

*Lay Summary of the  
2008 Annual Report  
Hip and Knee Replacement*



AOA

AUSTRALIAN  
ORTHOPAEDIC  
ASSOCIATION



SUPPLEMENTARY REPORT  
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National Joint Replacement Registry

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## *Introduction*

This summary is an explanation of the major findings of the Australian Orthopaedic Association's National Joint Replacement Registry Annual Report for 2008 and is provided as the Association believes it is important to provide a clear, concise and easily understood explanation of the current findings. This is especially important because of the increasing community interest in the reports produced by the Registry.

### *When and why was the Registry started?*

The Australian Orthopaedic Association started the National Joint Replacement Registry in 1999. It was a complex system to set up and as a consequence it took almost three years before the Registry was fully implemented in all 300 or so hospitals that do joint replacement surgery in Australia. This process was completed in mid 2002. Since that time the Registry has received information on nearly all hip and knee replacements that have been undertaken in Australia. For this report the Registry has analysed the results of just over 400,000 hip and knee replacements (191,673 hips and 209,316 knees). These are all the hip and knee replacements operations that the Registry has collected with an operation date up to and including the 31<sup>st</sup> December 2007.

In November 2007 the Registry also commenced collecting data on other additional types of joint replacement operations. These include shoulder, elbow, wrist, ankle and spinal disc replacement. As this only started towards the end of 2007 the Registry does not have any information on the results of these procedures but it does have a small amount of information on the types and number of procedures being undertaken. This information can be found in a supplementary report on this website (<http://www.aoa.org.au/docs/NJRRShoulderElbowWristAnkleSpinalDisc2008.pdf>).

The reason the Australian Orthopaedic Association started the Registry was to further improve the results of joint replacement surgery in this country. Generally speaking this type of surgery is very successful but as with all areas of medicine there is always room for improvement. One of the most serious consequences of a less than successful operation is the need to have a revision (redo) operation. The Registry aims to decrease the number of redo operations. A

large and ever increasing number of joint replacements are being done (almost 70,000 during 2007) therefore a small decrease in the proportion of replacements that need to undergo a redo has the potential to help a large number of people.

Orthopaedic surgeons felt that one of the things limiting further improvement was a lack of detailed information on the results of joint replacement surgery in this country. In particular information that was able to compare the effect of the many different factors known to influence the result.

Surgeons have a large choice of different types of artificial joints that they can use to replace damaged and painful joints. There are also different techniques that can be used to put these artificial joints in place. Surgeons know that there is variation in the results depending on the patient, the nature of the patient's problem, the type of joint replacement used and the way the operation is done.

The Registry is able to simultaneously compare all of these different factors. By doing this it is able to help the surgeon to decide what would be the best type of joint replacement to use in any particular situation. The Registry is able to detail the results for different classes (or categories) of joints and different individual types of joints in each of the classes. It is able to do this for each of the different problems that patients have that may require them to need a joint replacement. It is also able to determine the impact of patient age and their gender on the results.

The fact that it is a national database means that the Registry is able to report on results of a very large numbers of operations. This is important as it is known to improve the accuracy of the information.

It is important to emphasise however that this is not the only information that surgeons use but is just another source of information that is helpful. Surgeons rely on their training and experience as well as information not only from the Registry but also from medical journals, other registries elsewhere in the world, conferences and talking to other surgeons.

When surgeons interpret the Registry information they use their knowledge and

experience to put the Registry information into context with what they already know. They also use additional information from other sources to determine its significance. The role of the Registry is to provide information. The Registry does not decide or recommend what is the best joint replacement for a particular patient. This is always done by the surgeons in consultation with their patients.

### *How does the Registry work?*

The Registry collects a small amount of confidential information on each joint replacement operation that is done in Australia with the exception of those operations where the person involved does not want to have their information collected by the Registry. The information collected includes details of the patient, the reason for the surgery, which joint was replaced and the side of the operation. It also collects information on the type of joint replacement and all the individual components used in the operation.

