

National Collaborating Centre for Cancer

Myeloma

Myeloma: diagnosis and management

NICE Guideline 35

Appendices A - F

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1

1 **Appendix A: The cost effectiveness of** 2 **alternate imaging strategies for diagnosis** 3 **in secondary care of patients with** 4 **suspected myeloma**

A.15 **Background**

6 Bone disease is a common feature in myeloma and soft tissue lesions could also be present.
7 Therefore patients with a plasma cell disorder suspected to be myeloma undergo imaging to
8 identify anatomical lesions caused by the disease.

9 Skeletal survey with secondary imaging by CT or MRI for equivocal and negative results with
10 suspicion of myeloma is the primary imaging investigation used in UK. Skeletal survey is a
11 combination of plain radiographs which includes commonly affected sites (e.g. skull, spine,
12 chest, humeri, femora). It is readily available, low cost with relatively low radiation exposure.
13 However this form of imaging is potentially less sensitive than other imaging techniques
14 available. It is possible some patients who have a normal skeletal survey do have lesions
15 that just cannot be seen on plain films. Other techniques include computed tomography
16 (CT), magnetic resonance imaging (MRI) and FDG positron emission tomography CT (PET-
17 CT). These imaging techniques are potentially more sensitive and specific than the skeletal
18 survey. However, they are more costly and may increase radiation burden (especially PET-
19 CT and CT). They are also used at the treatment planning stage and many patients with a
20 positive diagnosis of myeloma would go on to receive these imaging techniques. In patient
21 groups with suspected myeloma where the prevalence is likely to be high it may be optimal,
22 in terms of both costs and health outcomes to perform this imaging for diagnosis avoiding the
23 need for this additional imaging at the treatment planning stage. Uncertainty remains around
24 whether performing cross-sectional imaging earlier is cost effective and if so which imaging
25 modalities are optimal.

26

A.27 **Existing economic evidence**

28 A systematic literature review was performed to assess the current economic literature for
29 this topic. The review identified 463 possibly relevant economic papers relating to myeloma.
30 Of these, no papers were deemed relevant for this topic and therefore no papers were
31 included in the review of existing economic evidence.

A.32 **De novo economic model**

33 The current economic literature did not adequately address the decision problem; therefore a
34 de novo economic evaluation was created to assess cost effectiveness. All analyses were
35 conducted in Microsoft Excel 2007.

A.3.16 **Aims of analysis**

37 The aim of the economic analysis was to assess the cost effectiveness of skeletal survey
38 compared to whole body CT (WB-CT), MRI spine with plain radiograph of the long bones
39 (MRI spine), whole body MRI (WB-MRI) and PET-CT for diagnosis in secondary care
40 patients with a plasma cell disorder suspected to be myeloma. Bone scans were not

1 considered in the economic model as it was unclear, at this point in time, how they would fit
2 into a clinical pathway for diagnosing myeloma. All analyses were conducted from a National
3 Health Service (NHS) and Personal Social Services (PSS) perspective although in line with
4 the scope of the guideline only diagnosis in a secondary care setting was considered.

A.3.25 Type of analysis

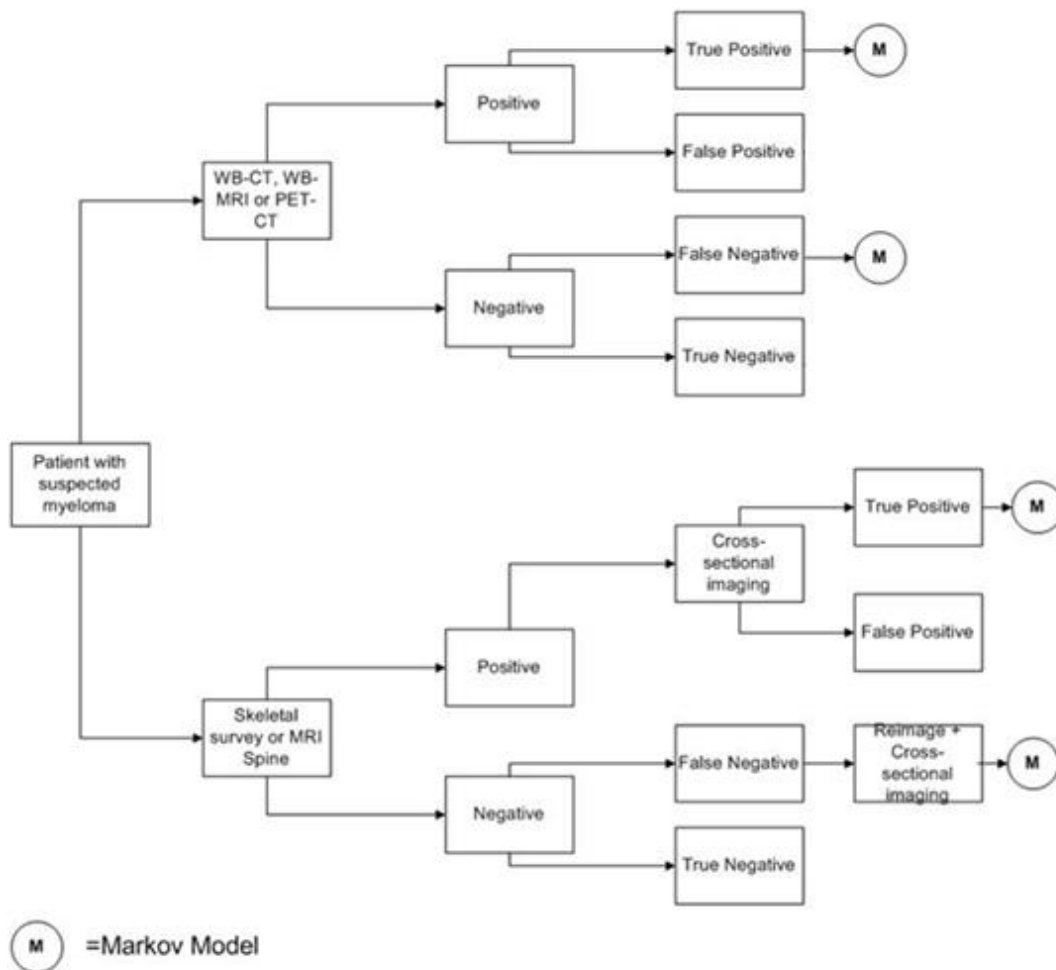
6 A decision tree model was created to estimate the proportion of people correctly diagnosed
7 using each competing imaging strategy. Following the decision tree portion of the model all
8 people with myeloma were assigned to a simple Markov model with two states, alive and
9 dead, with transition probabilities dependent on whether myeloma was correctly diagnosed
10 or not. All people with correct non-myeloma diagnoses (true negatives) and incorrect
11 myeloma diagnoses (false positives) were not followed up after the decision tree component
12 as they are assumed to have equal resource use and quality of life across all interventions
13 after this point. All models were created in Microsoft Excel 2007.

A.3.34 Model structure

15 The economic model considered five potential diagnostic imaging interventions skeletal
16 survey, WB-CT, MRI spine (with plain radiograph of the long bones), WB-MRI and PET-CT.

17 Patients receive either a positive or negative result based upon the diagnostic accuracy of
18 the imaging modality. Following a positive diagnosis decisions need to be made about
19 treatment requiring cross-sectional imaging. Patients in the skeletal survey or MRI spine arm
20 of the model receive cross-sectional imaging to guide treatment decisions, assumed to be
21 WB-CT in the base case, if initial imaging is positive for myeloma. People in the WB-CT, WB-
22 MRI or PET-CT arms are assumed to have received sufficient imaging to be able to make
23 these treatment decisions. Therefore, following positive imaging for myeloma, will receive no
24 further imaging for the purposes of either diagnosis or treatment planning. The structure of
25 the model is shown in Figure 1.

1 **Figure 1: Structure of the economic model**



2

3 Following the initial decision tree portion of the model people with myeloma enter one of
 4 three Markov models based on their time from first symptoms upon entering the model and
 5 whether they received a correct diagnosis or not. Discussion of the alternate Markov models
 6 is presented later.

7 The model assumes that people with myeloma who receive a false negative result from
 8 imaging will receive diagnostic reimaging six months later which would always correctly
 9 diagnose myeloma. All these patients would be entered into the Markov model for diagnosis
 10 after six months of first symptoms.

11 All people receiving chemotherapy treatment whether appropriately or not would have a
 12 decreased quality of life from the adverse events of treatment. It was deemed very unlikely,
 13 given the relatively intensive observation of patients with myeloma that patients falsely
 14 diagnosed would not go on to be correctly diagnosed before active treatment. False positives
 15 were therefore assumed to receive a correct diagnosis at cross-sectional imaging or at a
 16 reimaging six months later. Therefore, the only impact of a false positive diagnosis was an
 17 increase in resource use through additional imaging. As above these people would not be
 18 followed up in the Markov portion of the model. Whilst incorrect diagnoses are likely to lead
 19 to increased anxiety in patients no evidence was identified around their effect on 'quality of
 20 life' and therefore was not explored in the economic model.

A.3.41 Prevalence

2 A systematic review identified no studies reporting on the prevalence of myeloma amongst
 3 people receiving diagnostic imaging for plasma cell disorders suspected to be myeloma.
 4 Prevalence figures therefore had to be estimated from other myeloma populations. For the
 5 base case prevalence figures were taken from 1684 patients at the US Mayo clinic in 2006
 6 with a M protein in the serum or urine. The study estimated that 19.8% had myeloma, 54.7%
 7 monoclonal gammopathy of undetermined significance (MGUS) and the remaining 25.5%
 8 other lymphoproliferative disorders (Kyle & Rajkumar, 2007). Two other similar studies were
 9 identified: one involved 930 cases of m-protein in secondary care in Malmö between 1975
 10 and 1989 (Bird et al., 2009) and one based at a large district general hospital in Italy involved
 11 730 cases over a ten year period from 1973 to 1983 (Malacrida et al. 1987) (Table 1). Both
 12 studies, despite being in a European setting and perhaps more reflective of a UK population,
 13 were over 25 years old and may not match current diagnostic criteria. Both these alternate
 14 prevalence estimates were used as a one-way sensitivity analysis.

15 **Table 1: Summary of estimated prevalence of Myeloma, MGUS and other disorders**
 16 **in imaged population**

| | Myeloma | MGUS | Other |
|-------------------------------|---------|-------|-------|
| USA (Kyle & Rajkumar, 2007) | 19.8% | 54.7% | 25.5% |
| Sweden (Bird et al., 2009) | 19% | 72% | 4% |
| Italy (Malacrida et al. 1987) | 25.6% | 69.6% | 4.8% |

A.3.57 Diagnostic accuracy

18 Eight studies considering interventions included as part of the economic modelling were
 19 identified by the accompanying clinical evidence review (Alexandrakis, et al., 2001; Sohn et
 20 al., 2002; Alper et al., 2003; Zamagni et al., 2007; Myslivecek et al., 2008; Sager et al., 2011;
 21 Cascini et al., 2013; Erten et al., 2007). Two other studies were identified which only covered
 22 interventions outside of those considered in the economic analysis (Catalano et al., 1999;
 23 Svaldi et al., 2001). Evidence was found on all included interventions apart from WB-CT.

24 The evidence assessed using QUADAS-2 was of moderate to low quality. The risk of bias in
 25 the included studies was generally low or unclear due to underreporting with regards to the
 26 timing and blinding of the index and reference tests. There was great uncertainty in the
 27 patient selection methods as many studies did not report this and it was unclear whether a
 28 consecutive or random sample of patients had been recruited and if inappropriate exclusions
 29 had been avoided. It was therefore impossible to tell how representative they are of the
 30 patient group that would be seen in NHS practise. Some studies were highlighted as having
 31 a high risk of bias in the patient selection category as the population did not include a control
 32 group (i.e. negative reference standard results) meaning that the specificity of the test could
 33 not be determined. The reviewer highlighted to the Guideline Committee (GC) that only 4 of
 34 the 10 included studies included negative cases (not myeloma) to determine specificity. This
 35 again implies that the patient populations are not generalisable given that the majority of
 36 cases seen during diagnosis would be negative for myeloma. It also makes it unclear
 37 whether studies which reported a high sensitivity did so at the expense of a lower specificity
 38 and consequently more false positives.

39 Given these issues with the included evidence, especially the issues of applicability, patient
 40 selection and lack of negative cases in the patient cohorts the GC found it difficult to give
 41 weight to the values reported in the evidence review and to estimate values for inclusion in
 42 the economic model. This was particularly true around values of specificity. The base case
 43 values used in the economic model (Table 2), whilst based on the evidence review where
 44 possible are intended to be illustrative and not an estimate or ranking of the diagnostic

- 1 accuracy of the different imaging modalities. From the GC's clinical experience and
- 2 supported somewhat by low quality evidence MRI was assumed to be the most
- 3 diagnostically accurate, in terms of both sensitivity and specificity.

4 **Table 2: Sensitivity and specificity used in the base case economic model**

| | Sensitivity | Specificity | Source (Sensitivity, Specificity) |
|-----------------|--------------------|--------------------|--|
| Skeletal Survey | 64% | 50% | Sohn, Illustrative value |
| WB-CT | 94% | 94% | Illustrative value, Illustrative value |
| MRI spine | 93% | 95% | Myslivecek, Illustrative value |
| WB-MRI | 100% | 95% | Cascini, Illustrative value |
| PET-CT | 90% | 35% | Sager, Zamagni |

5 Given the lack of or weak evidence around the diagnostic accuracy estimates they were
6 extensively explored during sensitivity analysis. Sensitivity and specificity were also assigned
7 a wide, uninformative uniform distribution, between 50% and 100% during probabilistic
8 sensitivity analysis. This was deemed sufficient to cover all potential sensitivity and specificity
9 values based on the GCs clinical experience. As this range was at odds with the only value
10 of specificity reported for PET-CT in the evidence review the diagnostic accuracy of this
11 intervention was explored during a separate deterministic sensitivity analysis varying both
12 sensitivity and specificity between 0% and 100%. As insufficient evidence on specificity was
13 identified to estimate the trade-off between sensitivity and specificity both were considered
14 as independent variables in all sensitivity analyses with no covariance assigned between
15 them.

16 Whilst the GC's clinical experience considered both MRI and WB-CT to have a higher
17 sensitivity than skeletal survey it was deemed inappropriate, given the absence of robust
18 evidence, to give either narrower or more favourable distributions during the PSA. It should
19 be noted though that if WB-CT and MRI are more diagnostically accurate the PSA would
20 represent a conservative estimate for the cost effectiveness of both interventions.

A.3.61 Population demographics

22 The age and sex of our modelled cohort was likely to be similar to that reported in the
23 Kariyawasan et al (2007) study used for the clinical inputs in the model described in detail
24 below (Kariyawasan et al. 2007). The study, based at one myeloma centre in London, UK
25 estimated an average age of 65 years and was 58.3% male. No evidence was identified that
26 the accuracy of diagnosis or quality of life differed by age or sex. Furthermore all patients in
27 the cohort followed up in the Markov model would have myeloma for the remainder of their
28 lives. Therefore, general population survival and quality of life were not used in the model.
29 The sex and age of the cohort therefore have no influence on the outcome of the economic
30 evaluation and are intended to be illustrative of the likely population cohort in the UK. As
31 these demographics were not linked to the results it was futile to alter these during sensitivity
32 analysis.

A.3.73 Clinical inputs

34 The accompanying evidence review did not identify any papers that reported clinical
35 outcomes from differing imaging strategy. The link between diagnostic accuracy and clinical
36 outcomes and quality of life therefore had to be modelled.

37 A systematic review identified two studies which linked time to diagnosis to survival and
38 myeloma related complications (Friese et al., 2009; Kariyawasan et al., 2007). Kariyawasan
39 et al (2007) investigated the relationship between time to diagnosis of myeloma and number
40 of complications and survival. Kariyawasan et al (2007) was a retrospective study of 92
41 patients with myeloma who attended one London based myeloma centre between 2001 and

1 2006. Patients' medical records were analysed to look at time of first symptom, time of
 2 diagnosis, complications at time of diagnosis and presenting physician. The study concluded
 3 that time to diagnosis predicted both the number of complications and disease free survival
 4 of people with myeloma.

5 Friese et al (2009) was a US retrospective study of 5483 patients diagnosed with myeloma
 6 from the Surveillance, Epidemiology and End Results programme (SEERs). The study used
 7 this retrospective data to look at the time between anaemia or back pain symptoms and
 8 myeloma diagnosis. The study again estimated the relationship between time to diagnosis
 9 and complications. The study did not consider overall or disease free survival. The study
 10 concluded that time to diagnosis did not predict outcomes in patients with myeloma (OR 0.9,
 11 CI 0.8-1.1)

12 In the base case economic model outcomes from Kariyawasan et al (2007) were used. Even
 13 though the study size was significantly smaller than Friese et al (2009) the patient group and
 14 treatment pathway was more likely to be reflective of that in the NHS. A sensitivity analysis
 15 was performed that assumed there was no improvement in patient outcomes from prompt
 16 diagnosis (a de-facto cost-minimisation analysis) to investigate the robustness of the results
 17 to these differing conclusions.

18 Kariyawasan et al (2007) grouped time from first symptoms to diagnosis into three groups 0-
 19 3 months, 3-6 months and greater than 6 months. The outcomes from these groupings were
 20 used to inform the Markov models. Some patients presenting in secondary care for imaging
 21 for suspected myeloma would already have a delay between first symptoms and diagnosis.
 22 Patients were therefore assigned a time since first symptom before entering the decision tree
 23 portion of the model and were not all assumed to start at 0-3 months. Kariyawasan et al
 24 (2007) reported presenting physician and time since first symptom. The model used data
 25 from those initially presenting at GP as this group represents where the majority of patients
 26 will be referred from in practise and is exclusively outside of secondary care, making
 27 diagnostic imaging one of the first interventions in secondary care. The proportion of patients
 28 in each group is reported in Table 3.

29 The model assumed that the time between first symptom and diagnosis in people with a
 30 correct diagnosis would be identical to the time between first symptom and presentation (i.e.
 31 diagnosis would be made shortly after presentation in secondary care) and would enter the
 32 Markov model corresponding to this. People with a false non-myeloma diagnosis were
 33 assumed to have an additional 6 months until diagnosis and would always enter the 'greater
 34 than 6 months' Markov model. Table 3 shows the Markov model entered by time from first
 35 symptom at presentation in secondary care and the results of diagnostic imaging.

36 **Table 3: Time from first symptom to presentation and Markov pathway following**
 37 **diagnostic result**

| Time from first symptoms to presentation | Proportion of model cohort on entry | Markov entered True Positive Result | Markov entered False Negative result |
|--|-------------------------------------|-------------------------------------|--------------------------------------|
| 0-3 months | 21.6% | 0-3 months | >6 months |
| 3-6 Months | 21.6% | 3-6 Months | >6 months |
| >6 months | 56.9% | >6 months | >6 months |

A.3.88 Complications

39 Complication rates used in the model were identical to those reported in Kariyawasan et al.
 40 (2007). Kariyawasan et al (2007) reported five different types of complications: infection,
 41 neurological, renal disease, bone disease and anaemia (Table 4). Complication rates were
 42 significantly higher in the 'greater than 6 months' group than for the 'less than 3 months' and
 43 '3-6 month' groups. All patients in the 'greater than 6 months' reported at least one of these

- 1 five complications at presentation with only 61% in the 'less than 3 months group'.
- 2 Complications were assigned to the cohort, based on the time from first symptoms to
- 3 diagnosis, before entering the Markov portion of the model.

4 **Table 4: Proportion of complications at presentation for time from first symptoms to**
5 **diagnosis**

| Complication | Time from first symptoms to diagnosis | | |
|---------------|---------------------------------------|------------|-----------|
| | 0-3 Months | 3-6 Months | >6 Months |
| Infection | 7.1% | 4.8% | 11.6% |
| Neurological | 10.7% | 4.8% | 7.0% |
| Renal Disease | 21.4% | 19.1% | 55.8% |
| Bone Disease | 25.0% | 38.1% | 62.8% |
| Anaemia | 7.1% | 38.1% | 93.0% |

A.3.96 Health-related quality of life

7 Health related quality of life values used in the model were taken from one mapping study
8 (Proskorovsky et al., 2014) reporting values collected during one consecutive patient cohort
9 study (Jordan et al., 2014). Proskorovsky et al (2014) used health related quality of life
10 (HRQoL) data collected from 154 patients with a current diagnosis of myeloma presenting for
11 routine care at five UK and six German sites. Patients who had received either an autograft
12 transplantation or an innovative myeloma treatment in the last three months were excluded.
13 The cohort was 63% male and had a mean age of 66 years almost identical to that assumed
14 as the cohort for the economic model.

15 Three quality of life instruments were completed by participants. The EORTC QLQ-C30,
16 EORTC QLQ-MY30 (a myeloma specific supplement to the QLQ-30) and the EQ-5D. As the
17 EQ-5D with UK general population preference weights is NICE's preferred valuation method
18 for HRQoL in adults (National Institute for Health and Care Excellence, 2014) these were the
19 only values used in the economic model. The EQ-5D is a self administered questionnaire
20 made up of five dimensions (self-care, mobility, pain, usual activity and anxiety/depression)
21 consisting of three levels of severity ('extreme', 'some' and 'none'). These responses were
22 converted into one summary measure using UK general population preference weights. The
23 measure could theoretically return utility values between -0.594 to 1 (representing perfect
24 health).

25 Proskorovsky et al (2014) reported their utility values for four groups: Asymptomatic, Mildly
26 Symptomatic, Moderately Symptomatic and Severely Symptomatic based on the number and
27 the severity of the symptoms reported. Summary of the utility values and the definition for
28 each grouping is presented in Table 5. For the economic model people with no complications
29 reported had a utility value equal to that of the asymptomatic group and those presenting
30 with any complication had a utility value equal to that of the moderately symptomatic group.
31 A deterministic sensitivity analysis tested the alternate assumption of using asymptomatic
32 and severely symptomatic and the mildly and moderately symptomatic values for the 'no
33 complications' and complications groups respectively.

34 **Table 5: Symptom level and reported utility value**

| Symptom Level | Definition | Utility Value |
|------------------------|--|---------------|
| Asymptomatic | Patient had no symptoms/AEs | 0.923 |
| Mildly Symptomatic | ≥1 mild symptom/AE no moderate or severe symptoms/AE | 0.806 |
| Moderately Symptomatic | ≥1 moderate symptom/AE no severe symptoms/AE | 0.675 |
| Severely Symptomatic | ≥1 severe symptom/AE | 0.501 |

35 AE: Adverse Event

A.3.101 Overall survival

2 Survival for the three Markov models was based on an annual probability of survival based
 3 on the person's Durie-Salmon stage of myeloma at the time of diagnosis, disaggregated
 4 again by time from first symptoms to diagnosis, reported in Kariyawan et al (2007) (Table
 5 6).

6 **Table 6: Percentage of cohort in each Durie-Salmon stage by time between first**
 7 **symptom and diagnosis**

| Time from first symptoms to diagnosis | Durie-Salmon Stage | | | | | |
|---------------------------------------|--------------------|----|-----|-----|-----|-----|
| | 1a | 1b | 2a | 2b | 3a | 3b |
| 0-3 Months | 42% | 4% | 36% | 11% | 4% | 4% |
| 3-6 Months | 38% | 0% | 38% | 10% | 14% | 0% |
| >6 Months | 14% | 2% | 33% | 21% | 19% | 10% |

8 The annual probability of survival for each stage was based on one retrospective study of the
 9 clinical and laboratory data of 10,750 previously untreated people with myeloma from 17
 10 institutions including centres in Europe and North America between 1981 and 2002 (Greipp
 11 et al., 2005). As part of developing an updated staging system the study reported median
 12 survival for each Durie-Salmon stage. These median values were converted to annual
 13 probabilities of survival using standard conversion formulas. The probabilities were assumed
 14 to remain constant across all years of the economic model.

15 The Greipp et al (2005) study finds the lowest median survival amongst Durie-Salmon stage
 16 1b patients reporting a lower median survival than for both stage 2b and 3b. This is most
 17 likely as a result of low numbers of stage 1b patients in the study population (n=27). Stage 1b
 18 also make ups only a small proportion of patients in the economic model (<3%) and these
 19 counterintuitive inputs are likely to have little influence on outcomes. Median survival and
 20 annual probabilities of survival are reported in Table 7.

21 This data predates the use of immunomodulatory drugs (IMiDs) and proteasome inhibitors
 22 (PIs) in the treatment of myeloma which have led to survival significantly improving in
 23 patients. Given that more contemporary survival data, grouped by stage, was not identified
 24 by the accompanying evidence search a sensitivity analysis was performed for a 10%, 25%
 25 and 50% improvement in overall survival to test the robustness of the results to differing
 26 assumptions around survival.

27 **Table 7: Estimates of median and annual probability of survival used in the economic**
 28 **model**

| Durie-Salmon Stage | Median Survival (Months) | Annual Probability Survival |
|--------------------|--------------------------|-----------------------------|
| 1a | 69 | 88.6% |
| 1b | 22 | 68.5% |
| 2a | 58 | 86.6% |
| 2b | 34 | 78.3% |
| 3a | 45 | 83.1% |
| 3b | 24 | 70.7% |

29 The Markov models and thus the economic model as a whole had a time horizon of 10 years.
 30 This was considered sufficient to cover all significant differences in costs and quality of life
 31 between the different imaging modalities.

A.3.111 Radiation burden

2 Increased exposure to radiation from WB-CT scans has been associated with an increased
 3 risk of lifetime cancer attributable to imaging (Smith-Bindman et al., 2009). It was estimated
 4 that one whole body CT would increase the risk of lifetime cancer by 0.04% per scan over a
 5 5 year period. Given the difficulties in modelling cancer attributable to imaging, quality of life
 6 detriments and costs as a result of increased exposure to radiation these were not explicitly
 7 considered in the economic model. An increased incidence of cancer attributable to imaging
 8 would weigh against some imaging modalities in the economic evaluation.

A.3.129 Costs**A.3.12.10 Imaging costs**

11 The costs of the differing imaging modalities were taken from NHS reference costs apart
 12 from skeletal survey for which reference costs were not reported (Table 8). Skeletal survey
 13 costs were taken from internal recharge costs used in one UK myeloma centre. (King's
 14 College Hospital, personal communication, April 4, 2015) Whilst the NHS reference costs
 15 gave a value for MRI spine this did not include the additional long bone radiographs needed
 16 for myeloma diagnosis. In the absence of cost evidence around this it was estimated by the
 17 GC that the additional cost would be half that of skeletal survey. The GC also felt that the
 18 NHS reference costs might not be fully reflective of the true cost of imaging given differences
 19 in myeloma imaging compared to other haematological conditions. Therefore a deterministic
 20 sensitivity analysis was performed using internal recharge costs from the one UK myeloma
 21 centre for imaging costs. (The 50% assumption around long bone radiography remained
 22 during this sensitivity analysis).

23 **Table 8: Imaging costs used in the base case analysis and probabilistic sensitivity**
 24 **analysis**

| | Reference Cost | Source | PSA | Internal recharge Cost |
|------------------|----------------|--|---------------------------------------|------------------------|
| Skeletal Survey | £108.82 | Internal recharge (Personal correspondence) | Triangular(£54,163) | £108.82 |
| CT(Whole body) | £147.17 | NHS Reference Costs | Gamma($\alpha=8.2$, $\beta=17.9$) | £149.05 |
| MRI (Spine) | £199.01 | NHS Reference Costs+50% cost Skeletal Survey | Gamma($\alpha=17.8$, $\beta=11.2$) | £115.08 |
| MRI (Whole Body) | £203.06 | NHS Reference Costs | Gamma($\alpha=10.0$, $\beta=20.2$) | £209.28 |
| PET-CT | £651.96 | NHS Reference Costs | Gamma($\alpha=7.0$, $\beta=92.7$) | £397.77 |

A.3.12.21 Appointment costs

2 All appointment costs were taken from NHS reference costs. The initial appointment costs for
 3 diagnosis of myeloma were assumed equal to one 'consultant led non-admitted first
 4 appointment' in clinical haematology. Appointment costs for a repeat screening following a
 5 false negative or for cross-sectional imaging following a positive result with either skeletal
 6 survey or MRI spine were assumed to be equal to that of one 'consultant led non-admitted
 7 follow-up appointment' in clinical haematology (Table 9).

