) | 1 |
| Total replacement not using cement | 15,831 | 8.9% (8.2% to 9.6%) | 0.96 (0.89 to 1.04) |
| Hybrid total replacement | 2,702 | 8.7% (7.2% to 10.5%) | 0.94 (0.79 to 1.12) |
| Patello-femoral | 2,561 | 4.4% (3.1% to 6.2%) | 0.80 (0.60 to 1.07) |
| Unicondylar | 16,393 | 5.1% (4.5% to 5.8%) | 0.64 (0.58 to 0.72) |
| Type of provider | | | |
| NHS hospital | 195,923 | 9.8% (9.6% to 10.0%) | 1 |
| NHS treatment centre | 16,039 | 9.1% (8.2% to 10.0%) | 0.99 (0.92 to 1.07) |
| Independent hospital | 16,049 | 6.3% (5.7% to 7.1%) | 0.68 (0.61 to 0.75) |
| ISTC | 10,719 | 3.8% (2.7% to 5.3%) | 0.51 (0.43 to 0.60) |
| Country | | | |
| England | 223,745 | 9.5% (9.3% to 9.7%) | 1 |
| Wales | 14,986 | 9.1% (8.2% to 10.1%) | 0.86 (0.79 to 0.94) |

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3.4.4 Length of stay

The overall mean length of stay after a primary knee replacement was 6.6 days. Patients treated in England stayed 6.5 days in hospital and those treated in Wales 7.9 days ($p < 0.001$).

Table 3.14 Length of hospital stay for patients who received a primary knee replacement between 1st April 2003 and 31st December 2009, which were linked to a HES/PEDW episode.

| Category | Number of patients | Average length of stay (days) (95% CI) | Adjusted difference in average length of stay (days) (95% CI) |
|------------------------------------------------|--------------------|----------------------------------------|---------------------------------------------------------------|
| Age | | | |
| < 55 years | 15,237 | 5.3 (5.3 to 5.4) | 0 |
| 55 - 64 years | 55,123 | 5.5 (5.5 to 5.5) | -0.02 (-0.12 to 0.08) |
| 65 - 74 years | 91,009 | 6.2 (6.2 to 6.2) | 0.48 (0.39 to 0.58) |
| 75+ years | 77,362 | 8.1 (8.1 to 8.2) | 2.20 (2.10 to 2.30) |
| Gender | | | |
| Male | 101,674 | 6.3 (6.3 to 6.4) | 0 |
| Female | 137,057 | 6.8 (6.8 to 6.9) | 0.33 (0.28 to 0.37) |
| Patient physical status | | | |
| P1 – fit and healthy | 31,168 | 5.7 (5.6 to 5.7) | 0 |
| P2 – mild disease not incapacitating | 161,459 | 6.3 (6.3 to 6.3) | 0.19 (0.13 to 0.26) |
| P3+ – incapacitating systemic disease or worse | 46,104 | 8.4 (8.4 to 8.5) | 1.89 (1.81 to 1.97) |
| Prosthesis type | | | |
| Total replacement using cement | 201,244 | 6.8 (6.8 to 6.8) | 0 |
| Total replacement not using cement | 15,831 | 6.8 (6.7 to 6.9) | 0.05 (-0.04 to 0.14) |
| Hybrid total replacement | 2,702 | 6.8 (6.6 to 7.0) | 0.16 (-0.05 to 0.37) |
| Patello-femoral | 2,561 | 5.1 (5.0 to 5.2) | -1.22 (-1.44 to -1.00) |
| Unicondylar | 16,393 | 4.2 (4.2 to 4.3) | -1.92 (-2.01 to -1.83) |
| Type of provider | | | |
| NHS hospital | 195,923 | 6.9 (6.9 to 7.0) | 0 |
| NHS treatment centre | 16,039 | 5.9 (5.9 to 6.0) | -0.84 (-0.93 to -0.75) |
| Independent hospital | 16,049 | 4.9 (4.9 to 5.0) | -1.74 (-1.83 to -1.65) |
| ISTC | 10,719 | 4.4 (4.3 to 4.5) | -2.19 (-2.30 to -2.08) |
| Country | | | |
| England | 223,745 | 6.5 (6.5 to 6.6) | 1 |
| Wales | 14,986 | 7.9 (7.8 to 8.0) | 1.12 (1.03 to 1.21) |

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As expected we found that older patients, women and those in a poor physical condition stayed in hospital longer (Table 3.14). Length of stay was shorter in patients who had a unicondylar or a patello-femoral

knee replacement. Also, patients treated in treatment centres and independent hospitals were discharged earlier than those treated in an NHS hospital.