As previously mentioned if a problem occurs following a joint replacement operation one of the possible outcomes is that the operation is redone. This is referred to as a revision procedure. The Registry records the revision procedures and relates it to the first (or primary) operation. By doing this it is able to determine how many of the initial primary procedures have been revised, the reason why it was redone, how long after the original surgery the revision occurred and which of the components (if any) were replaced

### *How does the Registry present the results?*

The Registry presents the results of its analysis in a variety of different ways. The clearest and most important way is by the graphs and the tables, which appear after most of the graphs, referred to as cumulative percent revision tables.

The graphs are called Kaplan-Meier estimates of survivorship. When looking at these graphs the difference between the results of the factors being compared can be seen by comparing the curves on each graph and also between the different graphs. The more the curve of the graph slopes upwards the greater the number of revision (redo) operations that have been done.

In general the greater the difference in the slopes of the graph the more important the difference is. In the upper left hand corner of

each of these graphs is a series of figures. The most important of these are the hazard ratio (HR) and the p (probability) value. The hazard ratio is an indication of the relative risk. If the HR = 3 this means that of the factors being compared the factor with the curve on the graph with a greater slope has a 3 times greater risk of being revised compared to the other factor it is being compared to. The p value is a measure of the likelihood that the difference seen between the factors is a real difference and has not occurred simply by chance. In statistical terms this is called significance. The difference is regarded as significant (in other words likely to be real) if that p value is smaller than 0.05. A p value of 0.05 means that there is a one in 20 chance that the difference observed is not real. The lower the p value is below this figure the more likely it is that the difference observed is real. For instance a p value of 0.001 means that there is only a one in 1,000 chance that the difference is not real.

The cumulative percent revision tables give the number of revisions as a percentage of the number of operations being followed up at particular times i.e. 1 year, 2 years etc. If you look at these numbers and compare them to the graphs you will find that the numbers are simply the values on the graph at the specific time points stated. On occasion the Registry provides only tables of cumulative percent revisions and does not provide the graphs. This is usually done when the results of a large number of different replacements in one category are being presented. The reason the graphs are not provided in this situation is simply a space issue in that it would make the report too large.

### *Who Funds the Registry?*

The Registry is funded by the Commonwealth Government through the Department of Health and Ageing. The Government and the Department have been very supportive of the Registry. They provided the initial funding to establish the Registry and have maintained its funding for the last ten years.

### *Summary of Results from the 2008 Annual Report*

The report is set out in a variety of different chapters but done in a way that is a little different from last year's report.

The chapter on the analysis of government information which has been collected for each of the state governments is not included in the main report but is presented as a

separate report on the Registry website (<http://www.aoa.org.au/docs/NJRRStateAnalysis08.pdf>).

This information is presented as it gives a much longer history with respect to joint replacement surgery than is available when just Registry data is used.

This separate report continues to highlight the continued very large increase in the number of joint replacement operations being undertaken each year and that the increase has been much greater for knee replacements. In 1994-1995 financial year 18,635 hip replacements and 13,371 knee replacements were done. In the 2006-2007 financial year this had increased to 31,328 hips and 34,216 knees. This is an increase on the 1994-1995 figures of 68.1% and 155.9% respectively. Most hip and knee replacements are undertaken in private hospitals (just over 60%). The national figures for the number of hip and knee replacements undertaken in public hospitals actually decreased by 1.5% in the 2006-2007 financial year.

The remaining chapters deal with Registry specific information. This year the Registry is able to provide seven year results for many types of hip and knee replacement procedures.

It is important to understand that these results are regarded as mid-term results by most surgeons.

### *Results of Hip Replacement*

The information on hip replacement has been divided into four chapters.