A.3.12.38 Complication costs

9 It was assumed that the complications encountered at the time of diagnosis would be treated
 10 as part of general treatment for myeloma. The cohort were unlikely therefore to experience
 11 additional treatment, medical appointments or other resource use as a result of these
 12 complications. With a lack of evidence around costs associated with these complications it
 13 was assumed that they would result in one additional consultant led appointment cost as
 14 'consultant led non-admitted follow-up appointment'. These complication costs were explored
 15 during probabilistic sensitivity analysis (Table 9).

16 **Table 9: Other costs used in the base case analysis and probabilistic sensitivity**
 17 **analysis**

| | Cost | Source | PSA |
|-------------------------|---------|---------------------|--------------------------------------|
| First Appointment | £212.83 | NHS Reference Costs | Gamma($\alpha=5.3$, $\beta=40.2$) |
| Subsequent Appointments | £156.41 | NHS Reference Costs | Gamma($\alpha=5.8$, $\beta=27.1$) |
| Complication Costs | £156.41 | NHS Reference Costs | Gamma($\alpha=5.8$, $\beta=27.1$) |

A.3.12.48 Resource use associated with treatment of myeloma

19 Management for myeloma can potentially lead to great resource use especially when novel
 20 treatments and transplantation are used. The accompanying evidence review found no
 21 evidence that resource use differed, post diagnosis by either modality used or time from first
 22 symptoms to diagnosis. The GC's own clinical experience suggested that neither of these
 23 factors would lead to any significant difference in resource use even if expensive
 24 management strategies were being used. The GC felt even if there was a difference as a
 25 result of imaging modality or time from first symptoms to diagnosis it would be difficult to
 26 estimate the size and direction of that difference. Earlier diagnosis may lead to somewhat
 27 improved long-term outcomes but this may also result in more lines of novel treatments. The
 28 reverse could also be true that those with worse outcomes end up using a greater amount of
 29 resources given their greater need for treatment for major complications and for palliative
 30 care. With an equipoise around the management associated resource use it was assumed
 31 that they would be equal between all imaging modality. Thus management costs, post
 32 treatment for complications at diagnosis, were assumed to be equal between all interventions
 33 in the economic analysis and were therefore not considered.

34 All costs in the economic model were already at 2014 prices, the latest for which inflation
 35 figures were available. Therefore it was unnecessary to inflate any costs.

A.3.12.56 Discounting

37 All costs and QALYs were discounted at 3.5% per annum as recommended by the NICE
 38 Guidelines Manual (National Institute for Health and Care Excellence, 2014).

A.3.131 Sensitivity analysis

2 For the base case analyses a range of deterministic and threshold sensitivity analyses were
 3 conducted to test the robustness of the results of the economic analysis to different input
 4 parameters. PSA was also conducted around the base case to assess the combined
 5 parameter uncertainty in the model. In this analysis, the base case values that are utilised in
 6 the base case are replaced with values drawn from probability distributions.

A.3.147 Incremental net monetary benefit

8 All results are presented as incremental net monetary benefit (INMB). INMB is a
 9 representation of cost effectiveness where incremental QALY gains, compared to the
 10 comparator intervention, are converted into a monetary value by multiplying by a willingness
 11 to pay per QALY. For example if an intervention had a QALY gain of 0.5 compared to the
 12 comparator and the willingness to pay per QALY was £20,000, the monetary value of the
 13 QALY gain would equal £10,000. INMB is then calculated by subtracting total incremental
 14 cost from this monetary value of a QALY. For our analysis the 'willingness to pay' per QALY
 15 is equal to £20,000, NICE's conventional threshold, unless otherwise stated. Interventions
 16 which report a positive INMB are cost effective compared to the comparator with those
 17 reporting a negative value not being cost effective. The 'preferred' intervention would be the
 18 one which reports the highest INMB.

A.3.159 Results

A.3.15.20 Deterministic base case results

21 Table 10 shows the base case results for the different imaging modalities. WB-CT, MRI spine
 22 and WB-MRI are cost effective when compared to skeletal survey alone with them all being
 23 cost saving and health improving. WB-MRI showed the largest rise in incremental QALYs
 24 although this was directly as a result of it being illustratively assigned the highest sensitivity.
 25 WB-CT had the highest INMB although it was only marginally higher than that of WB-MRI.
 26 PET-CT was the only intervention to report a negative INMB. Table 10 shows the base case
 27 results for the different imaging modalities. WB-CT, MRI spine and WB-MRI are cost
 28 effective when compared to skeletal survey alone with them all being cost saving and health
 29 improving. WB-MRI showed the largest rise in incremental QALYs although this was directly
 30 as a result of it being illustratively assigned the highest sensitivity. WB-CT had the highest
 31 NMB although it was only marginally higher than that of WB-MRI. PET-CT was the only
 32 intervention to report a negative NMB.

33 **Table 10: Deterministic base case results for a willingness to pay of £20,000 per QALY**

| | Incremental Cost | Incremental QALYs | INMB |
|-----------------|------------------|-------------------|-----------|
| Skeletal Survey | Reference | Reference | Reference |
| WB-CT | -£ 142.40 | 0.0119 | £ 379.49 |
| MRI spine | -£ 33.39 | 0.0115 | £ 262.57 |
| WB-MRI | -£ 92.06 | 0.0142 | £ 376.56 |
| PET-CT | £ 792.85 | 0.0103 | -£ 587.37 |

34 These results were consistent when the other two estimates of prevalence were used. The
 35 estimate with the largest proportion of myeloma patients gave the highest values of INMB for
 36 the cross-sectional imaging approaches although the INMB of PET-CT remained negative
 37 (Table 11). This was true for the other two prevalence estimates of myeloma and WB-CT and
 38 WB-MRI remained cost saving and health improving. This is as a result of the large number
 39 of repeat visits given the low specificity of skeletal survey although this assumption is
 40 explored later. The prevalence of myeloma needed for the INMB of WB-MRI to remain

- 1 positive is 7% and 10% when a sensitivity/specificity are both assumed to be 80% and 90%
 2 respectively. Similar values were found for WB-CT.

3 Table 11: Incremental net monetary benefit under differing prevalence levels

| | USA (Kyle & Rajkumar, 2007) | Sweden (Bird et al., 2009) | Italy (Malacrida et al. 1987) |
|--------------------|-----------------------------|----------------------------|-------------------------------|
| Prevalence Myeloma | 19.8% | 19% | 25.6% |
| Skeletal Survey | Reference | Reference | Reference |
| WB-CT | £ 379.49 | £ 368.36 | £ 463.23 |
| MRI spine | £ 262.57 | £ 254.11 | £ 326.26 |
| WB-MRI | £ 376.56 | £ 363.37 | £ 475.84 |
| PET-CT | -£ 587.37 | -£ 600.27 | -£ 490.32 |

A.3.15.24 Probabilistic base case results

- 5 The probabilistic base case results are shown in Table 12. The probabilistic results use the
 6 mean values of the 10,000 iterations of the PSA. As the diagnostic accuracy of all imaging
 7 modalities were given an identical distribution during the PSA, the average diagnostic
 8 accuracy for all interventions would be identical over a large number of iterations.
 9 Consequently as a result there would be no difference in QALYs between modalities and the
 10 incremental QALYs would be equal to zero. Therefore only incremental costs were reported.
 11 In our probabilistic results the strategy of WB-CT ends up being the least costly option
 12 followed by skeletal survey, WB-MRI and MRI spine. This is also a de facto cost minimisation
 13 and shows WB-CT as a preferred option when we assume promptness of diagnosis has no
 14 impact on health outcomes as reported in Friese et al. (2009).

15 Table 12: Probabilistic base case results

| | Incremental Cost |
|-----------------|------------------|
| Skeletal Survey | Reference |
| WB-CT | -£ 10.96 |
| MRI spine | £ 93.84 |
| WB-MRI | £ 60.61 |
| PET-CT | £ 639.84 |

A.3.166 Sensitivity/specificity

- 17 The GC expressed difficulty estimating diagnostic accuracy values for the different imaging
 18 modalities. A range of sensitivity analyses were therefore carried out to test the robustness of
 19 any conclusions to these parameters. As there was particular difficulty in estimating
 20 specificities for the interventions, especially as studies in the accompanying evidence review
 21 often did not report this, a sensitivity analysis was performed assuming an arbitrary
 22 specificity (80%) for all imaging interventions. All other values were identical to the base
 23 case. Two other sensitivity analyses were performed, one assuming 80% sensitivity across
 24 all imaging modalities and one assuming both 80% sensitivity and specificity (Table 13).
 25 When 80% specificity is assumed in all interventions then the ranking of interventions
 26 remains the same with WB-CT remaining the preferred option. Similar results are seen for
 27 80% sensitivity although WB-CT remained the preferred option. When 80% sensitivity and
 28 specificity is assumed for all interventions there will be no difference in QALYs between
 29 interventions so the preferred option will also always be the least costly. In this analysis WB-
 30 CT was the preferred option. Whilst the GC acknowledge there was a paucity of evidence
 31 around diagnostic accuracy it was unlikely that skeletal survey would have sensitivity and
 32 specificity equal to WB-CT and WB-MRI and that these sensitivity analyses give a favourable
 33 estimate around skeletal survey. The conclusions were identical when both 60% and 100%

- 1 specificities were used. Whilst these results were explicitly arbitrary they provided a starting
 2 point for threshold sensitivity analysis presented below (Table 13).
- 3 Assuming a starting point of perfect diagnostic accuracy if skeletal survey had sensitivity less
 4 than 4 percentage points or a specificity less than 12 percentage points of that of WB-CT
 5 then WB-CT became both cost saving and health improving. For the same to be true of MRI
 6 these values needed to be 5 percentage points and 15 percentage point respectively. Higher
 7 values were needed for the same to be true of MRI spine although it never became the
 8 preferred option over either WB-CT or WB-MRI. PET-CT was never preferred to skeletal
 9 survey, or any of the other intervention, for any values of diagnostic accuracy. These
 10 conclusions were not sensitive to the starting point in terms of sensitivity and specificity with
 11 the results being consistent for all starting values of sensitivity and specificity.

12 **Table 13: Incremental net monetary benefit around different sensitivity and specificity**
 13 **assumptions**

| | Sensitivity | | | Specificity | | | Both= | | |
|-----------------|-------------|-------|-------|-------------|-------|-------|-------|-------|-------|
| | 80% | 60% | 100% | 80% | 60% | 100% | 80% | 60% | 100% |
| Skeletal Survey | Ref | Ref | Ref | Ref | Ref | Ref | Ref | Ref | Ref |
| WB-CT | £122 | £114 | £129 | £272 | £272 | £272 | £14 | £7 | £22 |
| MRI Spine | £16 | £12 | £19 | £153 | £153 | £153 | -£94 | -£97 | -£90 |
| WB-MRI | £61 | £50 | £73 | £260 | £251 | £269 | -£55 | -£76 | -£34 |
| PET-CT | -£830 | -£877 | -£783 | -£369 | -£450 | -£288 | -£611 | -£740 | -£483 |

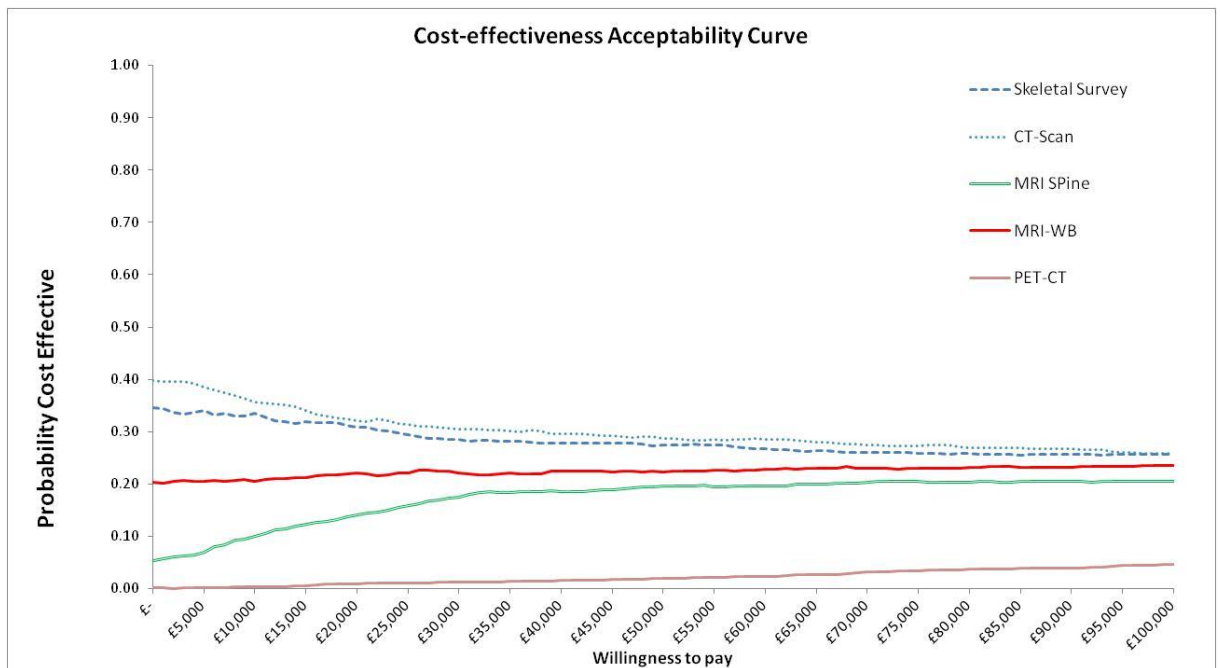
A.3.174 Utility values and survival

- 15 The use of alternate methods of estimating the utility values did not change the conclusions
 16 of the analysis. Given the large uncertainty around the diagnostic accuracy of the imaging
 17 modalities even with perfect information around these utilities there would still be
 18 considerable uncertainty around the QALY outcomes in the economic model. The same was
 19 true for survival with improvements in survival increasing the INMB of all cross sectional
 20 imaging approaches in the base-case. As the difference in QALYs were assumed to be zero
 21 in the probabilistic analysis neither of these sensitivity analyses influenced these results.

A.3.182 Probabilistic sensitivity analysis

- 23 It can be seen from the cost effective acceptability curve (Figure 2) that WB-CT remains the
 24 most likely preferred option for all willingness to pay values up to £100,000 followed closely
 25 by skeletal survey. At £20,000 per QALY there is a 32% probability that WB-CT is the
 26 preferred option closely followed by skeletal survey (31%). MRI spine and PET-CT only
 27 become the most probable preferred option for values significantly exceeding the NICE
 28 threshold of £20,000. Even at a zero willingness to pay threshold, where the least costly
 29 option is preferred, WB-CT still remains the preferred option in 40% of iterations. Given that
 30 the diagnostic accuracy of all interventions were given an identical distribution during PSA,
 31 for an infinite willingness to pay, all interventions had an equal probability of being the
 32 preferred option.

1 **Figure 2: Cost effectiveness acceptability curve**

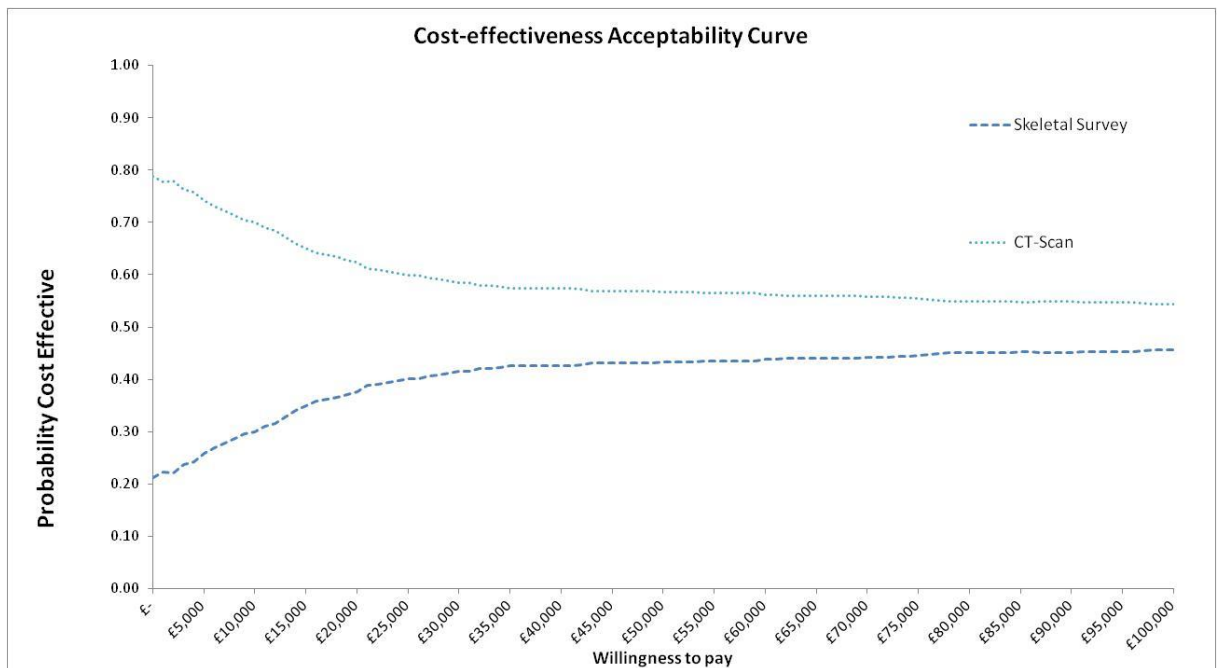


2

3 When the values during an iteration of the PSA are favourable to cross-sectional imaging
 4 approach then one of three options (WB-CT, MRI and PET-CT) would be preferred
 5 compared to two options (skeletal survey and MRI Spine) for when the iterations are
 6 unfavourable. This could potentially underestimate the true cost effectiveness of a cross-
 7 sectional approach by 'diluting' the results across three interventions. Therefore, the CEAC
 8 analysis was re-run to just compare WB-CT (Figure 3) and WB-MRI (Figure 4) to skeletal
 9 survey.

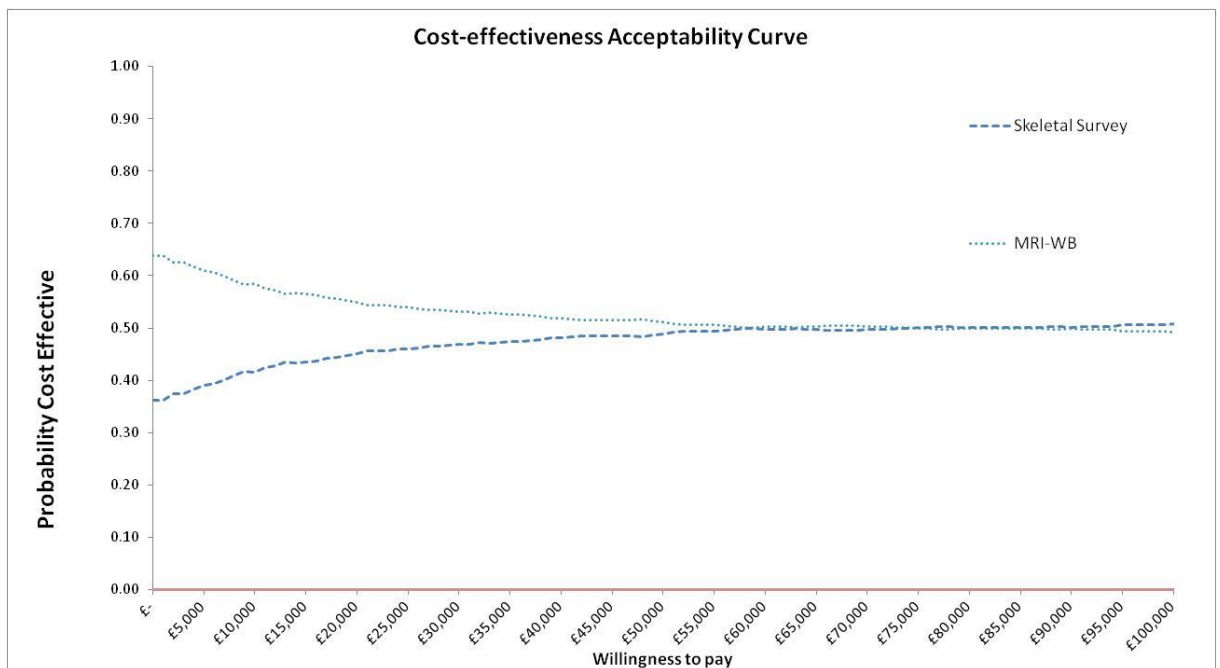
10 Under these direct comparisons both WB-CT and WB-MRI were the preferred option when
 11 compared to skeletal survey both for a willingness to pay of £20,000 and £0 (where the least
 12 costly option is preferred). Again as the diagnostic accuracy of the imaging modalities have
 13 identical distributions during PSA the probability of being the preferred option is identical
 14 across all interventions at an infinite willingness to pay.

1 **Figure 3: Cost effectiveness acceptability curve: WB-CT versus skeletal survey**



2

3 **Figure 4: Cost effectiveness acceptability curve: WB-MRI versus skeletal survey**



4

A.3.195 Conclusion

6 Even under the very conservative assumption that there is no difference in diagnostic
 7 accuracy between the different imaging modalities there is a strong case that an approach of
 8 using cross-sectional imaging at the time of diagnosis is a cost effective strategy for
 9 diagnosis in patients with a plasma cell disorder suspected to be myeloma. The main driver
 10 of this result appears to be the avoidance of the need for further cross-sectional imaging to
 11 guide treatment decisions, following a positive result on skeletal survey. Even under these
 12 conservative assumptions this approach could be both cost saving and health improving
 13 even with the use of WB-CT or WB-MRI being the preferred option in greater than 50% of
 14 cases even when the health provider’s willingness to pay per QALY is zero. The case

1 becomes stronger when the cross-sectional imaging starts to have a higher diagnostic
2 accuracy than skeletal survey with the illustrative base case values again suggesting an
3 approach using either WB-CT or WB-MRI could be cost saving and health improving. It is
4 unclear which is the most cost-effective between WB-CT and WB-MRI given a paucity of
5 good evidence around diagnostic accuracy and the decision sensitivity to differences in
6 diagnostic accuracy between both. Whilst it was the GCs opinion that MRI was the most
7 sensitive of the considered imaging modalities it was difficult to quantify by exactly how
8 much, if at all, without higher quality evidence.

9 These conclusions do not hold true for lower prevalences of myeloma where the number of
10 subsequent cross-sectional imaging following skeletal survey is likely to be much lower. The
11 WB-CT or WB-MRI imaging is therefore very unlikely to be cost effective as a general
12 screening tool for all paraproteinaemias and it is important that the patient population is
13 carefully defined. A looser definition and therefore a lower prevalence amongst the imaged
14 population could lead to harm through increased radiation burden and through inefficiently
15 allocated resources.

16 **References**

- 17 Alexandrakis MG, Kyriakou DS, Passam F, et al., (2001). Value of Tc-99m sestamibi
18 scintigraphy in the detection of bone lesions in multiple myeloma: comparison with Tc-99m
19 methylene diphosphonate. *Annals of Hematology*, 80, 349-353.
- 20 Alper E, Gurel M, Evrensel T, et al. (2003). 99mTc-MIBI scintigraphy in untreated stage III
21 multiple myeloma: comparison with X-ray skeletal survey and bone scintigraphy. *Nuclear*
22 *Medicine Communications*, 24, 537-542.
- 23 Bird J, Behrens J, Westin J, et al. (2009). UK Myeloma Forum (UKMF) and Nordic Myeloma
24 Study Group (NMSG): guidelines for the investigation of newly detected MGÇÉproteins and
25 the management of monoclonal gammopathy of undetermined significance (MGUS). *British*
26 *journal of haematology*, 147, 22-42.
- 27 Cascini GL, Falcone C, Console D, et al. (2013). Whole-body MRI and PET/CT in multiple
28 myeloma patients during staging and after treatment: personal experience in a longitudinal
29 study. *Radiologia Medica*, 118, 930-948.
- 30 Catalano L, Pace L, Califano C, et al. (1999). Detection of focal myeloma lesions by
31 technetium-99m-sestaMIBI scintigraphy. *Haematologica*, 84, 119-124.
- 32 Erten N, Saka B, Berberoglu K, et al. (2007). Technetium-99m 2-methoxy-isobutyl-isonitrile
33 uptake scintigraphy in detection of the bone marrow infiltration in multiple myeloma:
34 correlation with MRI and other prognostic factors. *Annals of Hematology*, 86, 805-813.
- 35 Friese CR, Abel GA, Magazu LS, et al. (2009). Diagnostic delay and complications for older
36 adults with multiple myeloma. *Leukemia & lymphoma*, 50, 392-400.
- 37 Greipp PR, San Miguel J, Durie BG, et al. (2005). International staging system for multiple
38 myeloma. *Journal of Clinical Oncology*, 23, 3412-3420.
- 39 Jordan K, Proskorovsky I, Lewis P, et al. (2014). Effect of general symptom level, specific
40 adverse events, treatment patterns, and patient characteristics on health-related quality of
41 life in patients with multiple myeloma: results of a European, multicenter cohort study.
42 *Supportive Care in Cancer*, 22, 417-426.
- 43 Kariyawan CC, Hughes DA, Jayatillake MM, et al. (2007). Multiple myeloma: causes and
44 consequences of delay in diagnosis. *QJM*, 100, 635-640.

- 1 Kyle RA & Rajkumar SV (2007). Monoclonal gammopathy of undetermined significance and
2 smouldering multiple myeloma: emphasis on risk factors for progression. *British journal of*
3 *haematology*, 139, 730-743.
- 4 Malacrida VITT, De Francesco D, Banfi G, et al. (1987). Laboratory investigation of
5 monoclonal gammopathy during 10 years of screening in a general hospital. *Journal of*
6 *clinical pathology*, 40, 793-797.
- 7 Myslivecek M, Nekula J, Bacovsky J, et al (2008). Multiple myeloma: predictive value of Tc-
8 99m MIBI scintigraphy and MRI in its diagnosis and therapy. *Nuclear Medicine Review*, 11,
9 12-16.
- 10 National Institute for Health and Care Excellence (2014). The guidelines manual. London:
11 NICE: 2014. National Institute for Clinical Excellence, 13, 4-2007.
- 12 Proskorovsky I, Lewis P, Williams CD, et al. (2014). Mapping EORTC QLQ-C30 and QLQ-
13 MY20 to EQ-5D in patients with multiple myeloma. *Health and quality of life outcomes*, 12,
14 35.
- 15 Sager S, Ergul N, Ciftci H, et al (2011). The value of FDG PET/CT in the initial staging and
16 bone marrow involvement of patients with multiple myeloma. *Skeletal Radiology*, 40, 843-
17 847.
- 18 Smith-Bindman R, Lipson J, Marcus R, et al. (2009). Radiation dose associated with
19 common computed tomography examinations and the associated lifetime attributable risk of
20 cancer. *Archives of internal medicine*, 169, 2078-2086.
- 21 Sohn SK, Ahn BC, Lee SW, et al. (2002). Bone marrow immunoscintigraphy using
22 technetium-99m anti-granulocyte antibody in multiple myeloma. *European Journal of Nuclear*
23 *Medicine & Molecular Imaging*, 29, 591-596.
- 24 Svaldi M, Tappa C, Gebert U, et al. (2001). Technetium-99m-sestamibi scintigraphy: an
25 alternative approach for diagnosis and follow-up of active myeloma lesions after high-dose
26 chemotherapy and autologous stem cell transplantation. *Annals of Hematology*, 80, 393-397.
- 27 Zamagni E, Nanni C, Patriarca F, et al. (2007). A prospective comparison of 18F-
28 fluorodeoxyglucose positron emission tomography-computed tomography, magnetic
29 resonance imaging and whole-body planar radiographs in the assessment of bone disease in
30 newly diagnosed multiple myeloma. *Haematologica*, 92, 50-55.