Glossary

| A | |
|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Acetabular component | The portion of a total hip replacement prosthesis that is inserted into the acetabulum – the socket part of a ball and socket joint. |
| Acetabular cup | See Acetabular component. |
| Acetabular prosthesis | See Acetabular component. |
| Arthrodesis | A procedure where a natural joint is fused together (stiffened). |
| Arthroplasty | A procedure where a natural joint is reconstructed with an artificial prosthesis. |
| ABHI | Association of British Healthcare Industries. |
| ASA | American Society of Anaesthesiology scoring system for grading the overall physical condition of the patient, as follows: P1 – fit and healthy; P2 – mild disease, not incapacitating; P3 – incapacitating systemic disease; P4 – life threatening disease; P5 – not expected to survive 24 hours. |
| B | |
| Bilateral operation | Operation performed on both sides, e.g. left and right knee procedures carried out during a single operation. |
| BMI | Body mass index. A statistical tool used to estimate a healthy body weight based on an individual's height. The BMI is calculated by dividing a person's weight (kg) by the square of their height (m ²). |
| BOA | British Orthopaedic Association. |
| Brand (of prosthesis) | The brand of a prosthesis (or implant) is the manufacturer's product name, e.g. the Exeter V40 brand for hips, the PFC Sigma brand for knees. |
| C | |
| CQC | Care Quality Commission. |
| Case ascertainment | Proportion of all relevant joint replacement procedures performed in England and Wales that are entered into the NJR. |
| Case mix | Term used to describe variation in surgical practice, relating to factors such as indications for surgery, patient age and sex. |
| Cement | The material used to fix cemented joint replacements to bone - polymethyl methacrylate (PMMA). |
| Cemented | Prostheses designed to be fixed into the bone using cement. |
| Cementless | Prostheses designed to be fixed into the bone by bony ingrowth or ongrowth, without using cement. |
| Compliance | The percentage of all total joint procedures, which were performed in an individual unit, that have been entered into the NJR within any given period. |
| CI | A confidence interval (CI) gives an estimated range of values which is likely to include the unknown population parameter (e.g. a revision rate) being estimated from the given sample. If independent samples are taken repeatedly from the same population, and a confidence interval calculated for each sample, then a certain percentage (confidence level: e.g. 95%) of the intervals will include the unknown population parameter. |
| Cup | See Acetabular component. |

| | |
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| D | |
| Data collection periods for annual report analysis | The NJR Annual Report Part 1 is about data collected between 1 st April 2009 and 31 st March 2010 – the 2009/10 financial year. The NJR Annual Report Part 2 analyses data on hip and knee procedures undertaken between 1 st January and 31 st December 2009 inclusive – the 2009 calendar year. The NJR Annual Report Part 3 is about hip and knee joint replacement revision rates for procedures that took place between 1 st April 2003 and 31 st December 2009. |
| DDH | Developmental Dysplasia of the Hip. A condition where the hip joint is malformed, usually with a shallow socket (acetabulum), which may cause instability. |
| DH | Department of Health. |
| E | |
| Excision arthroplasty | A procedure where the articular ends of the bones are simply excised, so that a gap is created between them or when a joint replacement is removed and not replaced by another prosthesis. |
| F | |
| Femoral component (hip) | Part of a total hip joint that is inserted into the femur (thigh bone) of the patient. It normally consists of a stem and head (ball). |
| Femoral component (knee) | Portion of a knee prosthesis that is used to replace the articulating surface of the femur (thigh bone). |
| Femoral head | Spherical portion of the femoral component of the artificial hip replacement. |
| Femoral prosthesis | Portion of a total joint replacement used to replace damaged parts of the femur (thigh bone). |
| Funnel plot | A graphical representation of analyses that plots observed values against expected values. Control limits based on standard deviation are superimposed on the plot. |
| H | |
| Hazard ratio | A comparative statistical measure of the instantaneous risk of experiencing the event of interest (e.g. implant revision) between two groups (e.g. two different products). |
| Head | See Femoral head. |
| Healthcare provider | NHS or independent sector organisation that provides healthcare; in the case of the NJR, orthopaedic hip and knee replacement surgery. |
| HES | Hospital Episode Statistics. Data on case mix, procedures, length of stay and other hospital statistics collected routinely by NHS hospitals in England. |
| Hybrid procedure | Joint replacement procedure in which cement is used to fix one prosthetic component while the other is cementless. For hip procedures, the term hybrid covers both reverse hybrid (cementless stem, cemented socket) and hybrid (cemented stem, cementless socket). |
| HQIP | Health Quality Improvement Partnership. |
| I | |
| Image/computer guided surgery | Surgery performed by the surgeon, using real time images to assist alignment and positioning of prosthetic components. |
| Independent hospital | A hospital managed by a commercial company that predominantly treats privately funded patients but does also treat NHS funded patients. |
| Indication (for surgery) | The reason for surgery. The NJR system allows for more than one indication to be recorded. |
| ISTC | Independent Sector Treatment Centre. |