- General Introduction
- Primary Partial Hip Replacement
- Primary Total Hip Replacement
- Revision Hip Replacement

#### *General Introduction*

In the introductory chapter the major change has been the comparison of revision rates for primary total hip replacement depending on the original problem (diagnosis) that led to the need for the hip replacement. At seven years the best outcome for primary total hip replacement was when the original diagnosis was either osteoarthritis or developmental dysplasia of the hip (DDH). DDH is a congenital condition which results in the growth of a misshapen socket and can result in the more severe cases in the hip being partially or completely dislocated. This and/or the misshapen socket can lead to early onset

osteoarthritis requiring a total hip replacement.

The Registry has sufficient information to also report the differences related to the original diagnosis in the outcome of resurfacing hip replacement. As with primary total hip replacement outcomes, the diagnosis of osteoarthritis is associated with the least number of redo operations. The risk of a redo is increased if the original diagnosis was avascular necrosis (AVN) of the femoral head or DDH. Comparing primary total hip replacement and resurfacing procedures when a patient has DDH resurfacing operations have four times more chance of being revised compared to those patients with DDH who had a primary conventional total hip replacement.

The Registry was unable to compare the outcome of either primary partial or primary bipolar hip replacement with respect to the original diagnosis because almost all of these procedures were undertaken for broken hips and very few for other reasons.

#### *Primary Partial Hip Replacement*

The second hip chapter discusses primary partial hip replacement. As already mentioned these are almost exclusively used in the treatment of broken hips. In particular elderly patients when the broken hip involves a complete fracture at the base of the ball of the hip which is also significantly displaced

The Registry has previously reported the continued decline in the use of the most revised type of primary partial hip prostheses which is the Austin Moore prosthesis. In 2007 its use continued to decrease and since 2003 the use of this prostheses has decreased by 45%

As well as the dramatic reduction in the use of this prosthesis there is also an evident increased use of prostheses such as the unipolar modular prostheses which have an apparent better outcome.

Three factors mentioned last year continue to have a significant impact on the revision rates of partial hip replacement. They are the category of prostheses used, the age at time of surgery and the method of fixation. The method of fixation refers to whether bone cement is used or not. Bone cement is a hard setting polymer that is mixed at the time of surgery and introduced into the femur to set and hold the partial hip replacement prosthesis in place. Those partial hip replacements that do not require cement have been designed to be held in place firstly

because of a tight fit into the bone and then subsequent bone growth onto a specially designed surface. This bone growth onto the surface holds the replacement in place in the longer term.

Unipolar monoblock prostheses particularly, Austin Moore prostheses have a significantly higher rate of revision than both unipolar modular and bipolar prostheses. Both unipolar monoblock and unipolar modular prostheses have significantly greater rates of revision when patients are less than 75 years of age at the time of surgery. The use of bone cement fixation in all categories of partial hip replacement reduces the risk of subsequent revision irrespective of age.

### *Primary Total Hip Replacement*

This chapter reports on the use and outcome of primary total hip replacement. These differ from primary partial hip replacement in that not only is the femoral head (ball) replaced (as is the case for partial hips) but the acetabular socket is also replaced. Primary total hip replacements are almost always done for some form of arthritis, most commonly osteoarthritis.

There are two main types of primary total hip replacement. They are conventional total hip replacement or resurfacing total hip replacement. The most used primary total hip is the conventional total hip replacement. This form of total hip replacement replaces the acetabular socket with a specially designed one piece cup or alternatively an acetabular shell with a liner that is inserted inside the shell. This is also the case for resurfacing total hip replacement. The difference between conventional and resurfacing total hip replacement relates to the femoral replacement. In a conventional total hip replacement the ball of the femur is completely removed and replaced by an artificial head (ball) which is placed on a femoral stem. The stem is that part of the replacement that is placed down inside the femur but protrudes enough above the top of the femur to allow the head to be placed on it and to restore the biomechanics of the damaged hip joint. A resurfacing procedure on the other hand involves removing the surface and re-shaping the existing femoral head so that a prosthesis that replaces the surface of the head can be positioned over the remaining natural femoral head.