31

1 **Appendix B: The cost-effectiveness of** 2 **balloon kyphoplasty and vertebroplasty** 3 **compared to non-surgical management for** 4 **the treatment of vertebral collapse in** 5 **patients with myeloma.**

B.1.6 Background

7 Bone disease remains the most common presenting feature of myeloma. The development
8 of bone damage in myeloma is due to cancerous cells in bone tissue (causing weak/soft
9 spots, making bones fragile and easy to fracture. When myeloma affects the vertebral spine,
10 it causes severe pain usually affecting the back and that often spreads around the chest or
11 abdomen in the distribution of spinal nerves. Myeloma in the neck vertebrae can lead to pain
12 going down the shoulders and arms, whereas disease affecting the lowest segments of the
13 spine (lumbar and sacral levels) causes pain affecting the legs.

14 Spinal bone disease can sometimes lead to collapse of one or more vertebrae, which causes
15 very serious consequences including acute severe pain. The core aims of the management
16 of spinal bone disease in myeloma are decompression, stabilization and pain control. Non-
17 surgical management (NSM) consists of pain management using drugs (analgesics),
18 radiotherapy, and external bracing/orthotics. Radiotherapy is effective for pain relief and
19 most patients need one or two fractions; however it may take several weeks for the full effect
20 and some patients experience a pain 'flare' in the early days after treatment.

21 Faster-acting interventions include procedures such as vertebroplasty (VP) or balloon
22 kyphoplasty (BKP), in which plastic cement is injected into the diseased vertebrae (vertebral
23 cement augmentation). These cement techniques can be performed by either surgeons or
24 non-surgeons (typically radiologists) unlike open spinal surgery which is performed almost
25 exclusively by either orthopaedic surgeons or neurosurgeons. For these reasons cement
26 techniques are referred to as NSM in clinical practise although for clarity are not included in
27 that definition within this report. Side-effects are usually mild and temporary but may be
28 problematic in a few patients.

29 There is uncertainty around whether BKP and VP are cost effective when compared to NSM.
30 Upfront treatment costs will be higher with both BKP and VP although could lead to
31 increased quality of life and reduced resource use post treatment.

B.2.2 Existing economic evidence

33 A systematic literature review was performed to assess the current economic literature for
34 this topic. The review identified 463 possibly relevant economic papers relating to myeloma.
35 Of these, no papers were deemed relevant for this topic and therefore no papers were
36 included in the review of existing economic evidence.

B.3.7 De novo economic model

38 The current economic literature did not adequately address the decision problem; therefore a
39 de novo economic evaluation was created to assess cost effectiveness. All analyses were
40 conducted in Microsoft Excel 2007.

B.3.11 Aims of analysis

2 The aim of the economic analysis was to assess the cost effectiveness of BKP and VP
3 compared to NSM for the treatment of vertebral compression fractures (VCFs) patients with
4 myeloma. Therefore, both cement techniques were compared only to NSM. All analyses
5 were conducted from a National Health Service (NHS) and Personal Social Services (PSS)
6 perspective.

B.3.27 Type of analysis

8 The analysis was a retrospective economic evaluation based on outcomes and resource use
9 reported in the one RCT identified for vertebral cement augmentation in the accompanying
10 clinical evidence review (Berenson et al., 2011). The trial compared BKP to NSM for the
11 treatment of VCFs in 134 patients with cancer.

12 The trial was based at 22 sites in Australia, Canada, Europe and the USA in patients aged at
13 least 21 years who had between one and three VCFs as well as scoring at least 4 on the
14 pain numeric rating score and at least 10 on the Roland-Morris Disability Score. Patients
15 were excluded if they had osteoblastic tumours, primary bone tumours or plasmacytoma in
16 the index VCF. Patients were also excluded if they were in any phase 1 anticancer trial, had
17 substantial clinical morbidities, were unsuitable for BKP or needed significant additional
18 treatment, over NSM or BKP for index VCF.

19 The patient group had an average age of 64 years and was 58% male with an average
20 estimated symptomatic fracture age of 3.5 months. The trial included cancers other than
21 myeloma with 62% of the trial population having another cancer diagnosis with sub-group
22 analysis by cancer type not presented. As the interventions considered in the analysis are
23 for the treatment VCF rather than the underlying cancer the Guideline Committee thought it
24 would be unlikely that outcomes would be different between cancer type over the one year
25 follow-up of the trial.

26 The study had a large amount of crossover with patients randomised to NSM allowed to
27 switch to BKP after one month follow-up. 38 (72%) of the 52 patients randomised to NSM
28 group, who completed one month follow-up, crossed over to BKP. Therefore three groups
29 were presented in the results by the authors: patients randomised to BKP, patients
30 randomised to NSM who ultimately received BKP (crossover) and those who continued with
31 NSM (NSM group). The authors reported no differences in the baseline characteristics of the
32 three groups although differences at time of crossover were not reported.

B.3.33 Clinical input data

34 All clinical inputs for the model were based on evidence identified in the accompanying
35 evidence review.

36 Low quality evidence did not show any difference in clinical outcomes between VP and BKP.
37 For the base case therefore the clinical outcomes were assumed to be identical between the
38 two interventions. The Guideline Committee hypothesised that it was possible that BKP had
39 improved clinical outcomes and greater quality of life through restoration of lost body height.
40 Whilst there would be a proportion of patients for which both BKP and VP would be suitable it
41 was often the case that the nature of the VCF or patient characteristics would make one of
42 the interventions clinically inappropriate. As there was also no randomised comparative
43 evidence comparing BKP to VP they were both compared to NSM in the base-case
44 economic evaluation but not with each other. Given this potential difference in quality of life
45 between the two cement techniques a threshold sensitivity analysis was performed to look at
46 the difference required for the more expensive intervention to become the preferred option.

B.3.41 Patient groups

2 RCTs are conventionally analysed using an intention to treat (ITT) approach to reduce bias
 3 due to non-random loss and crossover of participants. The ITT approach analyses patients
 4 by how they were randomised regardless of whether they adhered to the treatment they were
 5 randomised to or not. As the Berenson et al trial had large crossover the ITT approach may
 6 not fully capture the true outcomes of the interventions being considered. The study also did
 7 not report the characteristics of the crossover group at the time of crossover and it was
 8 unclear as to whether these patients differed significantly to those who remained in the NSM
 9 groups.

10 The Guideline Committee therefore considered that an 'as treated' comparison comparing all
 11 patients who ultimately received BKP to those who remained in NSM would most accurately
 12 estimate the difference in effectiveness between the two groups. It would also reflect more
 13 closely practice within the NHS where patients are likely to wait at least one month for
 14 cement techniques- a time after which the majority of patients in the NSM arm had crossed
 15 over to BKP. Consequently, for the purpose of the de novo economic evaluation two further
 16 groups were created from the trial results- a 'cement technique received' group pooling the
 17 BKP and crossover groups and a NSM-ITT group pooling the NSM and crossover group (i.e.
 18 those randomised to NSM). In the base case an 'as treated' approach was taken comparing
 19 the BKP and crossover group (cement technique received group) to the NSM group. A
 20 secondary analysis based on ITT principles was also conducted comparing the NSM-ITT
 21 group to those randomised to BKP.

B.3.52 Utilisation of non-surgical interventions for VCFs at one month

23 The study reported the utilisation of seven non-surgical interventions at baseline and one
 24 month post randomisation between those randomised to BKP and to NSM. The changes in
 25 the use of these interventions are shown in Table 14. Bed rest, whilst reported by the trial
 26 was excluded from the economic model as the financial cost of this would fall outside the
 27 perspective of the NHS and PSS whilst impact upon quality of life has been captured in the
 28 quality of life measures reported by the trial and discussed later.

29 There were no baseline difference (p -value<0.05) in utilisation of non-surgical interventions
 30 between the BKP and NSM group. A pooled percentage from the trial was therefore used for
 31 the baseline utilisation in the economic analysis. Changes in utilisation were statistically
 32 significantly lower (p -value<0.05) for the BKP group in all interventions other than wheelchair
 33 use, physical therapy and radiation therapy. As no patients crossed over before one month
 34 the NSM group was identical for both the 'as treated' and ITT analysis.

35 **Table 14: Percentage of patients in model cohort receiving non-surgical interventions**
 36 **at baseline and percentage point change in utilisation between base-line and**
 37 **one month follow-up.**

| | Percent baseline | BKP | NSM |
|-------------------|------------------|--------|--------|
| Walking Aids | 33% | -9.0% | 1.5% |
| Bracing | 14% | -12.7% | -1.4% |
| Wheelchair | 6% | -4.8% | -2.0% |
| Physical Therapy | 14% | -10.4% | -3.6% |
| Any Medication | 86% | -40.5% | -17.0% |
| Radiation Therapy | 4% | -0.9% | 11.3% |

38 For the crossover group, the use of non-surgical interventions was assumed to be equal to
 39 BKP for the base case 'as treated' analysis but equal to NSM during the ITT analysis. The
 40 difference in utilisation was assumed to be maintained for one year.

B.3.61 Future VCFs

2 Whilst further VCFs are common in patients receiving both cement techniques and NSM, the
3 accompanying systematic review found no evidence on whether there was a difference in the
4 incidence of future VCFs between the interventions. In lieu of evidence it was assumed that
5 the incidence between the groups was identical. Resultantly, both costs and outcomes of
6 these future events were assumed identical and were not explicitly included as part of the de
7 novo economic analysis.

B.3.78 Adverse events

9 Device related adverse events were observed during the trial in the BKP group. Two patients
10 had extravasation, one had superficial wound infection and two had symptomatic fractures
11 one of which was as a result of cement leakage. Two patients had arrhythmia, attributable to
12 anaesthesia but this was resolved. The Guideline Committee felt that these adverse events
13 were likely to be rare and that the additional costs and quality of life detriment were likely to
14 be significantly outweighed by underestimates of costs and quality of life detriments in the
15 NSM arms. Whilst the costs and quality of life detriments of these adverse events were not
16 explicitly considered in the economic evaluation, costs attributable to adverse events of
17 surgery were included (discussed later).

B.3.88 Survival

19 Survival for the economic analysis was taken from a prospective observational study of
20 outcomes and survival in 39 patients with myeloma receiving VP in an NHS setting (Chew et
21 al., 2011). The population had a mean age of 60 years at the time of treatment. The study
22 reported a median survival of 20 months with a one year survival of 90% and five year
23 survival of 40%. Survival was assumed to be identical for both the cement technique and
24 NSM groups given the paucity of information to the contrary identified by the systematic
25 review.

B.3.96 Time horizon

27 Two time horizons were used for the economic evaluation-a one year and five year. The one
28 year analysis covered the duration of the Berenson et al (2011) trial. It was unclear from the
29 accompanying evidence review whether differences in quality of life remained more than one
30 year post surgery. The Guideline Committee thought that the difference was likely to remain
31 after one year and until further VCF or death and that the one year time horizon would
32 represent a conservative estimate of any outcomes from cement techniques. Therefore, a
33 five year time horizon was also modelled. As no evidence was identified around the
34 effectiveness of BKP or VP post one year, two assumptions were investigated based on the
35 Guideline Committee's clinical experience. The first assumption was that the difference in
36 quality of life between the groups at one year would remain for the entirety of the five year
37 time horizon reflecting that increased mobility and reduced pain may continue significantly
38 past one year. The second assumption was that in the group with the highest quality of life
39 the difference would taper down at a constant rate until equal to the comparison group at five
40 years. This was to reflect that patients were likely to experience further VCFs over the time
41 horizon which would diminish their quality of life.

42 The analysis also conservatively assumed that the difference in costs between the two
43 groups would be identical after the first year. A sensitivity analysis was run for this model
44 though that also assumed that the difference in costs not attributable to cement techniques,
45 during the first year, would continue in all years.

46 A five year time horizon was considered adequate to capture all differences between the two
47 groups as the majority of patients would have either died or had a secondary VCF during this
48 time.

B.3.101 Quality of Life

2 The main measure of health related quality of life (HRQoL) in the trial was the The Short
 3 Form (36) Health Survey (SF-36) physical component summary score (PCS). The SF-36 is a
 4 patient completed generic health survey made up of eight components (vitality, physical
 5 functioning, bodily pain, general health perceptions, physical role functioning, emotional role
 6 functioning, social role functioning and mental health). These are used to calculate two
 7 summary scores, a physical component (PCS) and mental component, on a scale of 0
 8 (worse possible health) to 100 (best possible health). The change in SF-36 PCS from
 9 baseline for the BKP and NSM group, and from time of treatment for crossover group, is
 10 shown in Table 15. These were given a normal distribution and varied across their reported
 11 range during probabilistic sensitivity analysis (PSA).

12 **Table 15: Change in SF-36 PCS score following treatment**

| Follow-up | 1 Month | 3 Month | 6 Month | 12 Month |
|---------------------------|---------|---------|---------|----------|
| BKP | 9.2 | 9.6 | 8.8 | 10.6 |
| Crossover | 8.8 | 10.8 | 10.4 | 10.6 |
| NSM | -0.2 | 1.2 | -0.8 | 1.2 |
| Cement Technique Received | 9.0 | 10.1 | 9.4 | 10.6 |
| NSM-ITT | 5.7 | 7.5 | 7.4 | 8.3 |

13 Changes in the SF-36 PCS were converted to UK population preference EQ-5D weights
 14 using a mapping algorithm (Ara & Brazier, 2008). The EQ-5D UK tariff is NICE's preferred
 15 measure of health related quality of life in adults (National Institute for Health and Care
 16 Excellence, 2014). This was the only algorithm identified for mapping from mean SF-36
 17 component scores to EQ-5D scores. The algorithm showed good predictive value with
 18 predicted mean EQ-5D score being correct to within 2 decimal places in both datasets used
 19 to build the algorithm and external datasets used in validation. However, the algorithm was
 20 not validated in myeloma or cancer patients although it was shown to have good predictive
 21 value in a range of health conditions associated with VCF including walking impairment and
 22 lower back pain.

23 Berenson et al. (2011) reported a summary score for the SF-36 PCS whilst the Ara & Brazier
 24 (2008) algorithm needs the mean individual component scores. The proportion of the change
 25 in SF-36 scores attributable to each of the four physical components were assumed to be
 26 identical to that reported in the Fracture Reduction Evaluation (FREE) trial. The FREE trial
 27 was an RCT comparing BKP and NSM in patients with VCFs across 8 European centres.
 28 Although the study population included patients with myeloma these accounted for less than
 29 2% of the study population; the majority being osteoporosis patients. The proportion
 30 attributable to each physical component is shown in Table 16. Only the physical component
 31 contributions were used and all scores were inflated to sum to 100%.

32 **Table 16: Contribution to overall SF-36 score for each physical component**

| | Contribution (%) | |
|---|------------------|------|
| | BKP | NSM |
| Physical Functioning | 34% | 34% |
| Role limitations due to physical health | -13% | -12% |
| Bodily Pain | 55% | 56% |
| General Health Perceptions | 24% | 22% |

33 Given the changes in the SF-36 score and the contributions to each component in Table 16
 34 changes in EQ-5D scores were estimated for the group using the Ara & Brazier (2008)
 35 algorithm. The analysis used 'Model EQ (1)' of the seven reported by Ara & Brazier (2008) as

1 this did not require an age variable which was not reported for the NSM group post one
2 month and not reported for the crossover group at all. The use of the age variable increases
3 the predictive precision by less than 1%. The converted EQ-5D scores are reported in Table
4 17.

5 We assumed that all patients started with a baseline quality of life weight of 0.4392 the pre-
6 treatment mean EQ-5D score based on 11 consecutive patients, receiving VP in an NHS
7 setting (Chew, O'Dwyer & Edwards, 2013). As economic evaluation is primarily an
8 incremental analysis and the choice of baseline quality of life will have no effect on the
9 incremental results this assumption was not tested during sensitivity analysis.

10 **Table 17: Estimated EQ-5D scores following treatment**

| Follow-up | Baseline | 1 Month | 3 Month | 6 Month | 12 Month |
|---------------------------|----------|---------|---------|---------|----------|
| BKP | 0.4392 | 0.4667 | 0.4679 | 0.4655 | 0.4709 |
| Crossover | 0.4392 | 0.4657 | 0.4717 | 0.4705 | 0.4709 |
| NSM | 0.4392 | 0.4386 | 0.4428 | 0.4368 | 0.4428 |
| Cement Technique Received | 0.4392 | 0.4662 | 0.4693 | 0.4674 | 0.4709 |
| NSM-ITT | 0.4392 | 0.4563 | 0.4617 | 0.4613 | 0.4643 |

11 Berenson et al also reported a summary score for the mental component of the SF-36 for
12 one month post-randomisation showing a mean difference between the groups of 11.1 points
13 (95% CI 10.7-11.5) between the groups in favour of BKP. As this was only reported at one
14 month and not for the duration of the trial the contribution of the mental component to overall
15 quality of life was not included in the base case analysis. A sensitivity analysis was
16 performed giving an additional quality of life increment to those receiving BKP or VP to
17 capture this non-physical improvement in quality of life. Using the algorithm described above
18 for SF-36 mental component scores a mean difference in terms of the EQ-5D of 0.054 was
19 estimated at one month. Assuming that this difference persists over the time horizon of the
20 model this equated to an additional 0.054 and 0.270 QALYs for patients surviving the entirety
21 of the one year and five year time horizons respectively.

B.3.122 Costs

23 Costs were inflated to 2014 prices, using the hospital & community health services (HCHS)
24 index (Curtis, 2014) and converted using the appropriate purchasing power parity where
25 appropriate (National Institute for Health and Care Excellence, 2014). All costs are presented
26 in Table 18.

27 **Table 18: Unit costs**

| | Value | Source | PSA Distribution |
|--------------------------------------|-------|-------------------------|---|
| Total Cost BKP | £3369 | (Chew et al., 2013) | Gamma($\alpha=119.7$, $\beta=34.0$) |
| Total Cost VP | £2213 | (Chew et al., 2013) | Gamma($\alpha=35.4$, $\beta=62.5$) |
| Annual cost pharmaceutical treatment | £132 | (Puffer et al., 2004) | Triangular(£66,£264) |
| Annual cost radiotherapy | £431 | (Botteman et al., 2011) | Triangular(£216,£863) |
| Annual cost bracing | £500 | NHS Correspondence | Uniform(£250,£1000) |
| Annual cost wheelchair | £91 | (Curtis, 2014) | Triangular(£46,£182) |
| Annual cost walking | £91 | (Curtis, 2014) | Triangular(£46,£182) |

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The cost-effectiveness of balloon kyphoplasty and vertebroplasty compared to non-surgical management for the treatment of vertebral collapse in patients with myeloma.

| | Value | Source | PSA Distribution |
|-------------------------------|-------|------------------------------|---------------------------------------|
| aids | | | |
| Annual cost physical therapy | £312 | (Department of Health, 2015) | Gamma($\alpha=25.1$, $\beta=12.4$) |
| Annual Non-specific NSM costs | £0 | Guideline Committee Estimate | Uniform(£0,£3552) |

B.3.11.11 Treatment costs

2 The costs of VP were taken from 11 consecutive patients receiving VP for spinal metastases
3 at one NHS hospital. Resource use was collected prospectively using structured
4 questionnaires and costed using NHS reference costs where possible. For items of
5 equipment an estimation of their lifespan, number of uses and maintenance costs to
6 calculate a cost per hour per patient. Staff costs were based on published salaries for
7 consultant radiologist, a registrar in half of cases, two radiographers and four nurses. Costs
8 of complications, inpatient stay and drug costs were all included.

9 Chew et al estimated an average cost of £2213.25 per patient. This consisted of a cost of
10 £744 for the VP kit and other costs of £1469. Chew et al (2011) considered this was a likely
11 overestimate of the true cost as it was weighted heavily by one patient with widespread
12 metastatic bronchial carcinoma. An alternate non-kit cost of £996 was used during sensitivity
13 analysis equal to the average cost if all patients were treated as a day case or overnight stay.
14 Treatment costs other than the kit cost were assumed to be identical for both VP and BKP.

15 The cost of the BKP kit was taken from NICE TA279 looking at BKP and VP in the treatment
16 of osteoporotic vertebral compression fractures. It noted a list price for a BKP kit including
17 low viscosity cement of £2600 however it noted an average selling price of £1900. Whilst the
18 average selling price was deemed the most appropriate to use in the de novo economic
19 evaluation it was still likely to be an overestimate of the true costs. BKP kit costs are
20 commercially sensitive and likely to differ widely between institutions. This value was
21 therefore given a wide distribution for PSA.

B.3.11.22 Non-surgical management costs

23 The annual cost of analgesic medication was taken from a study estimating the costs
24 associated with VCFs from an NHS perspective using Hospital Episode Statistics and
25 Personal Social Services Research Unit data (Puffer et al., 2004). The study estimated an
26 annual cost of pharmaceutical treatments of £132. No cost data was identified for myeloma
27 patients specifically although the costs of pharmaceutical interventions were likely to be
28 similar to this patient group.

29 Radiation therapy costs were taken from a cost-effectiveness analysis of zoledronic acid in
30 the prevention of skeletal related events for patients with bone metastases secondary to
31 advanced renal cell carcinoma (Botteman et al., 2011). The study estimated an average cost
32 of radiotherapy of £431 using HRG codes and NHS reference costs and considering a
33 NHS+PSS perspective.

34 Bracing costs of £500 were estimated using correspondence with one NHS trust. Costs of
35 wheelchair and walking aids were taken from PSSRU data (Curtis, 2014). A cost of £91 was
36 used representing the unit cost of the use of self or attendant propelled chair per year.
37 Physical therapy costs were estimated from NHS Reference Costs. Six appointments were
38 assumed equal to a cost of £312 (Department of Health, 2015). These costs were applied to
39 both arms of the model in line with utilisation reported in Table 14.

40 There was potential resource use that was not reported by the trial and consequently not
41 included in the base case analyses. The Guideline Committee felt that the most important
42 missed resource use was doctor and nurse time spent fitting, adjusting and advising on

1 bracing and wheelchair use and time spent tailoring pharmaceutical treatment for pain. By
 2 virtue of greater utilisation in the NSM arm the underestimate would be larger than for the
 3 cement technique arms. Previous economic evaluations of spinal interventions, in non-
 4 myeloma patient populations have found significantly higher resource use, post surgery
 5 amongst non-surgical arms compared to surgical arms (Lewis et al., 2011; Bala et al., 2008).
 6 With a paucity of evidence it was difficult to accurately estimate this cost. Therefore,
 7 threshold sensitivity analysis was performed to estimate the additional cost needed in the
 8 NSM arm to reduce the cost per QALY to the £20,000 NICE threshold. During PSA a non-
 9 specific cost was added to the NSM arm ranging from £0 (no underestimate of cost) to £3552
 10 equal to the total annual healthcare related cost of VCFs (Puffer et al., 2004) representing a
 11 plausible upper limit to the underestimation of costs. In the absence of evidence the
 12 Guideline Committee were unable to come to a consensus on a 'most probable' value and it
 13 was therefore deemed appropriate to use a wide uniform distribution.

B.3.11.34 Imaging costs

15 Costs of imaging pre-treatment were not included in this de novo economic evaluation as
 16 these were assumed to be performed as part of a patient's regular follow-up and would be
 17 identical between the two groups.

B.3.11.48 Discounting

19 All costs and QALYs were discounted at 3.5% per annum as recommended by the NICE
 20 Guidelines Manual (National Institute for Health and Care Excellence, 2014).

B.3.121 Sensitivity analysis

22 For the base case analyses a range of deterministic and threshold sensitivity analyses were
 23 conducted to test the robustness of the results of the economic analysis to different input
 24 parameters. PSA was also conducted around the base case to assess the combined
 25 parameter uncertainty in the model. In this analysis, the values that are utilised in the base
 26 case are replaced with values drawn from a distribution used to reflect the uncertainty around
 27 parameter estimates. The PSA analysis was run for 10,000 iterations for both BKP and VP
 28 and for both a one year and five year time horizon.

B.3.129 Results

B.3.13.30 Deterministic base case results-one year time horizon

31 Table 19 and Table 20 show the base case results for BKP and VP respectively. Both
 32 cement procedures led to an increase in costs and QALYs. Total QALYs are equal between
 33 both cement techniques given the assumptions of the model with BKP having higher
 34 incremental costs owing to its increased kit cost. Both incremental cost effectiveness ratios
 35 (ICERs) are above the NICE threshold of £20,000 per QALY although as noted earlier they
 36 are likely to offer conservative estimates of both incremental QALYs and NSM total costs.

37 **Table 19: Base case deterministic results for balloon kyphoplasty**

| Outcome | BKP | NSM | Incremental |
|-----------------------------|--------|--------|-----------------|
| Total Cost | £3,485 | £304 | £3,181 |
| Total QALYs | 0.4429 | 0.4170 | 0.0260 |
| Cost per QALY gained | | | £122,498 |

1 Table 20: Base case deterministic results for vertebroplasty

| Outcome | VP | NSM | Incremental |
|-----------------------------|--------|--------|----------------|
| Total Cost | £2,329 | £304 | £2,025 |
| Total QALYs | 0.4429 | 0.4170 | 0.0260 |
| Cost per QALY gained | | | £77,987 |

B.3.13.22 Deterministic results five year time horizon

3 Table 21 and Table 22 show the base case results for BKP and VP respectively when a five
4 year time horizon is assumed with a continuing difference in quality of life. Whilst the ICERs
5 are reduced under the longer time horizon they still both remain above £20,000 per QALY.

6 Table 21: Five year time horizon deterministic results for balloon kyphoplasty

| Outcome | BKP | NSM | Incremental |
|-----------------------------|--------|--------|----------------|
| Total Cost | £3,485 | £304 | £3,181 |
| Total QALYs | 1.5678 | 1.4748 | 0.093 |
| Cost per QALY gained | | | £34,209 |

7 Table 22: Five year time horizon deterministic results for vertebroplasty

| Outcome | VP | NSM | Incremental |
|-----------------------------|--------|--------|----------------|
| Total Cost | £2,329 | £304 | £2,026 |
| Total QALYs | 1.5678 | 1.4748 | 0.093 |
| Cost per QALY gained | | | £21,779 |

B.3.13.38 Probabilistic base case results

9 Table 23, Table 24, Table 25 and Table 26 show the base case probabilistic results
10 calculated from the mean results of the PSA. The probabilistic results show an increased
11 cost for NSM whilst the cement technique costs and QALYs for both groups remain
12 consistent compared to the deterministic results. This is as a result of the non-specific NSM
13 costs which is set equal to zero during the deterministic analysis but is always a greater than
14 zero value during PSA. Other than for BKP in the conservative one year time horizon
15 analysis all ICERs are now below the NICE £20,000 threshold. As NSM costs were almost
16 certainly underestimated in the deterministic analysis these results are potentially more
17 reflective of the true cost effectiveness.

