Multiple Technology Appraisal (MTA)
Total hip replacement and resurfacing arthroplasty for the treatment of pain or disability resulting from end stage arthritis of the hip (Review of technology appraisal guidance 2 and 44)

Comments on Technical Content
by

[redacted]

Dear Committee,
I thank you for the opportunity to try and help. It is a difficult problem to use observational data to come to an accurate conclusion of what is best implant.

2.1 Background
IA group of patients require repeated revision surgery and this becomes increasingly demanding of expertise, equipment and higher cost. Also complications such as fracture around the stems of hip replacements in the elderly is a difficult complication to manage with generally longer in-patient stay and medical care. Likewise the costs of treating infection can be high. These different problems steadily increase for patients who have a hip replacement initially at a young age. Some patients are left with disability following failed hip revision that can require high cost maintenance.

Additionally, even patients of high activity levels will be selected for different prostheses irrespective of age. Age is not therefore a complete control for activity level which correlates with wear rates and subsequent failure.

These younger patients therefore often seek an innovative solution that may improve long term outcome. The surgeon is also seeking a better solution and will likely be less experienced with the innovative design, and so the learning curve of the surgeon also contributes to a higher failure rate. Inherently this group of active and motivated patients have a high mileage and therefore higher wear and so a high failure rate. Thus innovative designs suffer from an 'innovation bias'.

Patients want good function from their hip. This is crucial. A well functioning hip will wear faster than one that has restricted use. The age of a second-hand car is not necessarily a reflection of the mileage it has done. Our UK Joint Registry does not collect data on the amount of use a particular patient has had from their hip.

Page 21 2.4.2 Cost Effectiveness Results
2.4.2.2 RS vs THR
This comparison appears to miss some of the complexities of costings. Theatre time and in-patient stay vary between RS/THR and Revision THR as well as the cost of prostheses. Generally revision following THR requires a revision prosthesis (more expensive in terms of theatre time and implant cost) whereas following RS requires a primary THR. Has this difference been included in the analysis?

The 3 factors of implant, in-patient stay and theatre time each comprise about a third of the cost of a joint replacement. Theatre time and in-patient stay vary quite widely between institutions and also over time as new techniques of rapid rehabilitation have come into effect. (need to find a reference to support this)

Page 2.4.2.3 THR vs THR
One Category that is missing and is important is the cementless stem with a cemented polythene/ceramic articulation. This is known as a reverse hybrid and in some studies gives particularly good results, for example the Norwegian Registry.

Page 32 3.1.3.3 Variation in services and uncertainty about best practice
Unfortunately, inaccuracies in data collection can lead to the quoted low price of £560 in Tower Hamlets. For example reporting of reduction of a hip dislocation as a hip revision in some units. Also, patients having hemi-arthroplasty for hip fracture may have a very low cost implant (less than £200) but be coded as total hip replacement. This will contribute to the apparent significant range in cost.

Page 44 Table 3 Combination of bearing/articulation surface and fixation method by frequency as reported in NJR 2010-11
Table 3 appears to omit the reverse hybrid of a cementless stem on a cemented cup. This table does not recognise the variations between different designs of the same fixation method. This table fails to account for the introduction of cross-linked polythene designs as a separate group despite evidence for there being less wear with cross-linked polythene **(TO INSERT REF)**

Page 49 Paragraph 4
Are metal on metal prostheses included as a separate group in this report? In view of the fact that the ASR implant has been removed both as a resurfacing and as a total hip replacement due to its poor results have their results been removed from these relevant groups? I found no evidence in the report that this is the case.

Page 52
There is a wide variation in outcome depending on patient factors, surgical factors, centre factors and implant itself. These interactions are complex. It would be difficult to predict the outcome of a unit changing from an implant they have become accustomed to using.

A different implant would not necessarily give the results achieved by others.

Page 83
Harris hip scores and WOMAC function scores do not differ with cup designs nor the use of cross-linked polythene. There is widespread adoption of these new polythenes and an improved survival is predicted in the long term from the reduction in wear rates, but this is unlikely to be seen before 10 years of use.

In ceramic on polythene for the younger patient 9 year follow up is relatively short and so the importance of a non-scratchable surface may become evident many years later.

Implant dislocation is particularly troublesome for patients as it destroys confidence in their hip replacement and greatly limits their activities. This aspect is little studied. The benefit of cemented over cementless cups is therefore important even if it has little effect on revision rates and cost.