Modern resurfacing total hip replacement has only been available to Australian surgeons for the last seven or eight years. Up until the last two years the use of these prostheses was increasing, it has now however started to

decline. There has been a small reduction in the proportion of resurfacing procedures compared to all other hip replacements in each year for the last two years.

Overall resurfacing hip replacement has a greater risk of revision when compared to conventional primary total hip replacement. Factors affecting the outcome of resurfacing hip replacement include the type of prostheses, gender and age. Women have a significantly higher rate of revision and the risk of revision increases with age. Men also have an age related risk of revision which becomes significantly higher after the age of 65 years. Another major factor which the Registry reported for the first time this year is the size of the femoral prostheses that is used to replace the ball of the hip. The smaller the head size the greater the risk of a redo operation. The relationship between head size and risk of revision explains much of the difference previously seen between men and women.

When considering the results of primary conventional total hip replacement the Registry divides this category of hip replacement into three different types. This division is based on the method of fixation. As with partial hip replacement, primary total hip replacement may be cemented or cementless. There is also a third option which is referred to as hybrid fixation. This involves cementing either the acetabular socket replacement or the femoral replacement but not both. Almost all hybrid conventional total hip replacements have the femoral replacement cemented and the acetabular socket replacement cementless.

Cementless primary conventional total hip replacement is by far the most common type of primary conventional total hip replacement. This is followed by hybrid and then cemented primary conventional hip replacement. At seven years cementless hip replacement as a group has a higher rate of revision compared to both cemented and hybrid hip replacement. This difference between cementless and the other types of conventional hip replacement is more apparent the older the patient is at the time of the initial hip replacement. The results of hip replacements vary considerably depending on the type of hip replacement used. There are some types of cementless hip replacement that the Registry has shown to have a very low risk of revision.

The most common reason for a hip replacement needing to be revised is a

condition called aseptic (non infective) loosening. This means that the replacement eventually becomes loose in the bone. When this happens it becomes painful to walk. This is thought to occur because of an inflammatory reaction that develops around the replacement. The inflammation is brought about by the generation of little particles of material from the joint replacement. These particles are generated because of wearing of the prosthesis which is a product of activity and time. There has been a lot of work that has been undertaken trying to reduce the number of particles that form. One of the approaches is to look at making the joint surfaces in particular the articulating surfaces out of different materials.

This year the Registry has reported the initial early results obtained from comparing the different types of articulating surface. These included the most common articulating surface of metal on polyethylene as well as ceramic on polyethylene, ceramic on ceramic and metal on metal. The early results suggest that metal on polyethylene is the least revised. Surgeons however are more interested in the impact these surfaces will have on the long term outcome and it will be a number of years before the Registry has sufficient data to report on this.

### *Revision Hip Replacement*

The final hip chapter presents some quite complicated information on the outcome of having a hip revised. The Registry has only focused on the outcome of the first revision and has not included information on revisions that have been undertaken for infection.

In order to determine these results it is necessary for the Registry to have information not only on the first revision but also the initial primary replacement. As most revision operations are done many years after the primary operation, most of the revision procedures recorded by the Registry had the primary operation done prior to the commencement of the Registry. This means it is difficult to know the reasons for any subsequent revision as the full history of surgery on that joint is not available to the Registry. As time progresses this situation will change and eventually most revisions will be undertaken on cases where the Registry does have information on the original primary procedure. When this occurs the Registry will be able to report much more accurately the results of any subsequent revision operations.

The early results do however confirm what surgeons have known and that is the outcome of any revision operation is nowhere near as

good as a primary procedure. What is new however is that it appears the best results from revision hip surgery are achieved when a more extensive revision procedure is undertaken. In other words if the revision operation is a straight forward simple revision where a small number of minor components are revised (a minor revision) the results are not as good as when a more complex revision involving the replacement of all or most of the components (a major revision) is undertaken.