**18 Table 23: Base case probabilistic results for balloon kyphoplasty one year time
19 horizon**

| Outcome | BKP | NSM | Incremental |
|-----------------------------|--------|--------|----------------|
| Total Cost | £3,515 | £2,191 | £1,325 |
| Total QALYs | 0.4429 | 0.4170 | 0.0259 |
| Cost per QALY gained | | | £51,085 |

20 Table 24: Base case probabilistic results for vertebroplasty one year time horizon

| Outcome | VP | NSM | Incremental |
|-----------------------------|--------|--------|---------------|
| Total Cost | £2,338 | £2,168 | £170 |
| Total QALYs | 0.4429 | 0.4169 | 0.0260 |
| Cost per QALY gained | | | £6,544 |

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The cost-effectiveness of balloon kyphoplasty and vertebroplasty compared to non-surgical management for the treatment of vertebral collapse in patients with myeloma.

1 **Table 25: Base case probabilistic results for balloon kyphoplasty five year time**
2 **horizon**

| Outcome | BKP | NSM | Incremental |
|-----------------------------|--------|--------|----------------|
| Total Cost | £3,519 | £2,172 | £1,347 |
| Total QALYs | 1.5680 | 1.4773 | 0.0908 |
| Cost per QALY gained | | | £14,842 |

3 **Table 26: Base case probabilistic results for vertebroplasty five year time horizon**

| Outcome | VP | NSM | Incremental |
|-----------------------------|--------|--------|---------------|
| Total Cost | £2,354 | £2,166 | £188 |
| Total QALYs | 1.5681 | 1.4737 | 0.0944 |
| Cost per QALY gained | | | £1,994 |

B.3.144 Deterministic sensitivity analysis

5 Deterministic sensitivity analysis was carried out to test alternate assumptions and how these
6 influence the results of the economic evaluation (Table 27). The use of a non-kit cost of
7 £996, assuming that all patients are treated on an overnight or outpatient reduced the ICER
8 for both cement techniques. The ICER only dropped below £20,000 for the VP under the five
9 year time horizon. The same was true when difference in costs between interventions
10 continued past the first year. The addition of the mental component to the quality of life
11 scores reduced the ICER below £20,000 for both cement technique options under the five
12 year time horizon. Tapering of quality of life did not result in either ICER dropping below
13 £20,000 per QALY.

14 **Table 27: Deterministic sensitivity analysis results-ICER for alternative assumptions**

| | BKP-1 Year | BKP-5 year | VP-1 Year | VP-5 Year |
|--|------------|------------|-----------|-----------|
| Non-kit cost reduced to £996 | £104,276 | £29,120 | £59,765 | £16,690 |
| Mental component added | £39,743 | £11,726 | £25,302 | £7,471 |
| Difference in costs continue post one year | N/A | £30,590 | N/A | £18,171 |
| Tapering quality of life after 1 year | N/A | £50,743 | N/A | £32,309 |

B.3.14.15 Threshold analysis

16 A threshold analysis was performed to see how much extra NSM needed to cost, per patient,
17 before the ICER reduced below £20,000 per QALY (Table 28). All the additional costs were
18 lower than the upper limit of the PSA range.

19 **Table 28: Additional NSM costs required for ICER to be below £20,000 per QALY**

| | 1 Year Time Horizon | 5 Year Time Horizon |
|-----|---------------------|---------------------|
| BKP | £2662 | £1322 |
| VP | £1506 | £166 |

20 Threshold analysis also showed that BKP needed to provide an additional 0.054 QALYs over
21 the lifetime of a patient to give the same ICER when compared to VP. Given the assumptions
22 of the model this was irrespective of the time horizon.

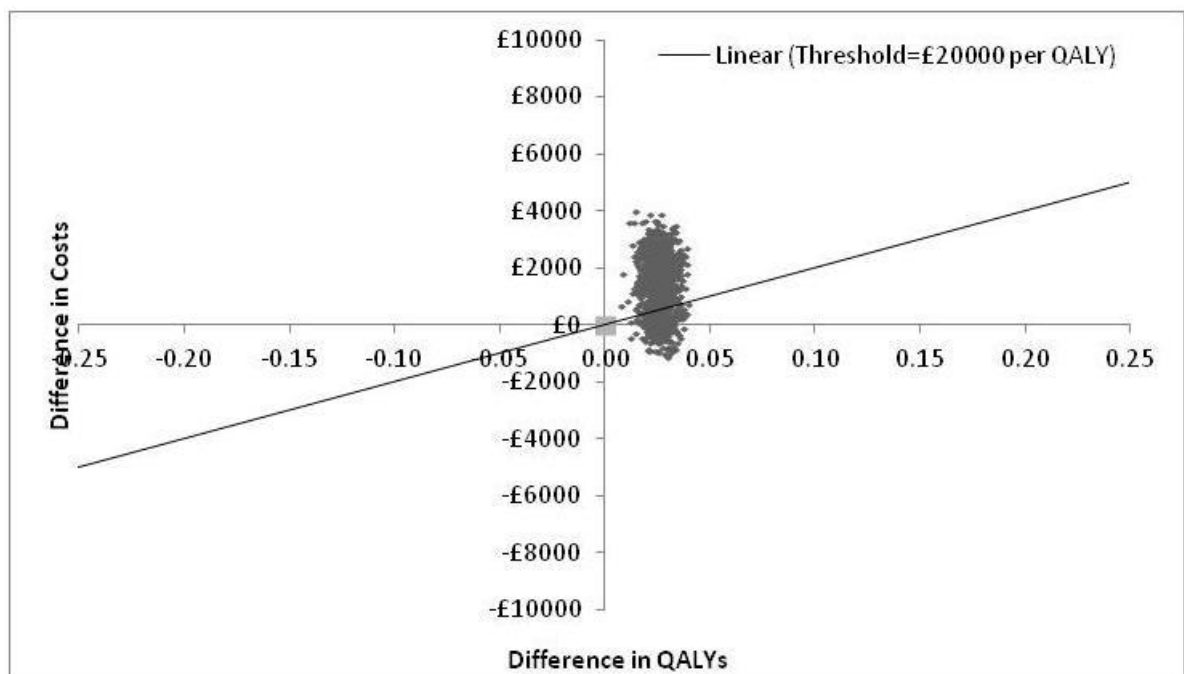
B.3.14.21 ITT Analysis

2 An alternative ITT analysis was carried out against all results and deterministic sensitivity
 3 analyses. ITT in all cases significantly increased the cost of the NSM arm (due to the cost of
 4 surgery now added to patients who crossed over) as well as increasing the total QALYs. The
 5 incremental cost and QALYs between cement techniques and NSM were reduced in all
 6 scenarios although the cost per QALY was generally consistent with the 'As Treated' results.
 7 The ITT analysis did not alter the results, in terms of being above or below £20,000 per
 8 QALY, in any scenario.

B.3.159 Probabilistic sensitivity analysis**B.3.15.10 Cost effectiveness plane**

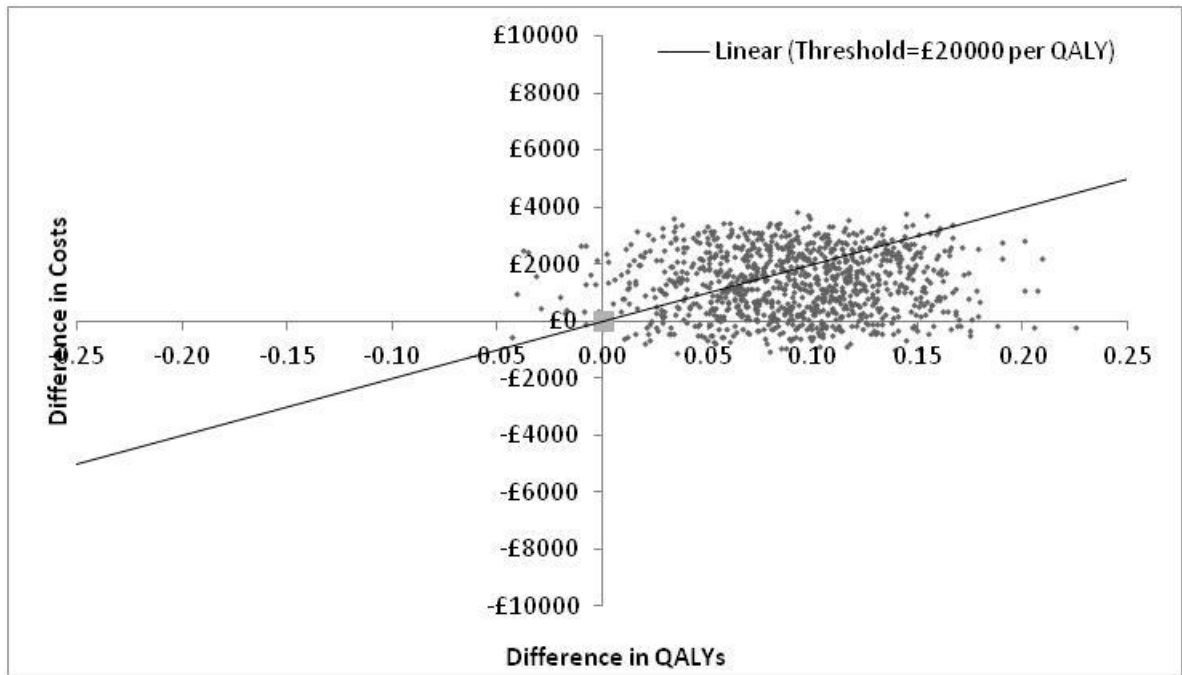
11 Despite the ICER for BKP being above the £20,000 threshold compared to NSM, for both the
 12 deterministic and probabilistic results, during PSA under a one year time horizon BKP was
 13 below the threshold in 26.1% of iterations (Figure 5). Under the five year time horizon this
 14 figure increased to over 64.2% meaning BKP was cost effective at the £20,000 threshold in
 15 over half of iterations (Figure 6). BKP was cost saving and health improving in 12.5% of
 16 iterations for both time horizons. VP was cost effective at a £20,000 threshold in 59.6% and
 17 89.4% of iterations for the one year and five year time horizons respectively (Figure 7 - 8).
 18 VP was health improving and cost saving in 44.7% of iterations. For both interventions the
 19 majority of iterations were in the North-East quadrant suggesting a more costly yet effective
 20 intervention. These results are echoed in the cost effectiveness acceptability curves (Figure
 21 9 - 12).

22 **Figure 5: Cost effectiveness plane for balloon kyphoplasty with a one year time**
 23 **horizon**

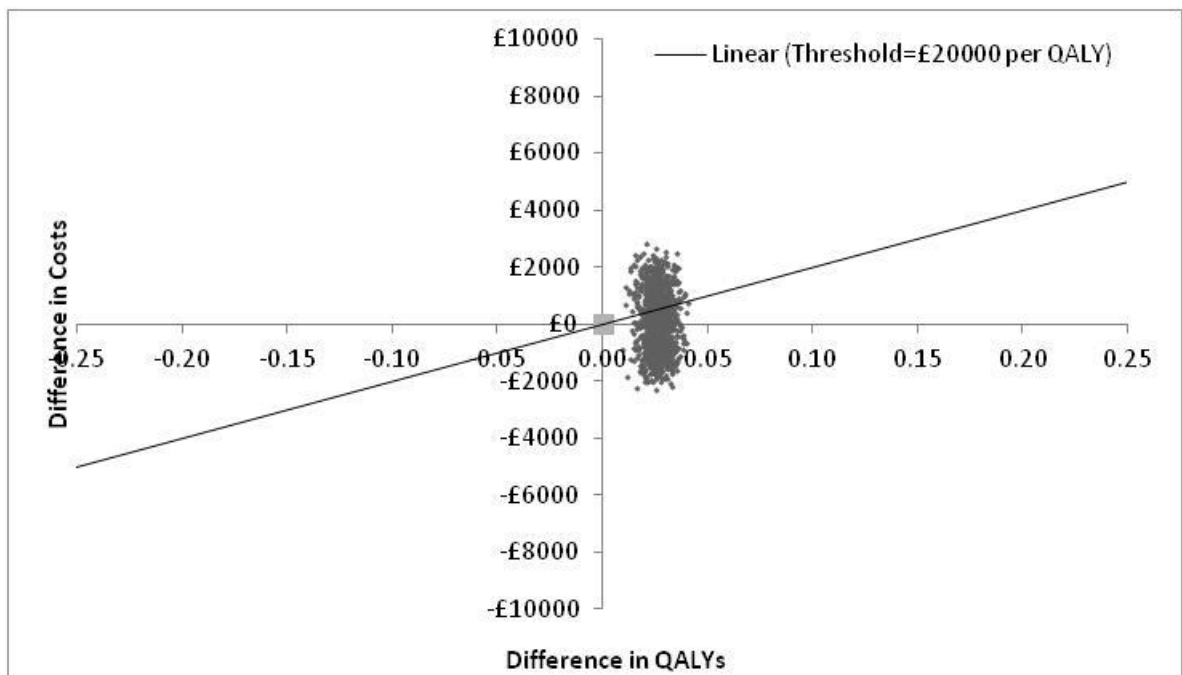


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1 **Figure 6: Cost effectiveness plane for balloon kyphoplasty with a five year time**
2 **horizon**



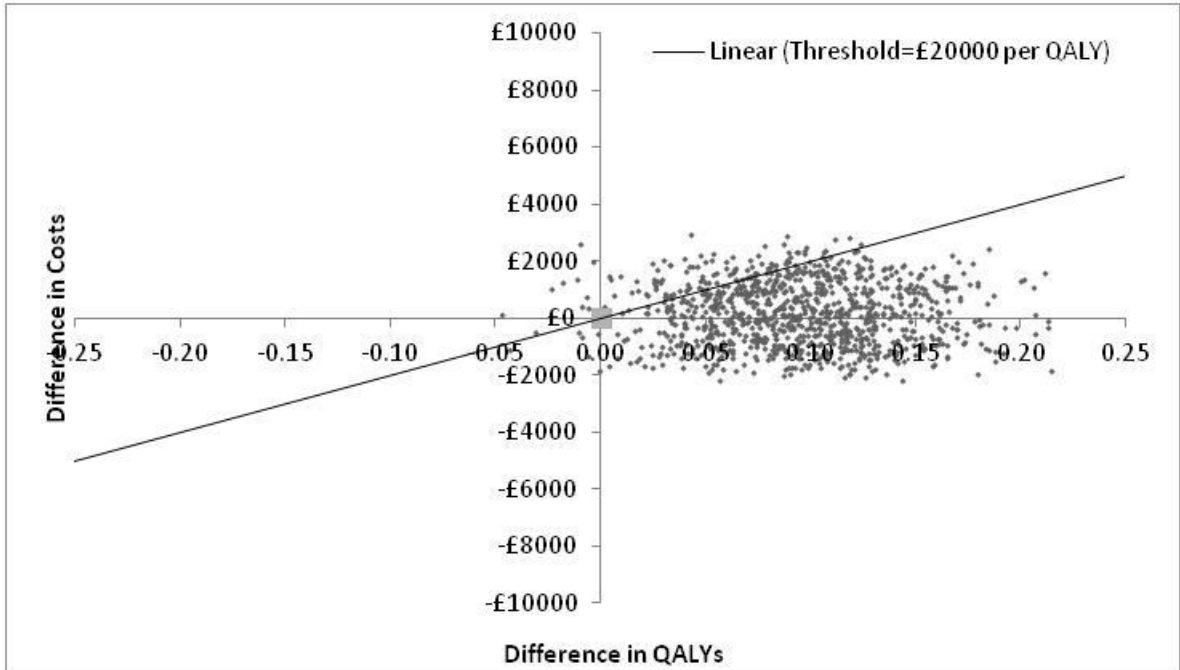
4 **Figure 7: Cost effectiveness plane for vertebroplasty with a one year time horizon**



5
6

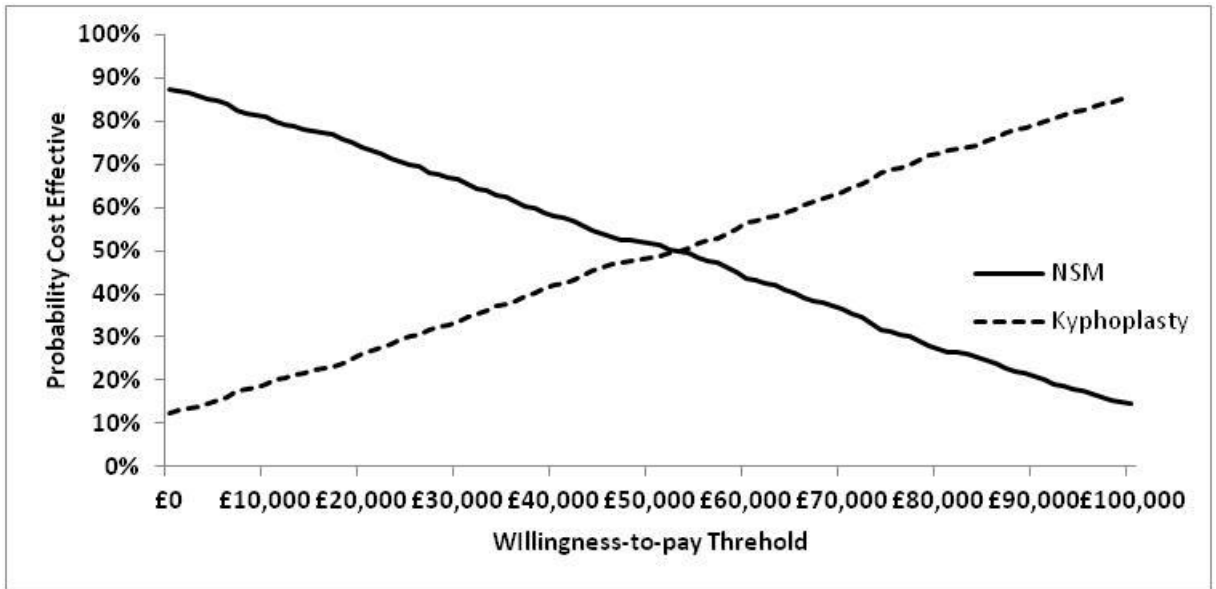
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2 **Figure 8: Cost effectiveness plane for vertebroplasty with a five year time horizon**



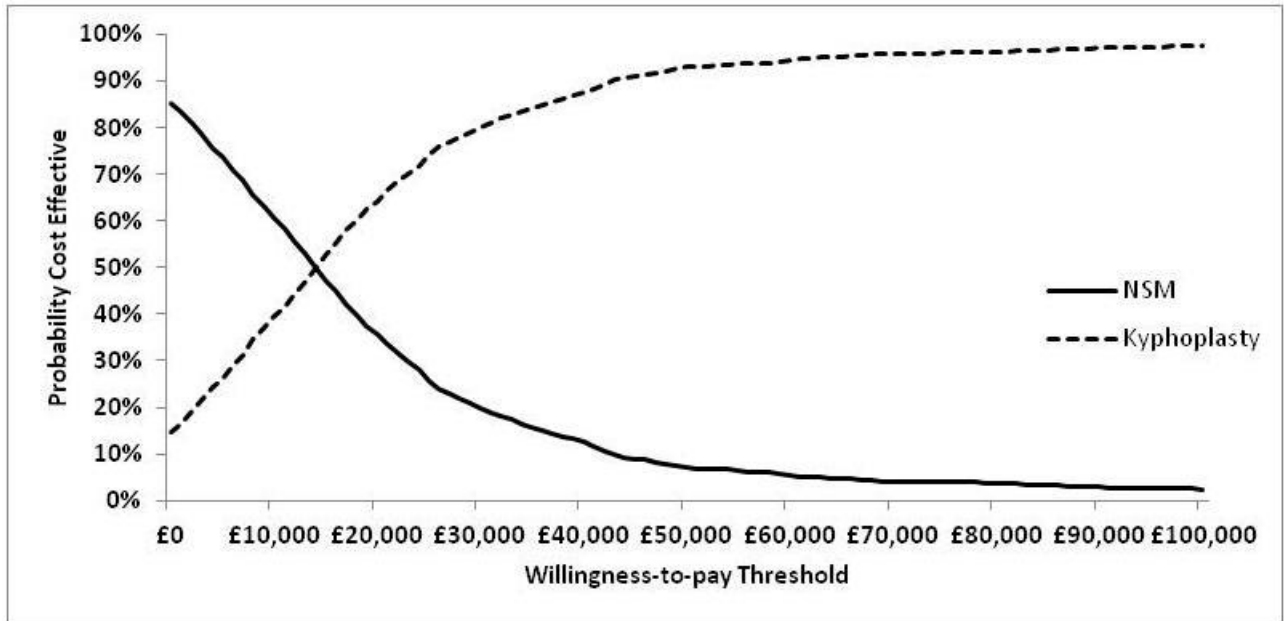
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4 **Figure 9: Cost effectiveness acceptability curve for balloon kyphoplasty with a one year time horizon**
5



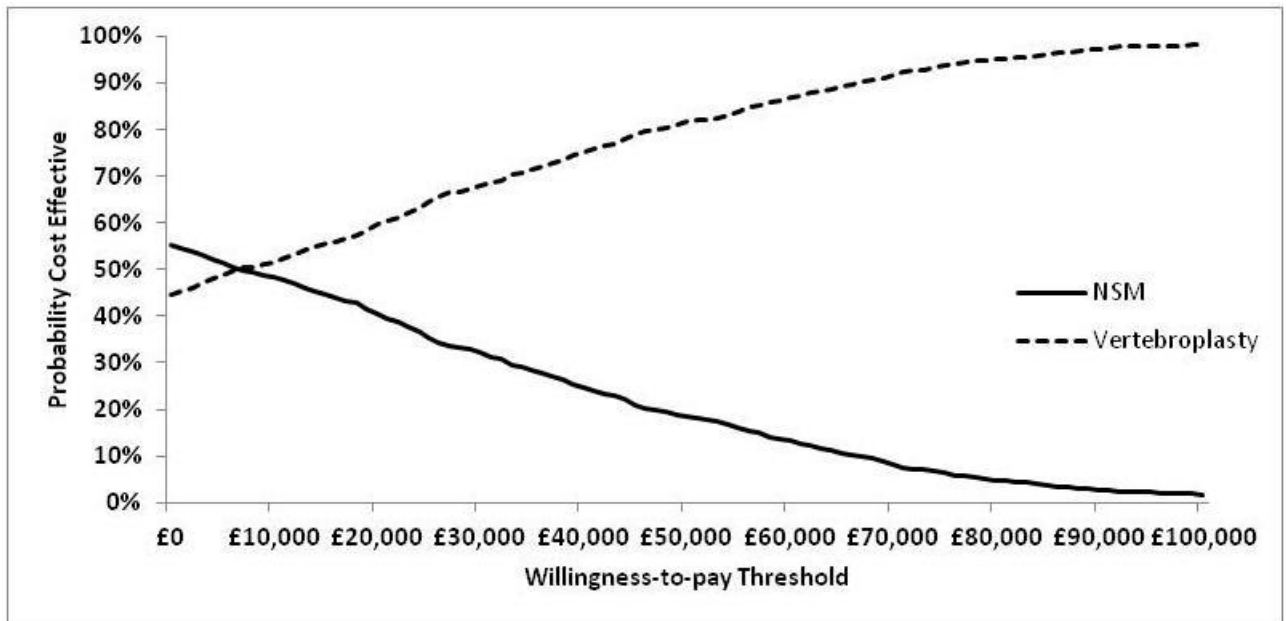
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1 **Figure 10: Cost effectiveness acceptability curve for balloon kyphoplasty with a five**
2 **year time horizon**



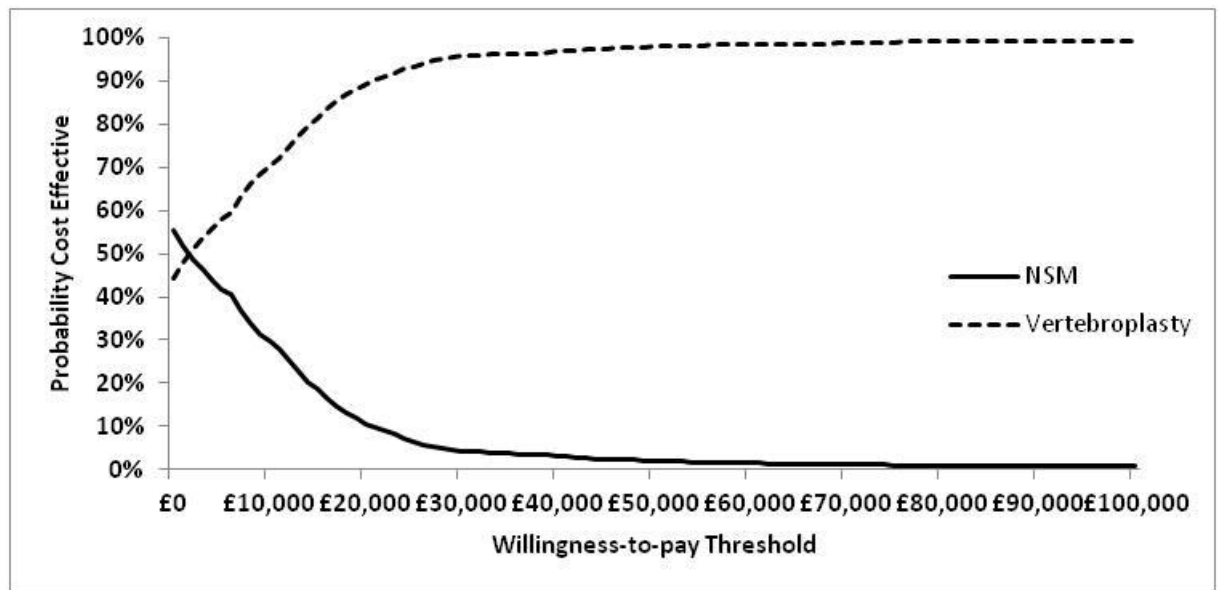
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4 **Figure 11: Cost effectiveness acceptability curve for vertebroplasty with a one year**
5 **time horizon**



6

1 **Figure 12: Cost effectiveness acceptability curve for vertebroplasty with a five year**
 2 **time horizon**



3

B.3.164 Conclusions

5 The results of the base case analysis showed that BKP and VP were not cost effective over
 6 a one year time horizon and only VP was cost effective over a five year time horizon.
 7 However, when considering the probabilistic results, both cement techniques were shown to
 8 be cost effective with a five year time horizon with VP also cost effective under a one year
 9 time horizon. Furthermore, during PSA and under a five year time horizon both cement
 10 techniques were cost effective in the majority of iterations with VP being cost saving and
 11 health improving in 40% of cases.

12 The results were shown to be particularly sensitive to the costs of NSM. Threshold sensitivity
 13 analysis showed that even if our economic analysis only modestly underestimates the true
 14 cost of NSM or the effectiveness of cement techniques then both VP and BKP would likely
 15 be cost effective.

16 References

17 Ara R & Brazier J (2008). Deriving an algorithm to convert the eight mean SF-36 dimension
 18 scores into a mean EQ-5D preference-based score from published studies (where patient
 19 level data are not available). Value in Health, 11, 1131-1143.

20 Bala MM, Riemsma RP, Nixon Jet al. (2008). Systematic review of the (cost-) effectiveness
 21 of spinal cord stimulation for people with failed back surgery syndrome. The Clinical journal
 22 of pain, 24, 741-756.