Wear becomes important in the younger patient if it leads to osteolysis. Bone loss limits the options for revision and re-revision become more difficult and more costly usually with lower levels of function. (Lower function actually improves survival of the implant). Eventually loss of bone that is either major on the acetabular or femoral side will lead to a situation where hip revision becomes impossible.

6.2.4
This good randomised controlled trial found reduced osteolysis with ceramic on ceramic and better survival with use of cementless fixation of cup and stem. This is strong evidence as it requires a randomised trial to avoid the error of National Registries in being only an observational report and affected by the 'innovation bias' in younger/active patients.

6.2.6
There is evidence in a paper from Bristol on mortality *BMJ* 2012;344:e2383 doi: 10.1136/bmj.e2383 (Published 3 April 2012)

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I draw attention to the paper from the Netherlands demonstrating that the main cost driver was not just the cost of implants, but also in-patient stay and ward costs. Rapid rehabilitation techniques have halved in-patient stay in recent years but this is likely to be independent of all hip designs.

Page 161
In paragraph two the finding that cementless stems and cups are at a significantly lower risk of revision than cemented is a consistent finding in Finland. In Sweden the opposite is found but it should be noted that Sweden has a long history of focussing on the skills of cementing and has never had a significant proportion of patients being treated with cementless hip replacement. The different findings from different Registries probably reflect the pattern of skill development in the two different countries.

Page 172
In the last paragraph what is missing in this discussion is the place of cross-linked polythene. This has been shown in this report to have lower wear rates and would benefit from separate analysis to see whether the extra costs of those implants is reflected in appropriate cost effectiveness.

Page 176
The idea of using propensity scoring to construct a matched sample of THR patients that can be compared to RS patients is good. However, why was the propensity score based on age and gender only? A surgeon may base the choice between RS and THr on many things that are not captured by age and gender alone. The idea of propensity scoring is to account for many covariates, not just two, and the NJR contains many covariates that would be useful. For instance, BMI and surgeon grade. By using the many covariates reported in the NJR, a better matching cohort would be constructed.

Page 186
Our joint registry identifies the surgeon as one of the larges factors in predicting outcome following hip replacement. This is a combination of the infection rate in the centres used by that surgeon, the implants available, the rehabilitation team, the pattern of referral and the skill of that surgeon. This study fails an opportunity to use this predictor in matching patients.

Each innovative design of implant has a period of interest and high use which later settles to an appropriate level. RS is no longer a widely used option, as stated in the report. Of great interest to patients and surgeons are the groups C, D, E and the two groups of similar numbers to E but unidentified in this report.

It is therefore innapropriate to pool these THR groups together, and also a lost opportunity.

Page 192
Most hip surgeons would be interested in analysis of patients under the age of 50. This is the group that is most demanding in terms of having high activity and also having longest life expectancy. This group will not simply have one revision in their lifetime, but probably several.
The committee may consider advising that all patients under 50 years be invited to join a randomised trial where a new design is to be compared to the 'best alternative' in the practice of that surgeon. The national joint Registry could be charged with the duty of providing the outcomes for these patients, and so allowing a large number and low cost study.

Figure 39
It is difficult to predict the future. The Warwick Evidence prediction of 20 years survival for a total hip replacement is of a 12.9% revision rate with age averaging ~~below~~ around 60 (Fig. 36). This seems very unlikely considering the long term results are already known for

Sweden and presented in Table 72 where in the 50 to 59 age group the revision rates are 30%.
In the Swedish graph the third phase of the bathtub can be seen with a steepening of most curves around 8 years. UK data does not allow this third phase to be identified and so the extrapolations of the current UK data are likely to be inaccurate.

Summary
It may help the Committee to understand this particularly high rate of failure among younger patients who are otherwise fit and well. This is shown in Figure 72 (page 301) from the Swedish data. For this reason patients and surgeons are seeking advice on which implants are best used in the younger patient. This was a significant reason for surgeons choosing the resurfacing in the younger patient as evidenced in the 14 year age difference beween RS and THR in Table 58, page 196. In the past it was also a reason for surgeons trying the uncemented stems in younger patients. Due to Registries having no control of allocation of choice of implant this has led significant bias through all Registries. Newer implants are used for the younger patients, but then appear to have a correlation with more rapid failure.