The other finding that was a little surprising and in part reflects the first finding is that the outcome of revising a resurfacing hip replacement is the same as revising a conventional hip replacement. One of the reasons surgeons have used resurfacing hip replacement has been because it was thought that if it needed to be revised then this would be quite straight forward and have similar results to a primary conventional hip replacement. The Registry information suggests that this is not the case.

### *Results of Knee Replacement*

As with hip replacement there are four different chapters on knee replacement in the report.

- General Introduction
- Primary Partial Knee Replacement
- Primary Total Knee Replacement
- Revision Knee Replacement

#### *General Introduction*

Almost all primary knee replacements whether they are partial or total are used to treat patients with severe arthritis of the knee, most commonly osteoarthritis. The Registry for the first time has reported the differences in the risk of revision of primary total knee replacement depending on the reason for doing the primary total knee replacement. The outcome for patients with osteoarthritis is very good but not quite as good as those patients with rheumatoid arthritis. Other major reasons for needing a knee replacement do not appear to significantly impact on the outcome when compared to patients who have had a knee replacement for osteoarthritis.

#### *Partial Knee Replacement*

Partial knee replacement as the name suggests involves the replacement of only part of the knee joint. These procedures include the unispacer procedure (no longer done in Australia), the patella/trochlear replacement which replaces only the joint surfaces of the knee cap and the unicompartmental knee replacement. The

unicompartmental knee replacement replaces the femoral and tibial joint surfaces but only on one side of the knee, much more commonly on the inner side. In each of these different categories there is an array of different individual types of replacements that are available for use. There are also two new types of partial knee replacement included in this year's report, partial resurfacing knee replacement and bicompartmental knee replacement however the number of these is quite small.

Patella/trochlear replacements are done in relatively small numbers and are only really used in very special circumstances. Unicompartmental knee replacements are used much more commonly but the Registry has reported a significant decrease in the use of this prosthesis in recent years. Both patella/trochlear and unicompartmental knee replacements have a much higher rate of revision compared to primary total knee replacement. Patella/trochlear has about four times the risk and unicompartmental at least twice the risk. Age is a major factor affecting the outcome of unicompartmental knee replacement. The younger the patient the more likely the procedure will be revised early. One in five patients under the age of 55 at the time of surgery has been revised within seven years.

### *Primary Total Knee Replacement*

Primary total knee replacement has the lowest risk of revision compared to all other types of primary knee replacement. When considering the outcome of primary total knee replacement the Registry considers a number of different categories of knee replacement.

The most important factor that the Registry has identified that influences the risk of a revision knee procedure is the age of the patient at the time of the initial knee replacement, the younger the patient the higher the risk of subsequent revision. This is true for all types of primary partial and primary total knee replacement.

A primary total knee replacement always involves the removal and replacement of the joint surface of the femur and the tibia on both the medial and lateral sides. A single femoral replacement and a single tibial replacement are used. The tibial replacement may be one component but it is more commonly two, usually a metal tray that fits over the cut surface of the tibia and a plastic insert that fits inside the tray and articulates with the single femoral replacement.

The first of the different categories relates to the method of fixation to bone of the femoral and tibial components. As with hips, both of these knee replacement components may be cemented, cementless or hybrid (one component cemented while the other component is inserted cementless). The Registry has not been able to identify any differences in outcome related to the way the components are fixed to bone.

A second way of categorising knee replacements is to divide the knee replacements according to the stability of the prostheses. An important difference between hip and knee joints is the stability of the joint. As the hip joint is a ball inside a socket joint there is a degree of stability because of the shape. This is not the case with the knee where two relatively flat surfaces articulate with each other. The stability of the knee joint is much more dependent on surrounding ligaments. One or more of these ligaments may be damaged in a knee joint and the prostheses must be able to provide stability to substitute for that damaged ligament.