23 Berenson J, Pflugmacher R, Jarzem P, et al. (2011). Balloon kyphoplasty versus non-
 24 surgical fracture management for treatment of painful vertebral body compression fractures
 25 in patients with cancer: a multicentre, randomised controlled trial. The Lancet Oncology, 12,
 26 225-235.

27 Botteman MF, Meijboom M, Foley I, et al. (2011). Cost-effectiveness of zoledronic acid in the
 28 prevention of skeletal-related events in patients with bone metastases secondary to
 29 advanced renal cell carcinoma: application to France, Germany, and the United Kingdom.
 30 The European Journal of Health Economics, 12, 575-588.

- 1 Chew C, O'Dwyer PJ & Edwards R (2013). Health service cost associated with percutaneous
- 2 vertebroplasty in patients with spinal metastases. *Clinical radiology*, 68, 776-779.
- 3 Chew C, Ritchie M, O'Dwyer PJ, et al. (2011). A prospective study of percutaneous
- 4 vertebroplasty in patients with myeloma and spinal metastases. *Clinical radiology*, 66, 1193-
- 5 1196.
- 6 Curtis L (2014). *The Unit Costs of Health and Social Care 2014*.
- 7 Department of Health (2015). *NHS Reference Costs 2013-14*.
- 8 Lewis R, Williams N, Matar HE, et al. (2011). The clinical effectiveness and cost-
- 9 effectiveness of management strategies for sciatica: systematic review and economic model.
- 10 National Institute for Health and Care Excellence (2014). *The guidelines manual*. London:
- 11 NICE: 2014. National Institute for Clinical Excellence, 13, 4-2007.
- 12 Puffer S, Torgerson DJ, Sykes D, et al. (2004). Health care costs of women with
- 13 symptomatic vertebral fractures. *Bone*, 35, 383-386.
- 14
- 15

1 Appendix C: Abbreviations

2

| | |
|---------|--|
| AlloSCT | Allogeneic stem cell transplantation |
| ASCT | Autologous stem cell transplantation |
| BKP | Balloon kyphoplasty |
| BP | Bisphosphonates |
| CI | Confidence Interval |
| GC | Guideline Committee |
| GVHD | Graft versus host disease |
| ICER | Incremental Cost Effectiveness Ratio |
| LETR | Linking Evidence to Recommendations |
| PCL | Plasma cell leukaemia |
| MDT | Multi disciplinary team |
| MGUS | Monoclonal gammopathy of undetermined significance |
| NPV | Negative Predictive Value |
| NSM | Non-surgical management |
| ONJ | Osteonecrosis of the jaw |
| PET-CT | Positron emission tomography CT |
| PPV | Positive Predictive Value |
| QALY | Quality Adjusted Life Years |
| QADAS | Quality Assessment of Diagnostic Accuracy Studies |
| SREs | Skeletal related events |
| VCFs | Vertebral compression fractures |
| VP | Vertebroplasty |
| VTE | Venous thromboembolism |
| WBCT | Whole body computed tomography |

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6

1 **Appendix D: Glossary**

2 **Allogeneic stem cell transplantation (AlloSCT)**

3 A complex procedure involving administration of high-dose cytotoxic therapy (chemotherapy
4 with or without radiotherapy) followed by transplant of peripheral blood or bone marrow stem
5 cells (and rarely cord blood) from a sibling or unrelated donor. This is usually followed by
6 immunosuppression.

7 **Amyloid**

8 The product (immunoglobulin light chain fragments) of a group of abnormal plasma cells
9 which is deposited in a variety of organs as an insoluble protein and is resistant to
10 degradation.

11 **Asymptomatic**

12 Without obvious signs or symptoms of disease. Cancer may cause symptoms and warning
13 signs, but, especially in its early stages, cancer may develop and grow without producing any
14 symptoms.

15 **Autologous stem cell transplantation (ASCT)**

16 A procedure involving administration of high-dose chemotherapy followed by transplant of
17 peripheral blood or bone marrow stem cells previously harvested from the patient

18 **Biopsy**

19 Removal of a sample of tissue from the body to assist in diagnosis or inform the choice of
20 treatment of a disease.

21 **Cast nephropathy**

22 The formation of plugs (urinary casts) in the renal tubules from free immunoglobulin light
23 chains filtered from the blood. This leads to renal failure.

24 **Chemotherapy**

25 The use of medication (drugs) that is toxic to cancer cells, given with the aim of killing the
26 cells or preventing or slowing their growth.

27 **Cohort studies**

28 Research studies in which groups of patients with a particular condition or specific
29 characteristic are compared with matched groups who do not have it, or patients within the
30 cohort are compared with each other.

31 **Computed tomography (CT)**

32 Imaging technique in which the person lies on a table within a x-ray gantry. The images are
33 acquired using a spiral (helical) path and banks of detectors, allowing presentation of the
34 internal organs and blood vessels in different projections including 3-D views.

35 **Cost effectiveness analysis**

36 A type of economic evaluation that compares the costs and benefits of different treatments.
37 In cost-effectiveness analysis benefits are measured in clinical outcome units, for example,
38 additional heart attack prevented, life years gained, etc. When a new treatment is compared
39 with current care, its additional costs divided by its additional benefits is called the cost
40 effectiveness ratio.

1 **False negative**

2 An individual who is truly positive for a disease, but whom a diagnostic test classifies them as
3 disease-free.

4 **Cytogenetics**

5 A branch of genetics that is concerned with the study of the structure and function of the
6 genetic material in a cell, especially the chromosomes. It includes routine analysis of
7 chromosomes, as well as molecular cytogenetics such as fluorescent *in situ* hybridization
8 (FISH) and other molecular techniques.

9 **Dialysis**

10 A process for removing waste and excess water from the blood, and is used primarily as an
11 artificial replacement for lost kidney function in people with kidney failure.

12 **Evidence table**

13 A table summarising the results of a collection of studies which, taken together, represent the
14 evidence supporting a particular recommendation or series of recommendations in a
15 guideline.

16 **False positive**

17 An individual who is truly disease-free, but whom a diagnostic test classifies them as having
18 the disease

19 **Fluorescence in situ hybridisation (FISH)**

20 A molecular test carried out on biopsy or cytology samples to show whether extra or
21 abnormal copies of specific genes or genetic material are present or absent.

22 **GRADE**

23 The GRADE approach is a method of grading the quality of evidence and strength of
24 recommendations in healthcare guidelines. It is developed by the Grading of
25 Recommendations, Assessment, Development and Evaluation (GRADE) Working Group.

26 **Graft versus host disease (GVHD)**

27 A common complication following an allogeneic stem cell transplant. Immune white blood
28 cells in the transplant (graft) recognize the recipient (the host) as "foreign." The transplanted
29 immune cells then attack the host's body cells.

30 **Health economics**

31 The study of the allocation of scarce resources among alternative health care treatments.
32 Health economists are concerned with both increasing the average level of health in the
33 population and improving the distribution of health.

34 **Heterogenous**

35 A term used to describe the amount of difference between observations, results or effects.

36 **Hypercalcaemia**

37 Raised calcium level in the blood

38 **Hyperviscosity**

39 Increased viscosity of the blood potentially leading to pathological complications

1 Immunohistochemistry

2 The process of detecting antigens (e.g., proteins) in the cells of a tissue section, by using
3 antibodies binding specifically to antigens in biological tissues.

4 Immunophenotyping

5 A technique used to study the protein expressed by cells. It is usually done on liquid
6 specimens and involves the labelling of white blood cells with antibodies directed against
7 surface proteins on their membrane. The labelled cells are processed in a flow cytometer, a
8 laser-based instrument capable of analyzing thousands of cells per second. The whole
9 procedure can be performed on cells from the blood, bone marrow or spinal fluid in a matter
10 of a few hours.

11 Immunosuppression

12 A reduction in the efficacy of the immune system due to disease, treatment or both.

13 Kyphoplasty

14 A minimally invasive spinal surgery procedure used to treat painful, progressive vertebral
15 compression fractures. Kyphoplasty involves the use of a balloon to restore the height and
16 shape of the vertebral body. This is followed by application of bone cement to strengthen the
17 vertebra

18 Light chain deposition

19 A rare disease characterised by the deposition of the light chain part of the immunoglobulin
20 molecule usually in the kidneys.

21 Lymph

22 Almost colourless fluid that bathes body tissues and is carried by lymphatic vessels. It
23 contains cells that help fight infection and disease.

24 Lymph nodes or glands

25 Small bean-shaped organs located along the lymphatic system. Nodes filter bacteria or
26 cancer cells that might spread through the lymphatic system and to other parts of the body.

27 Magnetic resonance imaging (MRI)

28 A type of scan which uses a magnetic field and radio waves to produce images of sections of
29 the body.

30 Meta analysis

31 Results from a collection of independent studies (investigating the same issue) are pooled,
32 using statistical techniques to synthesise their findings into a single estimate of an effect.
33 Where studies are not compatible e.g. because of differences in the study populations or in
34 the outcomes measured, it may be inappropriate or even misleading to pool statistically
35 results in this way.

36 Microarray technologies

37 A genetic test used to analyse very small amounts of RNA and DNA. It is a chip technology
38 that enables the analysis of large amounts of genetic information in a short period of time.

1 Monoclonal gammopathy of undetermined significance (MGUS)

2 A common plasma cell disorder characterised by a low level monoclonal protein (<30g/L),
3 less than 10% bone marrow plasma cells and the absence of myeloma related organ
4 disease.

5 Monoclonal protein (paraprotein)

6 Monoclonal protein or paraprotein is a single immunoglobulin molecule produced in excess
7 indicating a plasma cell disorder

8 Morbidity

9 Detrimental effects on health.

10 Mortality

11 Either (1) the condition of being subject to death; or (2) the death rate, which reflects the
12 number of deaths per unit of population in relation to any specific region, age group, disease,
13 treatment or other classification, usually expressed as deaths per 100, 1,000, 10,000 or
14 100,000 people.

15 Multi disciplinary team (MDT)

16 A team with members from different health care professions and specialties (e.g. urology,
17 oncology, pathology, radiology, nursing). Cancer care in the NHS uses this system to ensure
18 that all relevant health professionals are engaged to discuss the best possible care for that
19 patient.

20 Neuropathy

21 Damage to or disease affecting nerves, which may impair sensation, movement, gland or
22 organ function, or other aspects of health, depending on the type of nerve affected.

23 Osteoclastic activity

24 Increased activity of the osteoclast cells that lead to increased bone resorption

25 Palliative

26 Anything which serves to alleviate symptoms due to the underlying cancer but is not
27 expected to cure it.

28 Paraprotein – see monoclonal protein

29 Plasma cells

30 The type of white blood cell which produces antibodies

31 Plasma cell leukaemia (PCL)

32 A plasma cell disorder characterised by $>2 \times 10^9/L$ circulating plasma cells in the peripheral
33 blood

34 Plasmapheresis

35 The removal, treatment, and possible return of blood plasma (or components of blood
36 plasma) from the circulating blood using a plasmapheresis machine (cell separator).

37 Platelets

38 The small blood cells involved in stopping bleeding

1 Polymerase chain reaction techniques

2 A technology in molecular biology used to amplify a single copy or a few copies of a piece of
3 DNA, generating thousands to millions of copies of a particular DNA sequence.

4 Positron emission tomography CT (PET-CT)

5 A medical imaging technique using a device which combines a positron emission
6 tomography (PET) scanner (which utilises a radioactive tracer to show functional activity)
7 with an x-ray computed tomography (CT) scanner. Images acquired from both devices can
8 be taken sequentially, in the same session, and combined into a single superposed image.

9 Prevalence

10 The proportion of a population found to have a condition

11 Primary care

12 Services provided in a community setting, outside hospitals (secondary care), with which
13 people usually have first contact.

14 Prognosis

15 A prediction of the likely outcome or course of a disease; the chance of recovery, recurrence
16 or death.

17 Prognostic factors

18 Specific characteristics of a cancer or the person who has it which might affect the patient's
19 prognosis.

20 Prospective study

21 A study in which people are entered into research and then followed up over a period of time
22 with future events recorded as they happen.

23 Protein electrophoresis

24 The use of electrical currents to separate and characterise proteins in the blood to help
25 diagnose myeloma

26 Psychosocial support

27 A general term for any non-therapeutic intervention that helps a person cope with stressors
28 in the home or at work.

29 Qualitative research

30 Research in which the outcomes are usually recorded in words, rather than with numbers.
31 Often used to explore and understand peoples' beliefs, experiences, attitudes, behaviour and
32 interactions.

33 Quality adjusted life years (QALYs)

34 A measure of health outcome, which looks at both length of life and quality of life. QALYs are
35 calculated by estimating the years of life remaining for a patient following a particular care
36 pathway and weighting each year with a quality of life score (on a 0-1 scale). One QALY is
37 equal to 1 year of life in perfect health, or 2 years at 50% health, and so on.

38 Quantitative research

39 Research which uses numerical measurement techniques (e.g. measuring survival times
40 after treatment).

1 Radiotherapy

2 The use of radiation, usually high energy x-rays to control the growth of cancer cells.

3 Randomised controlled trial (RCT)

4 An experimental clinical trial (study) investigating the effectiveness of different treatments in
5 which participants are assigned at random to different groups which receive the intervention
6 being assessed or a 'control' treatment. RCTs give the most reliable (i.e. least biased) form
7 of evidence on clinical effectiveness.

8 Rare

9 A disease or a cancer that affects fewer than 1 in 2000 people

10 Relapse

11 Where cancer starts to grow again after treatment.

12 Sensitivity

13 In diagnostic testing, it refers to the chance of having a positive test result given that you
14 have the disease. 100% sensitivity means that all those with the disease will test positive, but
15 this is not the same the other way around. A patient could have a positive test result but not
16 have the disease – this is called a 'false positive'. The sensitivity of a test is also related to its
17 'negative predictive value' (true negatives) – a test with a sensitivity of 100% means that all
18 those who get a negative test result do not have the disease. To judge fully the accuracy of a
19 test, its Specificity must also be considered.

20 Sensitivity analysis

21 A means of representing uncertainty in the results of economic evaluations. Uncertainty may
22 arise from missing data, imprecise estimates or methodological controversy. Sensitivity
23 analysis also allows for exploring the generalisability of results to other setting. The analysis
24 is repeated using different assumptions to examine the effect on the results.

25 Skeletal survey

26 A series of plain x-rays of the skeleton including skull, spine, pelvis and long bones used to
27 detect myeloma-related bone disease

28 Specificity

29 In diagnostic testing, it refers to the chance of having a negative test result given that you do
30 not have the disease. 100% specificity means that all those without the disease will test
31 negative, but this is not the same the other way around. A patient could have a negative test
32 result yet still have the disease – this is called a 'false negative'. The specificity of a test is
33 also related to its 'positive predictive value' (true positives) – a test with a specificity of 100%
34 means that all those who get a positive test result definitely have the disease. To judge fully
35 the accuracy of a test, its Sensitivity must also be considered.

36 Survival

37 Survival is the time alive after diagnosis of a disease

38 Systematic review

39 A review of the literature carried out in order to address a defined question and using
40 quantitative methods to summarise the results.

1 Thrombo-embolism

2 Thromboses are abnormal blood clots in the veins. These can break off and block the blood
3 flow, especially in the lungs. This is called embolism

4 Vertebroplasty

5 Vertebroplasty is an image-guided, minimally invasive, nonsurgical therapy used to
6 strengthen a broken vertebra (spinal bone) that has been weakened by osteoporosis or by+
7 cancer. Percutaneous vertebroplasty involves the injection of acrylic bone cement into the
8 vertebral body in order to relieve pain and/or stabilise the fractured vertebrae and in some
9 cases, restore vertebral height.
10

1 Appendix E: Guideline scope

E.1.2 Guideline scope

E.1.13 Guideline title

4 Myeloma: diagnosis and management of myeloma

E.1.1.15 Short title

6 Myeloma

E.1.27 The remit

8 The Department of Health has asked NICE: 'to develop a guideline on the diagnosis and
9 management of multiple myeloma'.

E.1.30 Clinical need for the guideline

11 The management of myeloma is complex and challenging. It increasingly involves the use of
12 expensive drugs. The guideline will aim to raise standards nationally while allowing clinical
13 flexibility and defining a common pathway for patients at various stages of their illness, and
14 of different ages and levels of fitness. Although a consistent approach to management is
15 desirable, it needs to reflect the very different groups of patients with myeloma from the fit
16 and suitable for transplant, fairly fit but not suitable for transplant to patients who are
17 extremely frail and/or unwell.

E.1.3.18 Epidemiology

19 a) Myeloma is the 17th most common cancer in the UK and the 14th most common cancer in
20 men, according to figures from 2009. Incidence rates have remained stable over the past 10
21 years.

22 b) In 2010, 4672 people were diagnosed with myeloma in the UK.

23 c) Myeloma occurs most commonly in older people, with 71% of cases diagnosed in people
24 aged 65 years and over. Incidence increases with age, peaking in those aged 85 years and
25 over.

26 d) Myeloma is almost twice as common in men and women of African-Caribbean family
27 origin compared with people of other family origins.

28 e) Although there have been substantial improvements in the duration and quality of survival
29 during the past 15 years, myeloma remains incurable. Median survival is currently about 5
30 years. A significant minority (10%) of patients die within 3 months of diagnosis.

31 f) Survival rates are higher in younger patients. This is thought to be partly a result of
32 differences in treatment options for younger and older patients.

33 g) Myeloma is usually preceded by an asymptomatic monoclonal gammopathy of
34 undetermined significance (MGUS). It is important to distinguish between MGUS and
35 myeloma at the time of diagnosis.

E.1.3.21 Current practice

- 2 a) The non-specific clinical presentation of myeloma (bone pain, symptoms of impaired renal
3 function, anaemia, hypercalcaemia and hyperviscosity) often results in delayed diagnosis;
4 38% of cases are diagnosed only after emergency admission to hospital.
- 5 b) Diagnosis of myeloma is made using international criteria published by the International
6 Myeloma Working Group in 2003. The use of genetic profiling to give predictive and
7 prognostic information is increasing.
- 8 c) Several novel drug treatments have been licensed in the past 10 years, but there is some
9 variation in the regimens used and the timing of using these drugs. High-dose chemotherapy
10 with stem cell transplantation is a standard of care for patients who are fit enough for this
11 procedure.
- 12 d) Symptom-based and supportive management are especially important because of the
13 complex nature of the disease and side effects of its treatment. Management may include
14 radiotherapy, bisphosphonate treatment, pain control, treatment of bone and renal
15 complications, and psychosocial support.
- 16 e) A specialist multidisciplinary approach should involve the core multidisciplinary team
17 (MDT) (as defined in Improving outcomes in haematological cancers [NICE cancer service
18 guidance]) but also a wider group of specialists including: graduate and biomedical scientists,
19 clinical oncologists, spinal surgeons, radiologists, renal physicians, orthopaedic surgeons
20 and oncology pharmacists. There should also be links to community care through the GP.
- 21 f) When determining treatment for patients with myeloma, their response to previous
22 treatment, frailty, previous toxicities and comorbidities need to be considered.

E.1.43 The guideline

- 24 The guideline development process is described in detail on the NICE website (see section
25 6, 'Further information').
- 26 This scope defines what the guideline will (and will not) examine, and what the guideline
27 developers will consider. The scope is based on the referral from the Department of Health.
- 28 The areas that will be addressed by the guideline are described in the following sections.

E.1.4.29 Population

30 Groups that will be covered

- 31 • Adults (aged 16 years and over) referred to secondary care with suspected myeloma,
32 including those with MGUS.
- 33 • Adults (aged 16 years and over) with newly diagnosed or relapsed myeloma.
- 34 • Adults (aged 16 years and over) with high-risk myeloma, including primary plasma cell
35 leukaemia.
- 36 • No patient subgroups have been identified as needing specific consideration.

37 Groups that will not be covered

- 38 • Children and young people (under 16 years) with suspected or diagnosed myeloma.
- 39 • People with:
- 40 ○ solitary plasmacytoma in the absence of myeloma
- 41 ○ amyloid light-chain (AL) amyloidosis in the absence of myeloma
- 42 ○ paraproteins secondary to other conditions.

E.1.4.21 Healthcare setting

- 2 All settings in which NHS-funded care is provided.

E.1.4.33 Management

4 Key issues that will be covered

- 5 a) The specific information and support needs of patients with myeloma and their families
6 and carers at diagnosis and treatment planning, and during and after treatment (including
7 end of life care).
- 8 b) The role of centralised specialist laboratories offering integrated diagnostic reporting in the
9 diagnosis of Myeloma has been removed from the scope and added as a topic within the
10 update of the Improving Outcomes in Haematological Cancers service guidance, which is
11 now in development. For more information please see
12 <http://www.nice.org.uk/guidance/indevelopment/gid-cgwave0747>.
- 13 c) The role of specialist diagnostic investigations, including trephine biopsy,
14 immunophenotyping, cytogenetics and molecular technologies, in diagnosing MGUS and
15 standard and high-risk myeloma.
- 16 d) Imaging investigations at diagnosis.
- 17 e) The local and regional service provision needed for adequate disease management and
18 equity of access.
- 19 f) Primary disease management for newly diagnosed myeloma, including autologous stem
20 cell transplantation.
- 21 g) The management of primary plasma cell leukaemia.
- 22 h) The management of asymptomatic myeloma.
- 23 i) The most effective salvage therapies for relapsed and/or refractory myeloma.
- 24 j) The role of allogeneic stem cell transplantation in both primary treatment and treatment of
25 relapsed myeloma (salvage therapy).
- 26 k) The management of neuropathy in patients with myeloma (excluding pharmacological
27 management of neuropathic pain).
- 28 l) The prevention and management of bone disease, including spinal bone disease, for
29 patients with myeloma.
- 30 m) The prevention of thrombosis for patients with myeloma.
- 31 n) Prophylaxis of infection for patients with myeloma.
- 32 o) The management of renal disease for patients with myeloma.
- 33 p) Follow-up for patients with myeloma.
- 34 q) The management of treatment-related fatigue for patients with myeloma.

35

36 Issues that will not be covered

- 37 a) The management of MGUS.

- 1 b) The role of consolidation and maintenance therapy after primary management of
- 2 myeloma. Consolidation and maintenance therapy are the subject of two NICE technology
- 3 appraisals that are in development. The guideline will cross refer to these, in line with NICE
- 4 process, and therefore will not be investigating this issue.

E.1.4.45 Main outcomes

- 6 a) Overall survival.
- 7 b) Disease-related morbidity.
- 8 c) Disease-related mortality.
- 9 d) Treatment-related morbidity.
- 10 e) Treatment-related mortality.
- 11 f) Progression-free survival.
- 12 g) Time to next treatment.
- 13 h) Treatment response rate.
- 14 i) Renal outcome.
- 15 j) Psychological wellbeing.
- 16 k) Diagnostic accuracy.
- 17 l) Number and length of admissions to hospital after diagnosis.
- 18 m) Health-related quality of life.
- 19 n) Patient-reported outcomes.

E.1.4.20 Review questions

21 Review questions guide a systematic review of the literature. They address only the key
22 issues covered in the scope, and usually relate to interventions, diagnosis, prognosis, service
23 delivery or patient experience. Please note that these review questions are draft versions
24 and will be finalised with the Guideline Development Group.

25 Numbers in square brackets refer to the key issues listed in section 1.4.3.

26 a) What are the specific information and support needs of patients with myeloma and their
27 families and carers

28 i. at diagnosis and treatment planning

29 ii. during treatment

30 iii. during follow-up

31 iv. at the end of life? [1.4.3a]

32 b) What is the most effective way to deliver diagnostic services for suspected myeloma?
33 [1.4.3b]

34 c) What is the optimal laboratory testing strategy for suspected myeloma? [1.4.3c]

35 d) Can investigations done at the diagnosis of myeloma, including trephine biopsy,
36 immunophenotyping and cytogenetic and molecular genetic tests accurately predict

- 1 treatment outcomes (for example, can they identify patients with a poor prognosis for whom
- 2 an alternative treatment approach may be preferable)? [1.4.3c]
- 3 e) What is the optimal imaging strategy (including skeletal survey and spinal MRI) for
- 4 patients with newly diagnosed myeloma? [1.4.3d]
- 5 f) Should MRI results guide treatment decisions in patients with newly diagnosed
- 6 asymptomatic myeloma? [1.4.3d]
- 7 g) What is the optimal configuration of local and regional services for radiological imaging,
- 8 the management of renal disease, spinal disease and bone disease, and palliative care for
- 9 patients with myeloma? [1.4.3e]
- 10 h) Which patients with myeloma should be considered for autologous stem cell
- 11 transplantation? [1.4.3f]
- 12 i) What are the most effective primary treatments for patients with primary plasma cell
- 13 leukaemia? [1.4.3g]
- 14 j) What are the most effective primary treatments (including observation) for patients with
- 15 asymptomatic myeloma? [1.4.3h]
- 16 k) What are the most effective post-third line systemic therapy regimens for patients with
- 17 relapsed or refractory myeloma? [1.4.3i]
- 18 l) In which patients with relapsed or refractory myeloma is a second transplantation more
- 19 effective than other therapy? [1.4.3i]
- 20 m) Which patients with myeloma should be considered for allogeneic stem cell
- 21 transplantation? [1.4.3j]
- 22 n) What is the most effective way to manage neuropathy in patients with myeloma (excluding
- 23 pharmacological management of neuropathic pain)? [1.4.3k]
- 24 o) What is the most effective method of preventing bone disease in patients with myeloma?
- 25 [1.4.3l]
- 26 p) What is the most effective treatment for non-spinal bone disease in patients with myeloma
- 27 (including external beam radiotherapy and surgical intervention)? [1.4.3l]
- 28 q) What is the most effective treatment for spinal bone disease in patients with myeloma
- 29 (including external beam radiotherapy and surgical intervention)? [1.4.3l]
- 30 r) What is the most effective method for prevention of thrombosis in patients with myeloma?
- 31 [1.4.3m]
- 32 s) What is the most effective prophylactic strategy for infection in patients with myeloma
- 33 (including immunoglobulin, antibiotics, growth factors and vaccinations)? [1.4.3n]
- 34 t) What is the optimal management of renal disease in patients with myeloma? [1.4.3o]
- 35 u) What is the optimal follow-up protocol for patients with myeloma (including duration,
- 36 frequency, investigations and onward referral)? [1.4.3p]
- 37 v) Which interventions are most effective in reducing fatigue in patients being treated for
- 38 myeloma? [1.4.3q]

E.1.4.69 Economic aspects

- 40 Developers will take into account both clinical and cost effectiveness when making
- 41 recommendations involving a choice between alternative interventions. A review of the

- 1 economic evidence will be conducted and analyses will be carried out as appropriate. The
- 2 preferred unit of effectiveness is the quality-adjusted life year (QALY), and the costs
- 3 considered will usually be only from an NHS and personal social services (PSS) perspective.
- 4 Further detail on the methods can be found in The guidelines manual.

E.1.4.75 Status

6 Scope

- 7 This is the final scope.

8 Timing

- 9 The development of the guideline recommendations will begin in March 2014.

E.1.50 Related NICE guidance

E.1.5.11 Published guidance

12 NICE guidance to be updated

- 13 This guideline will not update or replace any NICE guidance.

14 NICE guidance to be incorporated

- 15 This guideline will incorporate the following NICE guidance:

- 16 • Bortezomib and thalidomide for the first-line treatment of multiple myeloma. NICE
- 17 technology appraisal guidance 228 (2011). [Incorporation into the guideline is subject to a
- 18 NICE technology appraisal review proposal.]
- 19 • Lenalidomide for the treatment of multiple myeloma in people who have received at least
- 20 one prior therapy. NICE technology appraisal guidance 171 (2009). [Incorporation into the
- 21 guideline is subject to a NICE technology appraisal review proposal.]
- 22 • Bortezomib monotherapy for relapsed multiple myeloma. NICE technology appraisal
- 23 guidance 129 (2007). [Incorporation into the guideline is subject to a NICE technology
- 24 appraisal review proposal.]