| | |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| K | |
| Kaplan-Meier | A statistical method of carrying out a survivorship analysis that can take into account 'censored' data, i.e. patient losses from the sample before the final outcome is observed (for instance, if a patient dies). |
| L | |
| Levy | Additional payment placed on the sales of specific hip and knee implants to cover the costs associated with ongoing operation and development of the NJR. |
| Linkable percentage | Linkable percentage is the percentage of all relevant procedures that have been entered into the NJR, which may be linked via NHS number to other procedures performed on the same patient. |
| Linkable procedures | Procedures entered into the NJR database that are linkable to a patient's previous or subsequent procedures by the patient's NHS number. |
| LHMoM | Large head metal on metal. Large femoral head normally used with a resurfacing cup. |
| LMWH | Low molecular weight heparin. |
| M | |
| MDS | Minimum dataset, the set of data fields collected by the NJR. Some of the data fields are mandatory (i.e. they must be filled in). Fields that relate to patients' personal details must only be completed where informed patient consent has been obtained. |
| MDS 1 (MDSv1) | Minimum dataset version one, used to collect data from 1 st April 2003. MDS 1 closed to new data entry on 1 st April 2005. |
| MDS 2 (MDSv2) | Minimum dataset version two, introduced on 1 st April 2004. MDS 2 replaced MDS 1 as the official data set on 1 st June 2004. |
| MDS 3 (MDSv3) | Minimum dataset version three, introduced on 1 st November 2007 as the new official data set. |
| MDS 4 (MDSv4) | Minimum dataset version four, introduced on 1 st April 2010 as the new official dataset. This dataset has the same hip and knee MDS 3 dataset, but includes the data collection for total ankle replacement procedures. |
| MHRA | Medicines and Healthcare products Regulatory Agency. |
| Minimally invasive surgery | Surgery performed using small incisions (usually less than 8cm). This may require the use of special instruments. |
| Mixing and matching | Also known as 'cross breeding'. Hip replacement procedure in which a surgeon chooses to implant a femoral component from one manufacturer with an acetabular component from another. |
| Modular | Component composed of more than one piece, e.g. a modular acetabular cup shell component with a modular cup liner. |
| N | |
| NHS | National Health Service. |
| NICE | National Institute for Health and Clinical Excellence. |
| NICE benchmark | See ODEP ratings. |
| NJR | National Joint Registry for England and Wales. Since 1 st April 2003, the NJR has collected and analysed data on hip and knee replacements. It covers both the NHS and independent healthcare sectors to ensure complete recording of national activity in England and Wales. |