Most knee replacements inserted do not require any additional stabilization and are referred to as minimally stabilized knee replacements. The next most common group is posterior stabilised which has additional stability built into the knee replacement that enables the prosthesis to substitute for the activity of the posterior cruciate ligament.

Other important ligaments about the knee are the medial and lateral collateral ligaments. These can also be substituted by the use of constrained knee replacements. These are not often required in primary operations. There is one final group of knee replacements when considering stability and these are the hinged knees. These are used mostly when there is absolutely no ligament stability left in the knee. Their use is very rare in the primary situation. The primary cases that involve the use of either the constrained or hinged knee are very difficult cases and it is unfair to these prostheses to compare the outcomes of this type of replacement to the much more commonly used minimally and posterior stabilised knee replacements.

When minimally and posterior stabilised knee replacements have been compared the Registry has not been able to see a difference in the results until this year. In this report however the Registry is reporting for the first time that there does appear to be a small difference, with the posterior stabilised knees having a slightly higher risk of revision.

A further way of dividing different knee replacements is to consider the way the tibial insert is designed to move on the surface of the tray. It may be fixed to the tray (fixed insert) or it may be designed to move (mobile insert). If it is a mobile insert it may be designed to rotate, slide or do both. Each of these is a different category of mobile insert. For a number of years the Registry has reported that in general fixed inserts have a lower risk of revision. There are however a number of prostheses with mobile inserts that have early to mid term revision rates that are similar to fixed inserts. The situation remains the same after analysing the data for this year's report.

The Registry also compares the risk of revision of primary total knee replacement depending on whether or not the patella surface of the knee replacement is replaced. The results from the Registry indicate that if the patella surface is not replaced then this increases the risk of having a subsequent revision operation.

### *Revision Knee Replacement*

The final chapter on knee replacement reports on the outcome of the first revision of either primary unicompartmental or primary total knee replacement. As with hip replacement the outcome of any revision operation is nowhere near as good as a primary replacement. The finding reported for hip replacement that the more extensive revision procedures are associated with a smaller risk of re-revision, is also evident with unicompartmental knee replacement. Revising a unicompartmental knee replacement to a total knee replacement rather than another unicompartmental knee replacement is associated with significantly fewer subsequent revisions.

The first revision of a primary total knee replacement has a high re-revision rate however this is not as dependent on the extent of the initial revision procedure. Both minor and major revisions have a similar and high risk of re-revision.

### *Outcomes of different types of Hip and Knee Replacement*

As well as looking at general factors affecting the results in different categories of hip and knee replacement the Registry also reports on the results of individual prostheses in the different categories. As can be seen from looking at the results there is variation in the revision rates for the different types of prostheses in each of the categories.

In addition the Registry also identifies individual replacements that have a higher than anticipated rate of revision. This means that for some reason these replacements have more than twice the rate of revision when compared to all other replacements in that specific category. There are many different types of prostheses in each category. This information allows surgeons to compare the results and make decisions on the continued use or otherwise of those replacements. It is important to emphasise that there may be many reasons why the revision rate is twice that of other replacements and some of these are not related or specific to the identified replacement.

If patients realise that they have a prosthesis that has been identified in the Report as having a higher than expected revision rate then it is important that they understand that most patients with these identified prostheses will in fact do very well both in the short and longer term. If a patient does believe they have one of these prostheses it would be worthwhile talking to their surgeon to clarify any issues that may arise as a result.

### *Summary*

The purpose of the National Joint Replacement Registry is to provide high quality data on the results of joint replacement in Australia. It is now providing increasingly relevant information to surgeons and this assists them to make more informed judgments on the best approach to use for individual patients. The information provided by the Registry will become increasingly valuable as time progresses. This is because longer term outcomes than currently available will be able to be provided. The interpretation of Registry information is complex. This is due to the interaction of the many factors known to influence the results. It is hoped however that the information presented in this report is not only useful to surgeons but also to patients involved in joint replacement surgery. In particular, it is hoped that it assists in promoting informed discussion between patients and their treating surgeons.