25 Other related NICE guidance

- 26 • Referral for suspected cancer. NICE clinical guideline NG12. (June 2015).
- 27 • Acute kidney injury. NICE clinical guideline 169 (2013).
- 28 • Neuropathic pain - pharmacological management. NICE clinical guideline 173 (2013).
- 29 • Denosumab for the prevention of skeletal-related events in adults with bone metastases
- 30 from solid tumours. NICE technology appraisal guidance 265 (2012).
- 31 • Neutropenic sepsis. NICE clinical guideline 151 (2012).
- 32 • Patient experience in adult NHS services. NICE clinical guidance 138 (2012).
- 33 • Anaemia management in people with chronic kidney disease. NICE clinical guideline 114
- 34 (2011).
- 35 • Medicines adherence. NICE clinical guideline 76 (2009).
- 36 • Metastatic spinal cord compression. NICE clinical guideline 75 (2008).
- 37 • Epoetin alfa, epoetin beta and darbepoetin alfa for cancer treatment-induced anaemia.
- 38 NICE technology appraisal guidance 142 (2008).
- 39 • Balloon kyphoplasty for vertebral compression fractures. NICE interventional procedure
- 40 guidance 166 (2006).

- 1 • Improving supportive and palliative care for adults with cancer. NICE cancer service
- 2 guidance (2004).
- 3 • Percutaneous vertebroplasty. NICE interventional procedure guidance 12 (2003).

E.1.5.24 Guidance under development

- 5 NICE is currently developing the following related guidance (details available from the NICE
- 6 website):
- 7 • Bortezomib for consolidation therapy after autologous stem cell transplantation for the
- 8 treatment of multiple myeloma. Publication date TBC
- 9 • Care of the dying adult. Publication date TBC.
- 10 • Bortezomib for induction therapy prior to high dose chemotherapy and autologous stem
- 11 cell transplantation for the treatment of multiple myeloma. NICE technology appraisal
- 12 guidance. Publication expected May 2014.
- 13 • Lenalidomide for the treatment of multiple myeloma in people who have received at least
- 14 one prior therapy with bortezomib (partial review of TA171). NICE technology appraisal
- 15 guidance. Publication expected July 2014.
- 16 • Pomalidomide for treating relapsed and refractory multiple myeloma previously treated
- 17 with both lenalidomide and bortezomib. NICE technology appraisal guidance. Publication
- 18 expected February 2015.

E.1.5.39 Related quality standard

- 20 End of life care for adults. NICE quality standard 13 (2011).

E.1.61 Further information

- 22 Information on the guideline development process is provided in the following documents,
- 23 available from the NICE website:
- 24 • How NICE clinical guidelines are developed: an overview for stakeholders the public and
- 25 the NHS: 5th edition
- 26 • The guidelines manual.
- 27 • Information on the progress of the guideline will also be available from the NICE website.

28
29

1 Appendix F: People and organisations 2 involved in producing the guideline

3

F.1.4 Members of the Guideline Committee

| | |
|---|---|
| Guideline Committee Chair | |
| Professor Curly Morris | Consultant Haematologist, Altnagelvin Hospital, Londonderry |
| Guideline Committee Lead Clinician | |
| Dr Guy Pratt | Senior lecturer, Cancer Sciences Honorary Consultant Haematologist, Birmingham |
| Guideline Committee Members | |
| Professor Sam Ahmedzai | Emeritus Professor, Palliative Medicine, Sheffield |
| Alan Chant | Patient and carer member |
| Andrea Guy | Clinical Nurse Specialist and Stem Cell Transplant Coordinator, Myeloma and Related Plasma Cell Disorders, London |
| Dr Matthew Jenner | Consultant Haematologist, Southampton |
| Nicola Montacute | Palliative Care Clinical Nurse Specialist, Somerset |
| Dr Nicola Mulholland | Consultant Radiologist and nuclear medicine physician, honorary senior lecturer, London. |
| Monica Morris | Clinical Nurse Specialist, Middlesex |
| Lesley Roberts | Patient and carer member |
| Dr Hamdi Sati | Consultant Haematologist, Swansea |
| Professor John Snowden | Consultant Haematologist & Director of Blood and Marrow Transplantation, Sheffield |
| Dr Matthew Streetly | Consultant Haematologist, London |
| Jane Woodward | Patient and carer member |

5 Declarations of interest

| Name | Interest declared | Category | Decision |
|--------------|--|-------------------------------------|--|
| Curly Morris | Received reimbursement of travel and subsistence expenses, and registration fee to attend the American Society for Haematology Meeting in Atlanta. | Personal pecuniary non-specific | Declare and can participate in discussion of all topics as expenses not beyond reasonable amounts. |
| Curly Morris | Received financial support from Celgene to attend the International Myeloma Workshop in Kyoto, Japan. Money was paid to Altnagelvin Haematology Laboratory Trust Funds | Non-personal pecuniary non-specific | Declare and can participate in discussion of all topics as expenses not beyond reasonable amounts. |
| Curly Morris | Received financial support from Mundi Pharma to attend the European Blood and Marrow | Non-personal pecuniary non-specific | Declare and can participate in discussion of all topics |

| Name | Interest declared | Category | Decision |
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| | Transplant Meeting in London. Money was paid to Altnagelvin Haematology Laboratory Trust Funds | | as expenses not beyond reasonable amounts. |
| Curly Morris | Member of the trial management group and involved in designing the trial protocol for Myeloma X trial (phase III on the role of a second autologous stem cell transplant in patients with relapsed myeloma following high dose rate chemotherapy and autologous stem cell rescue). Funded by CRUK. | Non-personal pecuniary specific | Declare and can participate in discussion of all topics as research not funded by the healthcare industry. |
| Curly Morris | Principal investigator and involved in designing the trial protocol for an Irish Clinical Oncology Research Group (ICORG) sponsored phase II trial of Bortezomib, Adriamycin and Dexamethasone (PAD) in patients with relapsed and refractory myeloma. Costs and free drug from Jansen Cilag. | Non-personal pecuniary specific | Declare and must withdraw from discussion of any topics which include PAD as an intervention until 12 months after publication of the results |
| Curly Morris | Received reimbursement of travel expenses from the organisers for speaking on myeloma to data managers at the European Blood and Marrow Transplant meeting | Personal pecuniary non-specific | Declare and participate in discussion of all guideline topics as expenses not beyond reasonable amounts |
| Curly Morris | The Binding Site Ltd have offered to reimburse travel and subsistence expenses for attendance at their conference in Edinburgh. | Personal pecuniary non-specific | Declare and participate in discussion of all guideline topics as expense not beyond reasonable amounts |
| Curly Morris | Received reimbursement of travel and subsistence expenses from EMBT for chairing a session and presenting on maintenance and consolidation post transplant in myeloma patients at their conference in Turin | Personal pecuniary non-specific | Declare and participate in discussion of all guideline topics as expenses not beyond reasonable amounts. |
| Curly Morris | Has accepted a travel grant from Celgene to attend International Myeloma Workshop in Rome in September. | Personal pecuniary non-specific | Declare and participate in discussion of all topics as expenses not beyond reasonable amounts. |
| Guy Pratt | Receives an annual payment from the Binding Site Ltd for being a member of their advisory board and providing general clinical advice. This involves overseeing, as chief investigator, a study recruiting normal blood donors from within the company for control | Personal pecuniary specific | Declare and must withdraw from discussion of any topics which include interventions made by Binding Site Ltd |

| Name | Interest declared | Category | Decision |
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| | samples. | | |
| Guy Pratt | Received honorarium from Celgene for chairing a meeting on general myeloma issues. | Personal pecuniary non-specific | Declare and can participate in discussion of all topics as conflict has now expired. |
| Guy Pratt | Received honorarium from Janssen for a presentation on Waldenstroms. | Personal pecuniary non-specific | Declare and participate in discussion of all topics as Waldenstroms is not being investigated by the guideline. |
| Guy Pratt | Received support for travel, accommodation and subsistence expenses from Binding Site Ltd to attend an educational meeting in Japan. | Personal pecuniary non-specific | Declare and can participate in discussion of all topics as expenses not beyond reasonable amounts. |
| Guy Pratt | Received support from the Italian Haematology Society to attend and present a lecture on Immunodeficiency in Multiple Myeloma | Personal pecuniary non-specific | Declare and can participate in discussion of all topics as expenses not beyond reasonable amounts. |
| Guy Pratt | Chief investigator (and designed trial protocol) for the PICCLE trial (parp inhibitor olaparib in relapsed chronic lymphocytic leukaemia). Astra Zeneca provided free drug support and the trial was supported by Leukaemia Lymphoma Research. | Non-personal pecuniary non-specific | Declare and participate in discussion of all topics as chronic lymphocytic leukaemia is not being investigated by the guideline |
| Guy Pratt | Principal investigator for the PADIMAC trial (Phase II study of bortezomib, adramycin, dexamethasone (PAD) therapy in previously untreated myeloma patients). Funded by Leukaemia Lymphoma Research | Non-personal pecuniary specific | Declare and participate in discussions on all topics as no supervisory responsibility on trials and not funded by pharmaceutical industry. |
| Guy Pratt | Principal investigator for the GOYA study (GA-101 +CHOP versus RCHOP chemotherapy in untreated Diffuse Large B-cell NHL). Funded by Roche | Non-personal pecuniary non-specific | Declare and participate in discussion of all topics as diffuse large B-cell NHL is not being investigated by the guideline |
| Guy Pratt | Principal investigator for the Lilly Myeloma trial (A Multicenter, Randomized, Double-Blind, Placebo-Controlled Phase 2/3 Study of Tabalumab in Combination with Bortezomib and Dexamethasone in relapsed by Myeloma). Funded by Lilly | Non-personal pecuniary non-specific | Declare and participate in discussions on all topics as no supervisory responsibility on trials. |
| Guy Pratt | Principal investigator for the | Non-personal | Declare and participate |

| Name | Interest declared | Category | Decision |
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| | Gilead CLL study (A Phase 3, Randomized, Double-Blind, Placebo-Controlled Study Evaluating the Efficacy and Safety of Idelalisib (GS-1101) in Combination with Bendamustine and Rituximab for Previously Treated Chronic Lymphocytic Leukemia). Funded by Gilead | pecuniary non-specific | in discussion of all topics as chronic lymphocytic leukaemia is not being investigated by the guideline |
| Guy Pratt | Co-investigator (involved in designing the trial protocol) for the TEAMM trial (trial assessing the benefit of antibiotic prophylaxis with levofloxacin, and its effect on health care associated infections in patients with newly diagnosed symptomatic myeloma). Funded by NIHR Health Technology Assessment. | Non-personal pecuniary specific | Declare and can participate in discussion of all topics as research not funded by the healthcare industry. |
| Guy Pratt | Co-investigator (involved in designing the trial protocol) for the BAP trial (bezafibrate/medroxyprogesterone in chronic lymphocytic leukaemia, acute myeloid leukaemia and non-Hodgkin's lymphoma). Funded by Queen Elizabeth Hospital Trust. | Non-personal pecuniary non-specific | Declare and participate in discussion of all topics as chronic lymphocytic leukaemia, acute myeloid leukaemia and NHL are not being investigated by the guideline |
| Guy Pratt | Member of the trial management group for a randomised phase II trial R2W in Waldenström's macroglobulinaemia funded by Cancer Research UK. Involved in trial design, protocol amendments and answering clinical queries. | Non-personal pecuniary non-specific | Declare and participate in discussion of all topics as Waldenström's is not being investigated by the guideline |
| Guy Pratt | Member of the data monitoring committee (checks safety data) for the LenaRIC trial (Phase II study of the adjuvant use of lenalidomide in patients undergoing reduced intensity conditioning allogeneic transplantation for multiple myeloma). Funded by CTAAC | Non-personal pecuniary specific | Declare and participate in discussions on all topics as no supervisory responsibility on trials. |
| Guy Pratt | Member of the data monitoring committee (checks safety data) for HA-1 trial (A phase I clinical trial of the vaccination of healthy human volunteers against the minor histocompatibility antigen (mHA) HA-1 using a DNA and MVA 'prime/boost' regimen). | Non-personal pecuniary non-specific | Declare and participate in discussion on all topics vaccination strategies are not being investigated by the guideline |
| Guy Pratt | Co-author on an evidence based position statement on | Personal non-pecuniary | Declare and participate in discussion on all |

| Name | Interest declared | Category | Decision |
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| | bendamustine in multiple myeloma, on behalf of the UK Myeloma Forum and Myeloma UK. | | topics as conclusions of the paper were based on a review of the published evidence. |
| Guy Pratt | Co-author on an evidence based position statement on maintenance and consolidation in multiple myeloma, on behalf of the UK Myeloma Forum and Myeloma UK. | Personal non-pecuniary | Declare and participate in discussion on all topics as conclusions of the paper were based on a review of the published evidence and the guideline will not be investigating maintenance and consolidation therapy for myeloma. |
| Guy Pratt | Registration fee for attendance at the British Society of Haematology Annual Meeting in Birmingham was paid by Janssen. | Personal pecuniary non-specific | Declare and participate in discussion of topics as payment was no beyond reasonable amounts. |
| Guy Pratt | Received an honorarium for chairing a medical advisory board for Takeda on ixazomib. | Personal pecuniary non-specific | Declare and participate in discussion of all guideline topics as ixazomib is not being investigated by the guideline. |
| Guy Pratt | Received an honorarium for chairing a medical advisory board for Amgen on carfilzomib. | Personal pecuniary specific | Declare and must withdraw from topics which include carfilzomib as an intervention until October 2015 |
| Guy Pratt | Received reimbursement of travel and subsistence expenses from the Binding Site Ltd to attend the American Society of Haematology Conference in San Francisco. | Personal pecuniary non-specific | Declare and participate in discussion of all guideline topics as payment not beyond reasonable expenses. |
| Guy Pratt | Received reimbursement of travel and subsistence expenses from The Binding Site Ltd to attend their meeting in Edinburgh. | Personal pecuniary non-specific | Declare and participate in discussion of all guideline topics as payment not beyond reasonable expenses. |
| Guy Pratt | Giving a presentation on the management of myeloma for Sebia UK Ltd in Birmingham. | Personal non-pecuniary non-specific | Declare and participate in discussion of all guideline topics as no payment was received. |
| Guy Pratt | Received reimbursement of travel and subsistence expenses from Helena Biosciences Europe for giving a talk on international standards for diagnosis and relapse in myeloma in Barcelona | Personal pecuniary non-specific | Declare and participate in discussion of all guideline topics as payment was not beyond reasonable expenses. |
| Guy Pratt | Has accepted a travel grant from Takeda to attend the 2015 | Personal pecuniary non- | Declare and participate in discussion of all |

| Name | Interest declared | Category | Decision |
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| | International Myeloma Workshop in Rome in September. | specific | topics as expenses not beyond reasonable amounts. |
| Guy Pratt | Received a fee in October 2015 from Amgen for speaking on a webinar, giving an update on the IMWG meeting | Personal pecuniary non-specific | Declare and can participate in discussions on all topics as presentation was not about any specific interventions. |
| Guy Pratt | Received a fee from Takeda for taking part in a debate on continuous versus fixed term treatment, at an educational meeting in November 2015 | Personal pecuniary non-specific | Declare and can participate in discussions on all topics as guideline is not covering treatment of myeloma. |
| Guy Pratt | Received a travel grant from Binding Site Ltd to attend ASH meeting in December 2015 | Personal pecuniary non-specific | Declare and participate in discussion of all topics as expenses not beyond reasonable amounts. |
| Hamdi Sati | Reimbursed for travel expenses to attend the European Haematology Association annual meeting by Napp Pharmaceuticals | Personal pecuniary non-specific | Declare and can participate in discussion of all topics as expenses not beyond reasonable amounts. |
| Hamdi Sati | Local principle investigator for the Myeloma X trial (A phase III study to determine the role of a second autologous stem cell transplant as consolidation therapy in patients with relapsed multiple myeloma following prior high dose chemotherapy and autologous stem cell rescue). Funded by CRUK | Non-personal pecuniary specific | Declare and participate in discussions on all topics as no supervisory responsibility on trials. |
| Hamdi Sati | Local principle investigator for the Myeloma XI trial (Randomised comparisons in myeloma patients of all ages of thalidomide, lenalidomide and bortezomib combinations and maintenance lenalidomide). Funded by CTAAC | Non-personal pecuniary specific | Declare and participate in discussions on all topics as no supervisory responsibility on trials. |
| Hamdi Sati | Local principle investigator for the MM1 trial (investigating whether adding MLN9708 to the combination of lenalidomide and dexamethasone, improves survival in patients with relapsed myeloma). Funded by Millenium Pharmaceuticals. | Non-personal pecuniary non-specific | Declare and participate in discussions on all topics as no supervisory responsibility on trials. |
| Hamdi Sati | Local principle investigator for the PASS observational study (A non-interventional observational post authorisation safety study of subjects treated | Non-personal pecuniary specific | Declare and participate in discussions on all topics as no supervisory |

| Name | Interest declared | Category | Decision |
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| | with lenalidomide). Funded by Celgene | | responsibility on trials. |
| Hamdi Sati | Local principle investigator for the PREAMBLE observational study (non-interventional observational study aimed at understanding the real world effectiveness of novel agents used in treating multiple myeloma and their impact on patient-reported outcomes). Funded by Bristol Myers Squibb. | Non-personal pecuniary specific | Declare and participate in discussions on all topics as no supervisory responsibility on trials. |
| Hamdi Sati | Is a signatory on a myeloma endowment fund (generated by patient donations, no direct contributions from pharmaceutical industry). Used to fund small projects and provide additional resource for ongoing research projects. | Non-personal pecuniary non-specific | Declare and participate in discussion of all topics as no contributions to the fund from the healthcare industry. |
| Hamdi Sati | Received reimbursement of travel and subsistence expenses from SHIRE for attending the 19th annual EHA meeting in Milan. | Personal pecuniary non-specific | Declare and participate in discussion of all topics as expenses not beyond reasonable amounts. |
| Hamdi Sati | Received reimbursement of travel and subsistence expenses from Celgene to attend the European Multiple Myeloma Academy meeting in Vienna. | Personal pecuniary non-specific | Declare and participate in discussion of all topics as expenses not beyond reasonable amounts |
| Hamdi Sati | Received reimbursement of travel, subsistence and registration expenses from Bristol-Myers Squibb to attend the American Society of Haematology meeting in San Francisco. | Personal pecuniary non-specific | Declare and participate in discussion of all topics as expenses not beyond reasonable amounts |
| Hamdi Sati | Is the local principle investigator for a trial examining ixazomib maintenance therapy post Autologous stem cell transplant in newly diagnosed multiple myeloma patients. Trial is sponsored by Takeda. | Non-personal pecuniary non-specific | Declare and participate in discussion of all topics as no supervisory responsibility on trials and the guideline is not covering maintenance therapy. |
| Hamdi Sati | Received reimbursement of travel and accommodation expenses to attend the 7th international meeting in Edinburgh 16-17 April 2015. Educational sponsorship by Binding site. | Personal pecuniary non-specific | Declare and participate in discussion on all topics as not receiving expenses beyond reasonable amount. |
| Hamdi Sati | Received an educational grant covering registration, travel and accommodation to attend the | Personal pecuniary non-specific | Declare and participate in discussion on all topics as not receiving expenses beyond |

| Name | Interest declared | Category | Decision |
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| | EHA 2015 meeting from BMS. | | reasonable amount. |
| Hamdi Sati | Local Principal Investigator for Tourmaline C16021 protocol trial examining the role of ixazomib maintenance in transplant ineligible patients, sponsored by Takeda. | Non-personal pecuniary non-specific | Declare and participate in discussion of all topics as no supervisory responsibility on trials and the guideline is not covering maintenance therapy. |
| Hamdi Sati | Has accepted a travel grant from Takeda to attend International Myeloma Workshop in Rome in September 2015. | Personal pecuniary non-specific | Declare and participate in discussion of all topics as expenses not beyond reasonable amounts. |
| Hamdi Sati | Received a travel grant from Takeda to attend the American Society of Haematology meeting in December 2015 | Personal pecuniary non-specific | Declare and participate in discussion of all topics as expenses not beyond reasonable amounts. |
| Hamdi Sati | Received an honorarium from Bristol Myers Squibb to give a presentation on chronic myeloid leukaemia in October 2015 | Personal pecuniary non-specific | Declare and participate in discussion of all topics as chronic myeloid leukaemia is not being covered by the guideline. |
| Hamdi Sati | Local PI for the OPTIMISM trial (Safety and Efficacy of Pomalidomide, Bortezomib and Low-dose Dexamethasone in Subjects With Relapsed or Refractory Multiple Myeloma). Trial is sponsored by Celgene. | Non-personal pecuniary non-specific | Declare and participate in discussion of all topics as no supervisory responsibility on trial and the guideline is not covering myeloma treatment. |
| John Snowden | Received an honorarium from MSD for chairing a meeting on antifungal drugs. | Personal pecuniary specific | Declare and must withdraw from topics which include antifungal drugs as an intervention until October 2014 |
| John Snowden | Received an honorarium from Celgene for chairing a meeting on myeloma drugs. | Personal pecuniary specific | Declare and must withdraw from topics which include myeloma drugs manufactured by Celgene (thalidomide, lenalidomide and pomalidomide) as an intervention until January 2015 |
| John Snowden | Received an honorarium from MSD for attending an advisory board on Posoconazole | Personal pecuniary specific | Declare and must withdraw from topics which include posoconazole (antifungal) as an intervention until October 2014 |
| John Snowden | Received reimbursement of accommodation, travel, | Personal pecuniary non- | Declare and can participate in |

| Name | Interest declared | Category | Decision |
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| | subsistence and registration fee from MSD, to attend the American Society for Hematology conference in New Orleans | specific | discussion of all topics as expenses not beyond reasonable amounts. |
| John Snowden | Co-applicant on a research grant from Pfizer to investigate characterisation of central brain processing of chemotherapy-induced peripheral neuropathy | Non-personal pecuniary specific | Declare and must withdraw from topics which include pregabalin as an intervention (manufactured by Pfizer for treating peripheral neuropathy). As pharmacological management of neuropathic pain has been excluded from the topic on management of neuropathy, JS can participate in discussion of this topic. |
| John Snowden | Local principle investigator for the Myeloma XI trial (Randomised comparisons in myeloma patients of all ages of thalidomide, lenalidomide and bortezomib combinations and maintenance lenalidomide). Funded by CTAAC | Non-personal pecuniary specific | Declare and participate in discussions on all topics as no supervisory responsibility on trials. |
| John Snowden | Local principle investigator for the RIC UCBT trial (Transplantation of umbilical cord blood from unrelated donors in patients with haematological diseases using a reduced intensity conditioning regimen). Funded by The Sue Harris Bone Marrow Trust. | Non-personal pecuniary non-specific | Declare and participate in discussion of all topics as transplantation of umbilical cord blood is not being investigated by the guideline and has no supervisory responsibility on trials. |
| John Snowden | Local principle investigator for the MAC UCBT trial (Transplantation of umbilical cord blood from unrelated donors in patients with haematological diseases using a myeloablative conditioning regimen). Funded by The Sue Harris Bone Marrow Trust. | Non-personal pecuniary non-specific | Declare and participate in discussion of all topics as transplantation of umbilical cord blood is not being investigated by the guideline and has no supervisory responsibility on trials. |
| John Snowden | Local principle investigator for the LenaRIC trial (Phase II study of the adjuvant use of lenalidomide in patients undergoing reduced intensity conditioning allogeneic transplantation for multiple myeloma). Funded by CTAAC. | Non-personal pecuniary specific | Declare and participate in discussions on all topics as no supervisory responsibility on trials. |
| John Snowden | Local principle investigator for the ProT-4 trial (Phase II study to evaluate the efficacy of | Non-personal pecuniary non-specific | Declare and participate in discussion of all topics as transfer of |

| Name | Interest declared | Category | Decision |
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| | prophylactic transfer of CD4 lymphocytes after T-cell depleted reduced intensity HLA-identical sibling transplantation for haematological cancers). Funded by Leukaemia and Lymphoma Research. | | lymphocytes after transplantation is not being investigated by the guideline and has no supervisory responsibility on trials. |
| John Snowden | Local principle investigator for the Myeloma IX trial (A randomised trial comparing second generation vs third generation bisphosphonates, induction chemotherapy regimens (CVAD vs CTD, and MP vs CTDa) and thalidomide maintenance vs no maintenance therapy). Funded by MRC | Non-personal pecuniary specific | Declare and participate in discussions on all topics as no supervisory responsibility on trials. |
| John Snowden | Local principle investigator for the Myeloma X relapse (intensive) trial (to determine whether a high-dose procedure with autologous transplant is superior to low-dose consolidation therapy following re-induction chemotherapy in patients with relapsed myeloma). Funded by CRUK | Non-personal pecuniary specific | Declare and participate in discussions on all topics as no supervisory responsibility on trials. |
| John Snowden | Local principle investigator for the RICAZA trial (Phase II study of the tolerability of adjunctive azacitidine in patients undergoing reduced intensity allogeneic stem cell transplantation for acute myeloid leukaemia). Funded by Celgene. | Non-personal pecuniary non-specific | Declare and participate in discussion of all topics as transplantation for acute myeloid leukaemia is not being investigated by the guideline and has no supervisory responsibility on trials. |
| John Snowden | Local principle investigator for the Living with advanced relapsed myeloma study (cross sectional observational study to identify preventable and manageable late effects). Funded by Myeloma UK. | Non-personal pecuniary specific | Declare and participate in discussions on all topics as no supervisory responsibility on trials. |
| John Snowden | Local principle investigator for a Phase 2, Multi-centre, Randomised, Open-Label, Parallel Group Study to Evaluate the Effect of VELCADE on Myeloma related Bone Disease. Funded by Janssen-Cilag Ltd. | Non-personal pecuniary specific | Declare and participate in discussions on all topics as no supervisory responsibility on trials. |
| John Snowden | Local principle investigator for the UK Haplo Trial (A UK multicentre phase II study of haploidentical stem cell transplantation in patients with | Non-personal pecuniary non-specific | Declare and participate in discussions on all topics as no supervisory responsibility on trials. |

| Name | Interest declared | Category | Decision |
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| | haematological malignancies). Funded by Leukaemia Lymphoma Research. | | |
| John Snowden | Local principle investigator for the HLA Epitope trial (HLA epitope matched platelet transfusion in aplastic anaemia, MDS and AML patients) Funded by NHS Blood and Transplant (NHSBT) | Non-personal pecuniary non-specific | Declare and participate in discussions on all topics as aplastic anaemia, myelodysplastic syndrome and acute myeloid leukaemia are not being investigated by the guideline and no supervisory responsibility on trials. |
| John Snowden | Principle investigator of a charitable grant from Royal Hallamshire Hospital Leukaemia and Research Fund, for a bolt-on study to Myeloma X, relating to supportive care in myeloma. | Non-personal pecuniary specific | Declare and can participate in discussion of all topics as research not funded by the healthcare industry. |
| John Snowden | Co-investigator on the MUK5 trial (A phase II randomised trial of carfilzomib, cyclophosphamide and dexamethasone (CCD) vs cyclophosphamide, velcade and dexamethasone (CVD) for first relapse or primary refractory multiple myeloma). Funded by Myeloma UK | Non-personal pecuniary non-specific | Declare and participate in discussions on all topics as no supervisory responsibility on trials. |
| John Snowden | Co-investigator on the TEAMM trial (trial assessing the benefit of antibiotic prophylaxis with levofloxacin, and its effect on health care associated infections in patients with newly diagnosed symptomatic myeloma). Funded by NIHR Health Technology Assessment. | Non-personal pecuniary specific | Declare and participate in discussions on all topics as no supervisory responsibility on trials. |
| John Snowden | Co-investigator on the AML 17 trial (Working parties on leukaemia in adults and children trial in AML or high risk MDS 17). Funded by CRUK | Non-personal pecuniary non-specific | Declare and participate in discussions on all topics as leukaemia, AML and MDS are not being investigated by the guideline no supervisory responsibility on trial. |
| John Snowden | Co-investigator on the FITT study (Investigating the effectiveness of co-morbidity assessment in male patients with myeloma and prostate cancer). Funded by Weston Park Hospital Cancer Charity and Sheffield Teaching Hospitals NHS Foundation trust. | Non-personal pecuniary non-specific | Declare and participate in discussions on all topics as no supervisory responsibility on trials. |