| | |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NJR Centre | National co-ordinating centre for the NJR. |
| NJR StatsOnline | Web facility for viewing and downloading NJR statistics on www.njrcentre.org.uk |
| O | |
| ODEP | Orthopaedic Data Evaluation Panel of the NHS Supply Chain. |
| ODEP ratings | ODEP ratings are the criteria for product categorisation of prostheses for primary total hip replacement against NICE benchmarks. The categorisation is based on NICE benchmarks: pre-entry benchmark (products commercially available that are involved in post-market clinical follow up studies); entry benchmark (after three, five and seven years; level A – acceptable evidence, level B – weak evidence); full benchmark (10 years; level A – strong evidence, level B – reasonable evidence, level C – weak evidence). For each year, there is a level for unacceptable evidence, where products should only be used as part of a clinical trial. |
| OPCS-4 | Office of Population, Censuses and Surveys: Classification of Surgical Operations and Procedures, 4 th Revision – a list of surgical procedures and codes. |
| Outlier | Data for a surgeon, unit or implant brand that falls outside of the defined control limits. |
| P | |
| Patella resurfacing | Replacement of the surface of the patella (knee cap) with a prosthesis. |
| Patello-femoral knee | Procedure involving replacement of the trochlear and replacement resurfacing of the patella. |
| Patello-femoral prosthesis | Two-piece knee prosthesis that provides a prosthetic (knee) articulation surface between the patella and femoral condyles. |
| Patient consent | Patient personal details may only be submitted to the NJR where explicit informed patient consent has been given. If a patient does not give consent, only the anonymous operation and implant data may be submitted. |
| Patient physical status | See ASA. |
| Patient procedure | Type of procedure carried out on a patient, e.g. primary total prosthetic replacement using cement. |
| Patient time | The summation of time (in years) for a cohort of primary procedures where the time is measured from the primary date to either date of revision, date of patient's death or analysis date (last observation date). |
| PDS | The NHS Personal Demographics Service is the national electronic database of NHS patient demographic details. The NJR uses the PDS Demographic Batch Service (DBS) to source missing NHS numbers and to determine when patients recorded on the NJR have died. |
| PEDW | Patient Episode Database Wales, the Welsh equivalent to Hospital Episode Statistics (HES) in England. |
| Primary hip/knee replacement | First total joint replacement operation performed on any individual patient. |
| Prosthesis | Orthopaedic implant used in joint replacement procedures, e.g. a total hip or a unicondylar knee. |
| PROMs | Patient Reported Outcome Measures. |
| PTIR | Patient Time Incidence Rate. This is the rate of occurrences of an incidence (i.e. revision) for a given patient time. |
| p-value | A p-value is reported as a result of a statistical hypothesis test. It represents the probability that any observed differences are due to chance. If the p-value is below a pre-determined cut-off (traditionally 0.05) the result is called “statistically significant” and it can be concluded that the observed differences are unlikely to be due to chance. |

| | |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| R | |
| Resurfacing (hip) | Resurfacing of the femoral head with a surface replacement femoral prosthesis and insertion of an acetabular cup with or without cement. |
| Revision hip/knee replacement | Operation performed to remove and replace one or more components of a total joint prosthesis for whatever reason. |
| RCS CEU | Royal College of Surgeons of England, Clinical Effectiveness Unit. |
| S | |
| Single stage revision | A revision carried out in a single operation. |
| Standard Deviation (SD) | The standard deviation is a measure of the spread of the data about the average. The smaller the standard deviation, the less spread out the data. |
| Surgical approach | Method used by a surgeon to gain access to, and expose, the joint. |
| Survivorship analysis | A statistical method that is used to determine what fraction of a population, such as those who have had a particular hip implant, has survived unrevised past a certain time. See Kaplan-Meier. |
| T | |
| TED stockings | Thrombo embolus deterrent (TED) stockings. Elasticated stockings that can be worn by patients following surgery and which may help reduce the risk of deep vein thrombosis (DVT). |
| THR | Total hip replacement (total hip arthroplasty). Replacement of the femoral head with a stemmed femoral prosthesis and insertion of an acetabular cup, with or without cement. |
| Thromboprophylaxis | Drug or other post-operative regime prescribed to patients with the aim of preventing blood clot formation in the post-operative period. |
| TKR | Total knee replacement (total knee arthroplasty). Replacement of both tibial and both femoral condyles, with or without resurfacing of the patella and with or without cement. |
| Total condylar knee | Type of knee prosthesis that replaces the complete contact area between the femur and the tibia of a patient's knee. |
| Treatment centre | Treatment centres are dedicated units that offer elective and short stay surgery and diagnostic procedures in specialities such as ophthalmology, orthopaedic and other conditions. These include hip and knee replacements. Treatment centres may be NHS (NHS treatment centre) or privately funded (independent sector treatment centre – ISTC). |
| Trochanter | Bony protuberance of the femur, found on its upper outer aspect. |
| Trochanteric osteotomy | Temporary incision of the trochanter, used to aid exposure of hip joint during some types of total hip replacement. |
| Two stage revision | A revision procedure carried out as two operations, often used in the treatment of deep infection. |
| Type (of prosthesis) | Type of prosthesis is the generic description of a prosthesis, e.g. modular cemented stem (hip), patello-femoral joint (knee). |
| U | |
| Uncemented | See cementless. |
| Unicondylar arthroplasty | Replacement of one tibial condyle and one femoral condyle in the knee, with or without resurfacing of the patella. |
| Unicondylar knee replacement | See Unicondylar arthroplasty. |
| Unilateral operation | Operation performed on one side only, e.g. left hip. |

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