| Name | Interest declared | Category | Decision |
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| John Snowden | Co-investigator on the AML 15 trial (Working parties on leukaemia in adults and children AML trial 15). Funded by MRC. | Non-personal pecuniary non-specific | Declare and participate in discussions on all topics as leukaemia is not being investigated by the guideline no supervisory responsibility on trial. |
| John Snowden | Co-investigator on the AML 16 trial (A programme of development for older patients with AML and high risk MDS). Funded by CRUK. | Non-personal pecuniary non-specific | Declare and participate in discussions on all topics as AML and MDS are not being investigated by the guideline no supervisory responsibility on trial. |
| John Snowden | Co-investigator on the MCL MiniAllo trial (Phase II study of low intensity allogeneic transplantation in Mantle Cell Lymphoma). Funded by CRUK, Genzyme Therapeutics, National Institute for Health Research Cancer Network (NRCN). | Non-personal pecuniary non-specific | Declare and participate in discussions on all topics as mantle cell lymphoma is not being investigated by the guideline no supervisory responsibility on trial. |
| John Snowden | Co-investigator on the ORCHARRD trial (Ofatumumab rituximab chemoimmunotherapy ASCT relapsed refractory DLBCL). Funded by GlaxoSmithKline. | Non-personal pecuniary non-specific | Declare and participate in discussions on all topics as diffuse large B cell lymphoma is not being investigated by the guideline no supervisory responsibility on trial. |
| John Snowden | Co-investigator on the FIGARO trial (A randomised trial of the FLAMSA-BU conditioning regimen in patients with AML and MDS undergoing allogeneic stem cell transplantation). Funded by Leukaemia and Lymphoma Research. | Non-personal pecuniary non-specific | Declare and participate in discussions on all topics as AML and MDS are not being investigated by the guideline no supervisory responsibility on trial. |
| John Snowden | Co-investigator on the MUK 4 trial (phase II trial of combination treatment with Vorinostat, bortezomib and dexamethasone in patients with relapsed multiple myeloma). Funded by Myeloma UK | Non-personal pecuniary specific | Declare and participate in discussions on all topics as no supervisory responsibility on trials. |
| John Snowden | Co-investigator on the SarCaBon trial (A randomised phase II trial of Saracatinib versus placebo for cancer-induced bone pain). Funded by MRC | Non-personal pecuniary non-specific | Declare and participate in discussions on all topics as no supervisory responsibility on trials. |
| John Snowden | Member of the UK Myeloma Forum. Involved in writing the evidence-based position statement: 'The use of consolidation and | Personal non-pecuniary non-specific | Declare and participate in discussion on all topics as conclusions of the paper were based on a review of |

| Name | Interest declared | Category | Decision |
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| | maintenance treatment in myeloma' | | the published evidence and the guideline will not be investigating maintenance and consolidation therapy for myeloma. |
| John Snowden | Member of the UK Myeloma Forum has been involved in writing the evidence-based position statement: 'The use of bendamustine in myeloma' | Personal non-pecuniary | Declare and participate in discussion on all topics as conclusions of the paper were based on a review of the published evidence. |
| John Snowden | Executive member of the UK Myeloma Forum, a non-profit organisation for the support of UK health professionals and scientists in the myeloma field. | Personal non-pecuniary | Declare and participate in discussion on all topics as interest does not impact on content of the guideline. |
| John Snowden | Co-author on the following abstract, which were prepared by BresMed on behalf of Celgene: Stradwick S, Freemantle N, Snowden J, Rodrigues F, Brereton N. 2012. Comparative Effectiveness of Lenalidomide plus Dexamethasone for the Treatment of Refractory/Relapsed Multiple Myeloma: A Systematic Review and Mixed Treatment Comparison. Blood (ASH Annual Meeting Abstracts); 120 (21): A4076. | Personal non-pecuniary | Declare and must withdraw from discussion of any topics which include drugs manufactured by Celgene as interventions (pomalidomide, thalidomide, lenalidomide) until November 2013 |
| John Snowden | Co-author on the following abstract, which were prepared by BresMed on behalf of Celgene: Stradwick S, Freemantle N, Vickers A, Rodrigues F, Monzini M, Brereton N, Snowden. 2013. Comparative Effectiveness of Lenalidomide Plus Dexamethasone Versus Bortezomib Subcutaneous for the Treatment of RRMM. Presented at the 14th International Myeloma Workshop (IMW); Kyoto, Japan; April 3–7. | Personal non-pecuniary | Declare and must withdraw from discussion of any topics which include drugs manufactured by Celgene as interventions (pomalidomide, thalidomide, lenalidomide) until April 2014 |
| John Snowden | Received reimbursement of travel expenses from the organisers for speaking on quality in transplantation at the Joint Accreditation Committee in Autoimmune Diseases meeting | Personal pecuniary non-specific | Declare and participate in discussion on all guideline topics as expenses not beyond reasonable amounts. |
| John Snowden | Will receive an honorarium for | Personal | Declare and participate |

| Name | Interest declared | Category | Decision |
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| | from Sanofi for attending an advisory board on the mobilising agent plerixafor and possibly some future currently unlicensed drugs | pecuniary non-specific | in discussion of all guideline topics as plerixafor is not being investigated by the guideline. |
| Matthew Jenner | Received an honorarium from Napp Pharmaceuticals for attending an advisory board on bendamustine. | Personal pecuniary specific | Declare and must withdraw from any topics which include bendamustine as an intervention until December 2014 |
| Matthew Jenner | Received payment from Janssen for giving an interview on the delivery of bortezomib in the community setting | Personal pecuniary specific | Declare and must withdraw from any topics which include bortezomib as an intervention until December 2014 |
| Matthew Jenner | Received payment from Celgene for chairing a debate on drug treatment of relapsed myeloma. | Personal pecuniary specific | Declare and must withdraw from topics which include myeloma drugs manufactured by Celgene (thalidomide, lenalidomide and pomalidomide) as an intervention until November 2014. |
| Matthew Jenner | Received reimbursement of travel and subsistence from Napp Pharmaceuticals to attend the American Society of Haematology meeting in New Orleans | Personal pecuniary non-specific | Declare and can participate in discussion of all topics as expenses not beyond reasonable amounts. |
| Matthew Jenner | Received reimbursement of travel and subsistence from Janssen to attend the International Myeloma Workshop in Japan | Personal pecuniary non-specific | Declare and can participate in discussion of all topics as expenses not beyond reasonable amounts. |
| Matthew Jenner | Has been offered reimbursement of travel and subsistence expenses from Celgene to attend the European Haematology Association | Personal pecuniary non-specific | Declare and can participate in discussion of all topics as expenses not beyond reasonable amounts. |
| Matthew Jenner | Is local principle investigator for the MM1 trial (investigating the effect of adding MLN9708 to the combination of lenalidomide and dexamethasone, improves survival in patients with relapsed myeloma). Funded by Millenium Pharmaceuticals. | Non-personal pecuniary non-specific | Declare and participate in discussions on all topics as no supervisory responsibility on trials. |
| Matthew Jenner | Is local principle investigator for the FOCUS trial (Randomized, Open-label, Phase 3 Study of Carfilzomib vs Best Supportive Care in Subjects with Relapsed and Refractory Multiple | Non-personal pecuniary non-specific | Declare and participate in discussions on all topics as no supervisory responsibility on trials. |

| Name | Interest declared | Category | Decision |
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| | Myeloma). Funded by Onyx Pharmaceuticals | | |
| Matthew Jenner | Is local principle investigator for the MUK five trial (phase II randomised trial of carfilzomib, cyclophosphamide and dexamethasone (CCD) vs cyclophosphamide, velcade and dexamethasone (CVD) for first relapse or primary refractory multiple myeloma). Funded by Myeloma UK | Non-personal pecuniary specific | Declare and participate in discussions on all topics as no supervisory responsibility on trials. |
| Matthew Jenner | Is local principle investigator for the MUK four trial (Phase II Trial of combination treatment with Vorinostat, Bortezomib and Dexamethasone in participants with Relapsed Multiple Myeloma). Funded by Myeloma UK. | Non-personal pecuniary specific | Declare and participate in discussions on all topics as no supervisory responsibility on trials. |
| Matthew Jenner | Is local principle investigator for the Myeloma IX trial (randomised trial comparing second generation vs third generation bisphosphonates, induction chemotherapy regimens (CVAD vs CTD, and MP vs CTDa) and thalidomide maintenance vs no maintenance therapy). Funded by the Medical Research Council. | Non-personal pecuniary specific | Declare and participate in discussions on all topics as no supervisory responsibility on trials. |
| Matthew Jenner | Is local principle investigator for the Myeloma X trial (phase III on the role of a second autologous stem cell transplant in patients with relapsed myeloma following high dose rate chemotherapy and autologous stem cell rescue). Funded by Cancer Research UK | Non-personal pecuniary specific | Declare and participate in discussions on all topics as no supervisory responsibility on trials. |
| Matthew Jenner | Is local principle investigator for the Myeloma XI trial (Randomised comparisons in myeloma patients of all ages of thalidomide, lenalidomide and bortezomib combinations and maintenance lenalidomide). Funded by CTAAC | Non-personal pecuniary specific | Declare and participate in discussions on all topics as no supervisory responsibility on trials. |
| Matthew Jenner | Signatory for a charitable hospital fund used for education and development for healthcare professionals. No contribution to this fund from the pharmaceutical industry. | Non-personal pecuniary non-specific | Declare and participate in discussion of all topics as no contributions to the fund from the healthcare industry. |
| Matthew Jenner | Was part of the group who developed evidence based | Personal non-pecuniary | Declare and participate in discussion on all |

| Name | Interest declared | Category | Decision |
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| | guidelines on myeloma for the BCSH. | | topics as interest does not impact on content of the guideline. |
| Matthew Jenner | Is chief investigator for the MUK four trial investigating bortezomib and dexamethasone with vorinostat in relapsed myeloma. Involved in designing the trial protocol. The trial is funded by Myeloma UK. | Non-personal pecuniary specific | Declare and participate in discussion of all guideline topics as the trial is not funded by the pharmaceutical industry |
| Matthew Jenner | Is local PI for the Pollux study. A randomised phase III study investigating lenalidomide and dexamethasone +/- daratumumab in relapsed myeloma. The study is funded by Janssen. | Non-personal pecuniary specific | Declare and participate in discussion of all guideline topics as not involved in designing the trial protocol and no supervisory responsibility for trial |
| Matthew Jenner | Received reimbursement of travel and subsistence expenses and an honorarium from Amgen Oncology for taking part in an advisory board on carfilzomib. | Personal pecuniary specific | Declare and withdraw from discussion of topics that include carfilzomib as an intervention until September 2015. Chairpersons action that can be asked questions on the evidence base but must not participate in drafting recommendations |
| Matthew Jenner | Received reimbursement of travel and subsistence expenses and an honorarium from Takeda UK for participating in an advisory board on myeloma | Personal pecuniary non-specific | Declare and participate in discussion of all guideline topics as interventions manufactured by Takeda are not being investigated by the guideline |
| Matthew Jenner | Invited to present on cytogenetics at an educational symposium at the British Society of Haematology Annual Scientific Meeting. Only received reimbursement of travel expenses | Personal pecuniary non-specific | Declare and participate in discussion on all topics as not receiving expenses beyond reasonable amount |
| Matthew Jenner | Member of the Myeloma XI trial management group. Myeloma X1 trial is investigating different chemotherapy schedules in newly diagnosed myeloma. These include schedules containing different combinations including thalidomide, lenalidomide, bortezomib and carfilzomib. The trial is primarily funded through CTAAC (Cancer Research UK). | Non-personal pecuniary specific | Declare and participate in all discussion as research not funded by the healthcare industry |

| Name | Interest declared | Category | Decision |
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| | Sponsor is University of Leeds. | | |
| Matthew Jenner | Received economy class travel, accommodation and registration for the European Haematology Association Annual Meeting in Vienna, 11-14 June 2015 by Janssen. | Personal pecuniary non-specific | Declare and participate in discussion on all topics as not receiving expenses beyond reasonable amount. |
| Matthew Jenner | Received economy class travel, accommodation and registration for the American Society of Hematology Annual Meeting in Orlando, 5-8th December 2015 by Janssen. | Personal pecuniary non-specific | Declare and participate in discussion on all topics as not receiving expenses beyond reasonable amount. |
| Matthew Jenner | Local principle investigator for the CENTAURUS study (a Randomized Phase 2 Trial to Evaluate Three Daratumumab Dose Schedules in Smoldering Multiple Myeloma). Sponsored by Janssen. | Non-personal pecuniary non-specific | Declare and participate in discussion on all topics as no supervisory responsibility for the trial and daratumumab is not being investigated by the guideline. |
| Matthew Jenner | Local principle investigator for the MAIA study (phase 3 Study Comparing Daratumumab, Lenalidomide, and Dexamethasone (DRd) vs Lenalidomide and Dexamethasone (Rd) in Subjects with Previously Untreated Multiple Myeloma who are Ineligible for High Dose Therapy) | Non-personal pecuniary specific. | Declare and participate in discussion on all topics as no supervisory responsibility for the trial. |
| Matthew Jenner | Local principle investigator for the OPTIMISSM trial (phase 3, multicentre, randomized, open label study to compare the efficacy and safety of pomalidomide, bortezomib and low-dose dexamethasone versus bortezomib and low-dose dexamethasone in subjects with relapsed or refractory multiple myeloma) | Non-personal pecuniary non-specific | Declare and participate in discussion of all topics as no supervisory responsibility on trial and the guideline is not covering myeloma treatment. |
| Matthew Jenner | Local principal investigator for the ACE-MY-01 study (a phase 1b study of ACP-196 in subjects with multiple myeloma). Sponsored by Acerta Pharma. | Non-personal pecuniary non-specific | Declare and can participate in discussion of all topics as no supervisory responsibility on the trial and BTK inhibitors are not being investigated by the guideline. |
| Matthew Jenner | Local principal investigator for NEOD001-CL002 trial (Phase 3, Randomized, Multicenter, DoubleBlind, PlaceboControlled, 2 Arm, | Non-personal pecuniary non-specific | Declare and can participate in discussion of all topics as no supervisory responsibility on the |

| Name | Interest declared | Category | Decision |
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| | Efficacy and Safety Study of NEOD001 Plus Standard of Care vs. Placebo Plus Standard of Care in Subjects with Light Chain (AL) Amyloidosis. Sponsored by Acerta Pharma | | trial and guideline is not covering light chain amyloidosis. |
| Matthew Jenner | Local principal investigator for MUK eight trial (randomised phase II trial of Cyclophosphamide and Dexamethasone in combination with Ixazomib, in relapsed or refractory multiple myeloma (RRMM) patients who have relapsed after treatment with thalidomide, lenalidomide and bortezomib). | Non-personal pecuniary non-specific | Declare and participate in discussion of all topics as no supervisory responsibility on trial and the guideline is not covering myeloma treatment. |
| Matthew Jenner | Has accepted sponsorship from Takeda/Millennium Pharmaceuticals to attend the European Hematology Association Annual meeting in Copenhagen in June 2016. | Personal pecuniary non-specific | Declare and can participate in discussion of all topics as expenses not beyond reasonable amounts. |
| Matthew Streetly | Received payment from Celgene for attending an advisory board on lenalidomide usage in myeloma | Personal pecuniary specific | Declare and must withdraw from any topics which include lenalidomide as an intervention until June 2014. |
| Matthew Streetly | Received reimbursement of travel and subsistence expenses from Janssen, for attending the International Myeloma Workshop | Personal pecuniary non-specific | Declare and can participate in discussion of all topics as expenses not beyond reasonable amounts. |
| Matthew Streetly | Received payment from Celgene for giving a presentation on "Optimising Myeloma therapy" | Personal pecuniary specific | Declare and must withdraw from topics which include myeloma drugs manufactured by Celgene (thalidomide, lenalidomide and pomalidomide) as an intervention until November 2014. |
| Matthew Streetly | Received payment from Celgene for giving presentations on "Pomalidomide Case Histories" | Personal pecuniary non-specific | Declare and must withdraw from any topics which include pomalidomide as an intervention until November 2014. |
| Matthew Streetly | Received payment from Janssen for giving a presentation on "Transplant: what is the data telling us?". Provided data on induction chemotherapy prior to transplant. | Personal pecuniary specific | Declare and must withdraw from any topics which include induction chemotherapy as an intervention until October 2014. Induction |

| Name | Interest declared | Category | Decision |
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| | | | chemotherapy is not being investigated by the guideline as there is a NICE Technology Appraisal in development in this area. Therefore MS will be able to participate in discussion of all topics |
| Matthew Streetly | Received payment from Celgene for giving a presentation on "Pomalidomide Background: Summary of Recent Data" | Personal pecuniary non-specific | Declare and must withdraw from any topics which include pomalidomide as an intervention until September 2014. |
| Matthew Streetly | Received payment from Janssen for giving a presentation on "Managing Patient's Expectations" | Personal pecuniary non-specific | Declare and participate in discussion of all topics as subject of presentation is not specific to the content of the guideline. |
| Matthew Streetly | Received payment from Celgene for giving a presentation on "Myeloma treatment in South East London" | Personal pecuniary specific | Declare and must withdraw from topics which include myeloma drugs manufactured by Celgene (thalidomide, lenalidomide and pomalidomide) as an intervention until February 2014. |
| Matthew Streetly | Had a consultative role on the Burden of Relapse study (a non-treatment related clinical study examining the impact (physical, psychological, economic) of periods of remission in comparison to periods of disease activity). Received payment from Celgene for teleconference participation every few months and review of data | Personal pecuniary specific | Declare and must withdraw from topics which include myeloma drugs manufactured by Celgene (thalidomide, lenalidomide and pomalidomide) as an intervention until January 2015. |
| Matthew Streetly | Chief investigator of the MM013 study (Phase 2 multicentre, open-label study to determine the efficacy and safety of pomalidomide in combination with low dose dexamethasone in subjects with relapsed or refractory myeloma). Trial funded by Celgene. Not involved in designing the trial protocol. | Non-personal pecuniary non-specific | Declare and must withdraw from topics which include pomalidomide as an intervention. Chair persons action that can be asked questions on the evidence base but must not be involved in drafting recommendations. |
| Matthew Streetly | Local principle investigator for the PADIMAC study (Phase II study of Bortezomib, Adriamycin and Dexamethasone (PAD) therapy | Non-personal pecuniary specific | Declare and participate in discussions on all topics as no supervisory responsibility on trials. |

| Name | Interest declared | Category | Decision |
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| | for previously untreated patients with multiple myeloma: Impact of minimal residual disease (MRD) in patients with deferred ASCT). Funded by Leukaemia & Lymphoma Research | | |
| Matthew Streetly | Local principle investigator for the TEAMM trial (trial assessing the benefit of antibiotic prophylaxis with levofloxacin, and its effect on health care associated infections in patients with newly diagnosed symptomatic myeloma). Funded by NIHR Health Technology Assessment. | Non-personal pecuniary specific | Declare and participate in discussions on all topics as no supervisory responsibility on trials. |
| Matthew Streetly | Local principle investigator for the CLARION trial (Randomized, Open-label Phase 3 Study of Carfilzomib, Melphalan, and Prednisone versus Bortezomib, Melphalan, and Prednisone in Transplant ineligible Patients with Newly Diagnosed Multiple Myeloma). Funded by Onyx Therapeutics | Non-personal pecuniary non-specific | Declare and participate in discussions on all topics as no supervisory responsibility on trials. |
| Matthew Streetly | Local principle investigator for the CNTO328 trial (Siltuximab (compared with placebo) in Patients With High-risk Smoldering Multiple Myeloma). Funded by Janssen | Non-personal pecuniary non-specific | Declare and participate in discussions on all topics as no supervisory responsibility on trials. |
| Matthew Streetly | Local principle investigator for the PASS observational study (A non-interventional observational post authorisation safety study of subjects treated with lenalidomide). Funded by Celgene | Non-personal pecuniary specific | Declare and participate in discussions on all topics as no supervisory responsibility on trials. |
| Matthew Streetly | Principle investigator for phase III trial in relapsed myeloma (patients randomised between daratumumab with lenalidomide and dexamethasone versus lenalidomide and dexamethasone alone). Trial is funded by Janssen | Non-personal pecuniary non-specific | Declare and participate in discussions on all topics as no supervisory responsibility on trials. |
| Matthew Streetly | Written a position statement for the UK Myeloma Forum, about horizon scanning for new agents in myeloma. Statement does not advocate any particular agents. | Personal non-pecuniary | Declare and participate in discussion on all topics as interest does not impact on content of the guideline. |
| Matthew Streetly | Planning to write a review of the long-term follow up data for a trial on pomalidomide. | Personal non-pecuniary | Declare and must withdraw from topics which include pomalidomide as an intervention. Chair |

| Name | Interest declared | Category | Decision |
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| | | | persons action that can be asked questions on the evidence base but must not be involved in drafting recommendations. |
| Matthew Streetly | Was sponsored to attend the American Society of Haematology Meeting in San Francisco by Janssen. Sponsorship covers flights accommodation and conference registration. | Personal pecuniary non-specific | Declare and participate in discussion on all topics as sponsorship is not beyond reasonable amounts. |
| Matthew Streetly | Accepted a travel award from Janssen Pharmaceuticals to attend the International Myeloma workshop in Rome in September 2015 | Personal pecuniary non-specific | Declare and can participate in discussion of all topics as expenses not beyond reasonable amounts. |
| Matthew Streetly | Received travel, conference registration and hotel support from Janssen-Cilag to attend the American Society of Haematology meeting in December 2015. | Personal pecuniary non-specific | Declare and can participate in discussion of all topics as expenses not beyond reasonable amounts. |
| Matthew Streetly | Local principal investigator for the ACE-MY-01 study (a phase 1b study of ACP-196 in subjects with multiple myeloma). Sponsored by Acerta Pharma. | Non-personal pecuniary non-specific | Declare and can participate in discussion of all topics as no supervisory responsibility on the trial and BTK inhibitors are not being investigated by the guideline. |
| Sam Ahmedzai | An honorarium from MSD was paid to his department for giving a lecture on 'The Science of Symptoms' | Non-personal pecuniary non-specific | Declare and participate in discussion of all topics as subject of presentation is not specific to the content of the guideline. |
| Sam Ahmedzai | An honorarium from Creative Ceutical was paid to his department for taking part in a teleconference to set up an interview study of quality of life in advanced breast cancer | Non-personal pecuniary non-specific | Declare and participate in discussion of all topics as advanced breast cancer is not being investigated by the guideline. |
| Sam Ahmedzai | An honorarium from Amgen was paid to his department for giving a lecture on metastatic bone disease. | Non-personal pecuniary non-specific | Declare and participate in discussion of all topics as metastatic bone disease is not being investigated by the guideline. |
| Sam Ahmedzai | An honorarium from Napp Pharmaceuticals was paid to his department for taking part in an advisory board on pain. | Non-personal pecuniary non-specific | Declare and participate in discussion of all topics as management of pain is not being investigated by the |

| Name | Interest declared | Category | Decision |
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| | | | guideline. |
| Sam Ahmedzai | An honorarium from Prostrakan was paid to his department for giving a lecture on introduction to nausea and vomiting and its management | Non-personal pecuniary non-specific | Declare and participate in discussion of all topics as management of nausea and vomiting is not being investigated by the guideline. |
| Sam Ahmedzai | An honorarium from Archimedes was paid to his department for participating in the Archimedes Academy. Participation includes chairing the meeting and helping to select topics and speakers. Also gave a lecture on 'Update on pain control', and took part in a debate on end of life care. | Non-personal pecuniary non-specific | Declare and participate in discussion of all topics as subject of presentation is not specific to the content of the guideline. |
| Sam Ahmedzai | An honorarium from the World Association for Sleep Medicine was paid to his department for participating in their symposium | Non-personal pecuniary non-specific | Declare and participate in discussion of all topics as subject of presentation is not specific to the content of the guideline. |
| Sam Ahmedzai | An honorarium from Gruenthal was paid to his department for participating in an advisory board on education and awareness strategies for breakthrough cancer pain | Non-personal pecuniary non-specific | Declare and participate in discussion of all topics as breakthrough cancer pain is not being investigated by the guideline. |
| Sam Ahmedzai | An honorarium from Bayer was paid to his department for taking part in a meeting on Sativex | Non-personal pecuniary specific | Declare and can participate in discussion of all topics as pharmacological management of neuropathic pain has been excluded from the topic on management of neuropathy. |
| Sam Ahmedzai | Chief investigator a study to investigate characterisation of central brain processing of chemotherapy-induced peripheral neuropathy. Funded by Pfizer | Non-personal pecuniary specific | Declare and must withdraw from topics which include pregabalin as an intervention (manufactured by Pfizer for treating peripheral neuropathy). As pharmacological management of neuropathic pain has been excluded from the topic on management of neuropathy, SA can participate in discussion of this topic. |
| Sam Ahmedzai | Chief investigator for an observational study looking at a | Non-personal pecuniary non- | Declare and participate in discussion of all |

| Name | Interest declared | Category | Decision |
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| | new treatment for opioid-induced constipation in cancer patients. Study is funded by Astra Zeneca. | specific | topics as management of opioid induced constipation is not being investigated by the guideline. |
| Sam Ahmedzai | Chief investigator for a study of an experimental new opioid for pain control in cancer patients. Study is funded by Grunenthal | Non-personal pecuniary non-specific | Declare and participate in discussion of all topics as pain control is not being investigated by the guideline. |
| Sam Ahmedzai | Chief investigator for a study on a pain killer for cancer and non-cancer patients. Study is funded by Mundi Pharma | Non-personal pecuniary non-specific | Declare and participate in discussion of all topics as pain control is not being investigated by the guideline. |
| Sam Ahmedzai | Chief investigator for a study to measure the response to 'Standard laxative treatment' (SLT) in patients with opioid-induced constipation, across several European countries. Study is funded by Mundi Pharma. | Non-personal pecuniary non-specific | Declare and participate in discussion of all topics as management of opioid induced constipation is not being investigated by the guideline. |
| Sam Ahmedzai | Chief investigator for a study to investigate HRQOL of triple negative breast cancer patients. Funded by Creative Ceutical | Non-personal pecuniary non-specific | Declare and participate in discussion of all topics as breast cancer is not being investigated by the guideline. |
| Sam Ahmedzai | Is co-investigator of a trial of an experimental drug to treat bone cancer pain in cancer patients. Trial is funded by the MRC and Astra Zeneca. | Non-personal pecuniary non-specific | Declare and participate in discussions on all topics as pain control is not being investigated by the guideline and no supervisory responsibility on trials. |
| Sam Ahmedzai | Fund holder for the SPORG research group. Money is spent on supportive and palliative care research. No contributions to the fund from pharmaceutical companies | Non-personal pecuniary non-specific | Declare and participate in discussion of all topics as no contributions to the fund from the healthcare industry. |
| Sam Ahmedzai | Received an honorarium and reimbursement of travel expenses from Mundipharma for lectures given during the Pain Forum lecture tour in South East Asia and Brazil on: 'pain in special populations' 'assessing and treating pain in patients with substance abuse concerns' case presentations on cancer pain, palliative care, neuropathic pain and non-malignant pain. adequacy of opioid analgesic | Personal pecuniary specific | Declare and must withdraw from topics which include analgesics as interventions (Mundipharma make analgesics) until April 2015. |

| Name | Interest declared | Category | Decision |
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| | consumption at country, global and regional levels. | | |
| Sam Ahmedzai | Received reimbursement of travel and subsistence expenses to attend the European Hyponatraemia Network conference in Zurich from Otsuka | Personal pecuniary non-specific | Declare and participate in discussion of all topics as payment was not beyond reasonable amounts. |
| Sam Ahmedzai | Gave a lecture on 'issues associated with therapeutic opioids - – an evidence-based approach to pain management' at the World Institute of Pain in Maastricht. Travel and subsistence expenses were reimbursed by Mundipharma for attending and an honorarium from Mundipharma was paid to the University of Sheffield | Non-personal pecuniary non-specific | Declare and participate in discussion of all topics as payment was not beyond reasonable amounts and pain management is not being investigated by the guideline. |
| Sam Ahmedzai | Meeting with Chugai to discuss potential research into weight loss in cancer in collaboration with NCRI. | Non-personal pecuniary non-specific | Declare and participate in discussion of all topics as weight loss as a symptom is not being covered by the guideline and the research is not funded by the healthcare industry. |
| Sam Ahmedzai | Had a meeting with Chugai, in his capacity as chair of the NCRI studies group, to discuss a potential study on weight loss in cancer. | Non-personal pecuniary non-specific | Declare and participate in discussion on all topics as weight loss as a symptom is not being covered by the guideline and the research is not funded by the healthcare industry. |
| Sam Ahmedzai | Appointed (January 2015) by Royal College of Physicians to be their Clinical Lead for the National Care of the Dying Audit. Funded post (1 PA per week) that will be paid direct to SA. Role is to advise and lead the RCP audit team in designing a new format for the National Care of the Dying Audit, overseeing its application and helping RCP to announce and disseminate the results. | Personal pecuniary non-specific | Declare and participate in discussion on all topics as not specific to myeloma. |
| Nicola Mulholland | Principle investigator for a trial on biomarkers in lymphoma. Involved in designing the trial protocol. Funded by The Elimination of Leukaemia Fund. | Non-personal pecuniary non-specific | Declare and participate in discussion of all topics as lymphoma is not being covered by the guideline and the research is not funded by the healthcare industry. |

| Name | Interest declared | Category | Decision |
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| Nicola Mulholland | Sub-investigator for the ZEST study (Zevalin for older people with diffuse large B cell lymphoma). Funded by Spectrum Pharmaceuticals. Involvement is to administer the drug – not involved in collecting or analysing the data | Non-personal pecuniary non-specific | Declare and participate in discussions on all topics as diffuse large B cell lymphoma is not being investigated by the guideline and no supervisory responsibility on trial. |
| Nicola Mulholland | Investigator on a phase I/II study of ¹⁷⁷ Lu-HH1 (Betalutin™) radioimmunotherapy for treatment of relapsed CD37+ non-Hodgkin's Lymphoma. Funded by Nordic Nanovector AS | Non-personal pecuniary non-specific | Declare and participate in discussion on all topics as non-Hodgkin Lymphoma is not being investigated by the guideline |
| Nicola Mulholland | Investigator on the NETTER-1 clinical trial. A phase III trial study comparing treatment with ¹⁷⁷ LU-DOTA0-Tyr3-Ocstretotate to Octretotate LAR in patients with inoperable, progressive, somatostatin receptor positive, midgut carcinoid tumors. Trial funded by Advanced Accelerator Applications. | Non-personal pecuniary non-specific | Declare and participate in discussion on all topics as midgut carcinoid tumours are not being investigated by the guideline. |
| Nicola Mulholland | Investigator on the Foxfire study. An open-label randomised phase III trial of 5-Fluorouracil, Oxaliplatin and Folinic acid +/- interventional radio-embolisation as first line treatment for patients with unresectable liver-only or liver-predominant metastatic colorectal cancer | Non-personal pecuniary non-specific | Declare and participate in discussion on all topics as colorectal cancer is not being investigated by the guideline. |
| Nicola Mulholland | In the process of applying for an ARSAC licence to be an investigator on a phase III, randomised placebo controlled, double blind study of oral ixazomib citrate (MLN9708) maintenance therapy in patients with multiple myeloma following autologous stem cell transplant. Funded by Millenium Pharmaceuticals | Non-personal pecuniary non-specific | Declare and participate in discussion on all topics as maintenance therapy is not being investigated by the guideline. |
| Nicola Mulholland | Received an honorarium and reimbursement for travel and subsistence expenses from Sirtex for attending their quest investigator study in Sweden | Personal pecuniary non-specific | Declare and participate in discussion of all guideline topics as Sirtex manufacture interventions for the treatment of liver cancer which is not being investigated by the guideline |
| Nicola Mulholland | Received reimbursement of | Personal | Declare and participate |

| Name | Interest declared | Category | Decision |
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| | travel and subsistence expenses from TheraSphere for attending their training session in Germany | pecuniary non-specific | in discussion of all guideline topics as expenses not beyond reasonable amounts and TheraSphere manufacture interventions for the treatment of liver cancer which is not being investigated by the guideline. |
| Nicola Mulholland | Has been sponsored to undertake a study on lymphoma. | Non-personal pecuniary non-specific | Declare and participate in discussion on all topics as topic not covered in the guideline. |
| Andrea Guy | Attended a symposium on pomalidomide organised by Celgene. No fee received. Symposium was to present the data on this drug | Personal non-pecuniary | Declare and participate in discussion of all topics as no fee received. |
| Andrea Guy | Local principle investigator on myeloma lifestyle study on the management of fatigue. Trial is funded by Cancer Research UK. Celgene have funded a physiotherapist's salary to work on the trial. | Non-personal pecuniary specific | Declare and participate in discussions on all topics as no supervisory responsibility on trials. |
| Andrea Guy | Attended the European Multiple Myeloma Academy educational meeting in Vienna. Travel expenses paid by event organisers. | Personal pecuniary non specific | Declare and participate in discussion of all guideline topics as payment was not beyond reasonable amounts. |
| Monica Morris | Received honorarium for attending a nurse educational event held by Janssen on the supportive care needs of patients with myeloma. | Personal pecuniary specific | Declare and must withdraw from any topics which involve the supportive needs of patients until May 2014. |
| Monica Morris | Provided advice for Janssen on the content of a nurse educational leaflet on the management of patients on Bortezomib. No payment was received. | Personal non-pecuniary specific | Declare and participate in discussion of all guideline topics as no payment was received and a colleague is to take over the work for the duration of the guideline. |
| Monica Morris | Planning to publish the findings of her MSc research into the experience of myeloma family carers. No financial support was provided for the research. | Personal non-pecuniary specific | Declare and participate in discussion of all guideline topics as no payment was received. |
| Monica Morris | Has been invited to take part in an advisory group for Myeloma UK looking at their research strategy. Travel and subsistence expenses will be | Personal pecuniary non-specific | Declare and participate in discussion of all guideline topics as payment is not beyond |

| Name | Interest declared | Category | Decision |
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| | paid by Myeloma UK. No honorarium or other payment will be received. | | reasonable amounts. |
| Monica Morris | Received reimbursement of travel and subsistence expenses from Celgene for attending the Myeloma Academy educational event in Vienna | Personal pecuniary non-specific | Declare and participate in discussion of all guideline topics as payment is not beyond reasonable amounts. |
| Monica Morris | Received an honorarium from Novartis for attending a nursing advisory board meeting on Panobinostat | Personal pecuniary non-specific | Declare and participate in discussion of all guideline topics as panobinostat is not being investigated by the guideline. |
| Monica Morris | Acts as a reviewer for the myeloma section of the Cancer Research UK patient information website (CancerHelp UK). This review is done every 2 years. Receives a small payment from CRUK. | Personal Pecuniary non-specific | Declare and participate in discussion of all topics as review is on myeloma in general and it is not funded from the healthcare industry. |

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F.2.2 Organisations invited to comment on the guideline development

4 The following stakeholders registered with NICE and were invited to comment on the scope
5 and the draft version of this guideline.

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| 5 Borough's Partnership NHS Foundation Trust | Abbott Molecular |
| Addenbrookes Hospital | Aintree University Hospital NHS Foundation Trust |
| Allocate Software PLC | Amgen UK |
| Association for Palliative Medicine of Great Britain | Association of Anaesthetists of Great Britain and Ireland |
| Association of Chartered Physiotherapists in Oncology and Palliative Care | Belfast Health and Social Care Trust |
| Binding Site Group Ltd | Bristol Myers Squibb Pharmaceuticals Ltd |
| British Association of Spinal Surgeons | British Dietetic Association |
| British Lymphoma Pathology Group | British Medical Association |
| British Medical Journal | British National Formulary |
| British Nuclear Cardiology Society | British Nuclear Medicine Society |
| British Psychological Society | British Red Cross |
| British Society of Interventional Radiology | British Society of Paediatric Gastroenterology Hepatology and Nutrition |
| BSPGHAN | Caplond Services |
| Care Quality Commission | Celgene UK Ltd |
| Cheshire and Merseyside SCN | counselling for prisoners network |
| Covidien Ltd. | Croydon Clinical Commissioning Group |
| Croydon Council | Croydon University Hospital |

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| Cumbria Partnership NHS Foundation Trust | CWHHE Collaborative CCGs |
| Department of Health | Department of Health, Social Services and Public Safety Northern Ireland |
| DePuy UK | |
| East and North Hertfordshire NHS Trust | East Kent Hospitals University NHS Foundation Trust |
| East of England Strategic Clinical Network | Ethical Medicines Industry Group |
| Faculty of Dental Surgery | Five Boroughs Partnership NHS Trust |
| Gloucestershire Hospitals NHS Foundation Trust | GP update / Red Whale |
| Health and Care Professions Council | Health and Social Care Information Centre |
| Healthcare Improvement Scotland | Healthcare Infection Society |
| Healthwatch East Sussex | Herts Valleys Clinical Commissioning Group |
| Humber NHS Foundation Trust | Isabel Hospice |
| Janssen | Janssen Cilag Ltd |
| Johnson & Johnson Medical Ltd | Lanes Health |
| Launch Diagnostics | Leukaemia & Lymphoma Research |
| Leukaemia CARE | Liverpool Community Health |
| London cancer alliance | London North West Healthcare NHS Trust |
| Macmillan Cancer Support | Manchester Royal Infirmary |
| Mastercall Healthcare | Medical Directorate Services |
| Medicines and Healthcare Products Regulatory Agency | Medtronic |
| Milton Keynes Hospital NHS Foundation Trust | Milton Keynes NHS Foundation |
| Ministry of Defence | Muslim Doctors and Dentists Association |
| Myeloma UK | Napp Pharmaceuticals Ltd |
| National Association of Primary Care | National Atrial Fibrillation Clinical Policy Forum |
| National Clinical Guideline Centre | National Collaborating Centre for Cancer |
| National Collaborating Centre for Mental Health | National Collaborating Centre for Women's and Children's Health |
| National Deaf Children's Society | National Institute for Health and Care Excellence |
| National Institute for Health Research Health Technology Assessment Programme | National Institute for Health Research |
| National Patient Safety Agency | Newcastle upon Tyne Hospitals NHS Foundation Trust |
| NHS Barnsley Clinical Commissioning Group | NHS Choices |
| NHS Chorley and South Ribble CCG | NHS Connecting for Health |
| NHS Cumbria Clinical Commissioning Group | |
| NHS England | NHS Hardwick CCG |
| NHS Health at Work | NHS Improvement |
| NHS North East Lincolnshire CCG | NHS Plus |
| NHS Sheffield | NHS Somerset CCG |
| NHS South Cheshire CCG | NHS Wakefield CCG |
| NHS Warwickshire North CCG | NHS West Cheshire CCG |
| Norfolk and Suffolk Palliative Care Academy | North of England Commissioning Support |
| Northern Health and Social Care Trust | Nottingham City Council |
| Novartis Pharmaceuticals | Nursing and Midwifery Council |
| Nutricia Advanced Medical Nutrition | Nutrition and Diet Resources UK |

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| Older People's Advocacy Alliance | Oxford University Hospitals NHS Trust |
| Oxfordshire Clinical Commissioning Group | Pfizer |
| Primary Care Pharmacists Association | Primrose Bank Medical Centre |
| Public Health Agency for Northern Ireland | Public Health England |
| Public Health Wales | Public Health Wales |
| Queen Elizabeth Hospital King's Lynn NHS Trust | Robert Jones & Agnes Hunt Orthopaedic & District Hospital NHS Trust |
| Roche Diagnostics | Roche Products |
| Royal College of Anaesthetists | Royal College of General Practitioners |
| Royal College of General Practitioners in Wales | Royal College of Midwives |
| Royal College of Nursing | Royal College of Obstetricians and Gynaecologists |
| Royal College of Paediatrics and Child Health | Royal College of Pathologists |
| Royal College of Physicians | Royal College of Psychiatrists |
| Royal College of Radiologists | Royal College of Speech and Language Therapists |
| Royal College of Surgeons of England | Royal Cornwall Hospitals NHS Trust |
| Royal National Institute of Blind People | Royal Pharmaceutical Society |
| Royal Surrey County Hospital NHS Trust | Sandoz Ltd |
| Scottish Intercollegiate Guidelines Network | Sebia |
| Serious Hazards of Transfusion | Sheffield Teaching Hospitals NHS Foundation Trust |
| Smith & Nephew UK Limited | Social Care Institute for Excellence |
| Society and College of Radiographers | Somerset, Wiltshire, Avon and Gloucestershire Cancer Services Operational Group |
| South Eastern Health and Social Care Trust | South London & Maudsley NHS Trust |
| South Wales Cancer Network | South West Yorkshire Partnership NHS Foundation Trust |
| Southern Health & Social Care Trust | St Helens and Knowsley Teaching Hospitals NHS Trust |
| St Josephs Hospice | Staffordshire and Stoke on Trent Partnership NHS Trust |
| Stockport Clinical Commissioning Group | Takeda UK Ltd |
| TB Action Group | The British Society for Haematology |
| The Institute of Cancer Research | The Patients Association |
| uMotif Digital Health | University College London |
| University Hospital Birmingham NHS Foundation Trust | University Hospitals Birmingham |
| University Hospitals Coventry and Warwickshire NHS Trust | Velindre NHS Trust |
| Vexim UK Ltd | Welsh Government |
| Welsh Scientific Advisory Committee | West Suffolk Hospital NHS Trust |
| Western Health and Social Care Trust | Western Sussex Hospitals NHS Trust |
| Wigan Borough Clinical Commissioning Group | York Hospitals NHS Foundation Trust |
| Yorkshire and Humber Strategic Clinical Network | |

F.3.1 Individuals carrying out literature reviews and complementary work

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| Overall Co-ordinators | |
|--------------------------------|---|
| Dr John Graham | Director, National Collaborating Centre for Cancer, Cardiff |
| Dr Andrew Champion | Centre Manager, National Collaborating Centre for Cancer, Cardiff |
| Angela Bennett | Assistant Centre Manager, National Collaborating Centre for Cancer, Cardiff |
| Project Manager | |
| Katrina Blears | National Collaborating Centre for Cancer, Cardiff |
| Kimberley Cox | National Collaborating Centre for Cancer, Cardiff |
| Jennifer Stock | National Collaborating Centre for Cancer, Cardiff |
| Senior Researcher | |
| Dr Nathan Bromham | National Collaborating Centre for Cancer, Cardiff |
| Researchers | |
| Dr Mia Schmidt-Hansen | National Collaborating Centre for Cancer, Cardiff |
| Dr Susan O'Connell | National Collaborating Centre for Cancer, Cardiff |
| Angharad Morgan | National Collaborating Centre for Cancer, Cardiff |
| Information Specialists | |
| Elise Hasler | National Collaborating Centre for Cancer, Cardiff |
| Senior Health Economist | |
| Matthew Prettyjohns | National Collaborating Centre for Cancer, Cardiff |
| Health Economist | |
| James Hawkins | National Collaborating Centre for Cancer, Cardiff |
| Needs Assessment | |
| Verity Bellamy | Head of Cancer Intelligence, Yorkshire and Humber Strategic Clinical Network. |

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F.4.5 Expert advisors to the Guideline Development Group

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| Mr Max Gibbons | Consultant Orthopaedic Surgeon |
| Mr Melvin Grainger | Consultant Orthopaedic Spinal Surgeon, Birmingham |
| Dr David Wilson | Consultant Radiologist, Oxford |
| Dr Isabel Syndikus | Clinical Oncologist, Liverpool |

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8 Declarations of interest

| Name | Interest declared | Category | Decision |
|-------------|---|---------------------------------|---|
| Max Gibbons | Receives payment and reimbursement of travel expenses from Oxford BioMet, 3 times per year, for giving a lecture on knee replacement. Last lecture given in July 2014 | Personal pecuniary Non-specific | Declare and participate in discussion of topic as interest is not specific to the content of the guideline and will not be involved in drafting recommendations |

| Name | Interest declared | Category | Decision |
|-----------------|---|-------------------------------------|--|
| Max Gibbons | Co-signatory of a charitable trust fund for bone tumour research at the University. Fund is used to fund travel expenses for Fellows. | Non-personal pecuniary Non-specific | Declare and participate in discussion of topic as interest is not specific to the content of the guideline and will not be involved in drafting recommendations |
| Melvin Grainger | Will be teaching on a cadaver course for Consultant level spinal surgeons in May 2015 run by Depuy Synthes. Involvement is to demonstrate 3 operative procedures – posterior vertebroectomy, cervical pedicle screws and cervical corpectomy. These procedures relate to spinal reconstruction but are not specific to myeloma. Will be able to claim a fee for giving the training but has not done so yet. | personal pecuniary Non-specific | Declare and participate in discussion of topic as interest is not specific to myeloma and will not be involved in drafting recommendations. |
| Melvin Grainger | Received an educational grant from Stiker to attend Eurospine conference in October 2014. | Personal pecuniary Non-specific | Declare and participate in discussion of topic as interest is not specific to the content of the guideline and will not be involved in drafting recommendations. |
| Melvin Grainger | Attended inaugural meeting of myeloma spinal working group chaired by Mr Sean Molloy and supported by Myeloma UK in January 2013. Have subsequently been given opportunity to comment on development of potential pathway for treatment of spinal myeloma, although had little direct input. This had lead to the submission of a paper entitled 'Optimising the management of patients with spinal myeloma disease' to the British Journal of Haematology in March 2015 (I am not aware of acceptance/rejection of this paper as of today). The paper was submitted by Dr. Charalampia Kyriakou on behalf of the myeloma spinal working group. | Personal non-pecuniary Non-specific | Declare and participate in discussion of topic as interest is not specific to the content of the guideline and will not be involved in drafting recommendations. |
| Melvin Grainger | Received a request from NICE to comment on Pediguard (an instrument for inserting pedicle screws that is used in general | Personal non-pecuniary | Declare and participate in discussion of topic as interest is not specific to myeloma |

| Name | Interest declared | Category | Decision |
|-----------------|---|-------------------------------------|---|
| | spinal surgery). No fee received. | | and will not be involved in drafting recommendations. |
| Isabel Syndikus | Is an investigator on the PATCH (PR09) trial, a randomised phase II trial studying how well the oestrogen skin patch works compared with luteinizing hormone releasing hormone analogue in treating patients with locally advanced or metastatic prostate cancer. Funded by Imperial College London | Non-personal pecuniary Non-specific | Declare and participate in discussion of all topics as prostate cancer is not being investigated by the guideline. |
| Isabel Syndikus | Is an investigator on the POUT trial, a phase III randomised trial of peri-operative chemotherapy versus surveillance in upper tract urothelial cancer. Funded by Cancer Research UK. | Non-personal pecuniary Non-specific | Declare and participate in discussion of all topics as the trial is not funded by the pharmaceutical industry and bladder cancer is not being investigated by the guideline. |
| Isabel Syndikus | Is an investigator on the PROMPTS trial, a prospective randomised phase III study of observation versus screening MRI and pre-emptive treatment in castrate resistant prostate cancer patients with spinal metastasis. Funded by Cancer Research UK. | Non-personal pecuniary Non-specific | Declare and participate in discussion of all topics as the trial is not funded by the pharmaceutical industry and prostate cancer is not being investigated by the guideline. |
| Isabel Syndikus | Is an investigator on the RADICALS trial, investigating radiotherapy and androgen deprivation in combination after local surgery in patients with prostate cancer. Funded by the Medical Research Council | Non-personal pecuniary Non-specific | Declare and participate in discussion of all topics as the trial is not funded by the pharmaceutical industry and prostate cancer is not being investigated by the guideline. |
| Isabel Syndikus | Is an investigator on the STAMPEDE trial, a randomised controlled trial investigating systemic therapy in advancing or metastatic prostate cancer. Funded by the Medical Research Council. | Non-personal pecuniary Non-specific | Declare and participate in discussion of all topics as the trial is not funded by the pharmaceutical industry and prostate cancer is not being investigated by the guideline. |
| Isabel Syndikus | Is an investigator on the RAPPER trial, an assessment on genetic polymorphisms for predicting the effects of radiotherapy. Funded by the Christie Hospital NHS Foundation Trust | Non-personal pecuniary Non-specific | Declare and participate in discussion of all topics as the trial is not funded by the pharmaceutical industry. |
| Isabel Syndikus | Is an investigator on the UK | Non-personal | Declare and participate |

| Name | Interest declared | Category | Decision |
|-----------------|---|-------------------------------------|---|
| | Genetic Prostate Cancer Study. Funded by the Institute for Cancer Research | pecuniary Non-specific | in discussion of all topics as the trial is not funded by the pharmaceutical industry and prostate cancer is not being investigated by the guideline. |
| Isabel Syndikus | Is an investigator on the BAYER 88-8223 trial, a phase III randomised double blind placebo controlled trial of radium 223 dichloride in combination with abiraterone acetate and prednisone/prednisolone in the treatment of asymptomatic or mildly symptomatic chemotherapy-naive subjects with bone predominant metastatic castration resistant prostate cancer. Funded by Bayer in collaboration with Janssen. | Non-personal pecuniary Non-specific | Declare and participate in discussion of all topics and prostate cancer is not being covered by the guideline. |
| Isabel Syndikus | Is an investigator on the FAST FORWARD trial, a randomised trial testing a 1-week course of curative whole breast radiotherapy against a standard 3-week schedule in terms of local cancer control and late adverse effects in patients with early breast cancer. Funded by the Institute for Cancer Research. | Non-personal pecuniary Non-specific | Declare and participate in discussion of all topics as the trial is not funded by the pharmaceutical industry and breast cancer is not being investigated by the guideline. |
| Isabel Syndikus | Is an investigator on the NCRN464 trial, a randomised double blind placebo controlled phase I/II trial of RNAActive derived cancer vaccine in symptomatic or minimally symptomatic patients with metastatic castrate refractory prostate cancer. Funded by CureVac GmbH. | Non-personal pecuniary Non-specific | Declare and participate in discussion of all topics as prostate cancer is not being investigated by the guideline. |
| Isabel Syndikus | Is an investigator on the PIVOTOL trial, a randomised phase II trial of prostate and pelvic versus prostate alone radiotherapy treatment volumes using high dose IMRT for locally advanced prostate cancer. Funded by the Institute for Cancer Research | Non-personal pecuniary Non-specific | Declare and participate in discussion of all topics as the trial is not funded by the pharmaceutical industry and prostate cancer is not being investigated by the guideline. |
| Isabel Syndikus | Is an investigator on the SCORAD III trial, comparing single radiotherapy treatment with a course of radiotherapy treatments for cancer pressing | Non-personal pecuniary Non-specific | Declare and participate in discussion of all topics as the trial is not funded by the pharmaceutical |

| Name | Interest declared | Category | Decision |
|-----------------|--|-------------------------------------|--|
| | on the spinal cord. Funded by Cancer Research UK | | industry. |
| Isabel Syndikus | Is an investigator on the SUPREMO trial, investigating radiation therapy of standard therapy in treating women with stage II breast cancer who have undergone mastectomy. Funded by the Medical Research Council. | Non-personal pecuniary Non-specific | Declare and participate in discussion of all topics as the trial is not funded by the pharmaceutical industry and breast cancer is not being investigated by the guideline. |
| Isabel Syndikus | Is an investigator on a study of GDC-0068 or GDC-0980 with abiraterone acetate versus abiraterone acetate in patients with castration-resistant prostate cancer previously treated with docetaxel chemotherapy. Funded by Genetech | Non-personal pecuniary Non-specific | Declare and participate in discussion of all topics as prostate cancer is not being investigated by the guideline. |
| Isabel Syndikus | Is an investigator for the National Study of Hodgkin's Lymphoma Genetics. Funded by the Lymphoma Research Trust and the Leukaemia Research Foundation | Non-personal pecuniary Non-specific | Declare and participate in discussion of all topics as the trial is not funded by the pharmaceutical industry and Hodgkin's Lymphoma is not being investigated by the guideline. |
| David Wilson | Runs a private radiology practice. St Lukes Radiology in Oxford. | Personal Pecuniary Non specific | Declare and participate in discussion of topic as will not be involved in drafting the recommendations |
| David Wilson | President elect of the British Institute of Radiology | Personal non-pecuniary Non-specific | Declare and participate in discussion of topic as will not be involved in drafting the recommendations |
| David Wilson | Is the audit leave for Medica – a tele-radiology company that do outsourced work for the NHS. Leads the team responsible for auditing their work to check it is of the correct standard | Personal pecuniary Non-specific | Declare and participate in discussion of topic as will not be involved in drafting the recommendations |
| David Wilson | Is a partner in European Imaging and uses their facilities to see private patients | Personal pecuniary Non-specific | Declare and participate in discussion of topic as will not be involved in drafting recommendations |
| David Wilson | Is a partner in the Oxford Clinic (an orthopaedic practice) and uses their facilities to see private patients | Personal pecuniary Non-specific | Declare and participate in discussion of topic as will not be involved in drafting recommendations |
| David Wilson | Has a private radiology practice (St Lukes Radiology Oxford) | Personal pecuniary Non- | Declare and participate in discussion of topic |

| Name | Interest declared | Category | Decision |
|--------------|---|---------------------------------------|--|
| | which also does outsource work for the NHS on musculoskeletal radiology | specific | as will not be involved in drafting recommendations |
| David Wilson | Wife works for his private radiology practice – St Lukes Radiology | Personal family interest Non-specific | Declare and participate in discussion of topic as will not be involved in drafting recommendations |
| David Wilson | Is in the process of planning a multi-centre prospective randomised controlled trial comparing vertebroplasty with radiotherapy in patients with myeloma induced spinal fractures. It trial goes ahead will be chief investigator (involved in designing the trial protocol). Trial hoped to be funded by CRUK. | Non-personal pecuniary Specific | Declare and participate in discussion of topic as will not be involved in drafting recommendations |
| David Wilson | Treasurer of the European Society of Skeletal Radiology | Personal non-pecuniary Non-specific | Declare and participate in discussion of topic as will not be involved in drafting recommendations |
| David Wilson | President Elect of the British Institute of Radiology | Personal non-pecuniary Non-specific | Declare and participate in discussion of topic as will not be involved in drafting recommendations |

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