

## APPENDIX 1 – METHODS

### DATA COLLECTION

**Implementation study.** The implementation study<sup>1,2</sup> aimed to identify factors influencing implementation of a step-wise strategy of non-surgical therapy for patients with hip and knee osteoarthritis (OA) based on available guidelines before undertaking surgical therapy. A cross-sectional internet based survey was conducted in 2013 among 482 Dutch orthopaedic surgeons (response rate 36%, n=172). The first part of the survey included questions about background characteristics: age, gender, years of working experience, number of new patients with hip/ knee OA per month, work setting (university medical centre, teaching hospital, general hospital, private clinic, other). In addition, questions were included about the use/ prescription of recommended non-surgical options in (inter)national guidelines, including: education, lifestyle advice, use of acetaminophen, use of NSAIDs, referral to physical therapist and referral to a dietician (if indicated, BMI  $\geq 25$ ). Answers could be given on a 4-point scale ranging from 'never' to 'almost always'. The second part of the questionnaire consisted of 58 items covering the identified barriers and facilitators from previously performed interviews. Orthopaedic surgeons were asked to what degree each barrier and facilitator influenced the prescription of non-surgical treatments in patients with hip and/ or knee OA. Answers could be given on a 4-point Likert scale ranging from 'no extent' to 'a large extent'.

**De-implementation study.** The de-implementation study<sup>3,4</sup> aimed to identify factors influencing de-implementation of low value blood management practices in primary hip and knee arthroplasties (the use of perioperative cell salvage (CS) and erythropoietin (EPO)). A cross-sectional internet based survey was conducted in 2012 among 400 Dutch orthopaedic surgeons (response rate 40%, n=153). The survey started with two items concerning the current use of EPO and CS on a 7-point Likert scale ranging from 'no extent' to 'a very large extent'. The second part of the survey consisted of 53 items covering the identified barriers from previously performed interviews. Orthopaedic surgeons were asked to what degree each barrier influenced the use of EPO and CS in primary hip and knee arthroplasties. Answers could be given on a 7-point Likert scale ranging from 'no extent' / 'not important' to 'a very large extent' / 'very important'.

The same eighty-six Dutch orthopaedic surgeons participated in both studies, which enables us to study whether leaders in implementation are the same persons as leaders in de-implementation. As these data represent a subset of our findings and were not collected for this purpose, we use them here only to generate hypotheses.

## **DATA ANALYSIS**

### **Are leaders and laggards the same group of people in implementation and de-implementation?**

As a first step, leaders and laggards in both the implementation and de-implementation study had to be defined. From the implementation study<sup>1,2</sup> we selected two sets of treatments: the implementation of medication guidelines (use of acetaminophen and NSAIDs) and the implementation of referral guidelines (referral to physical therapy and dietician). Respondents answered on a 4-point scale the extent to which these treatments were used, and were categorised based on their answers into leaders (often, almost always) and laggards (never, sometimes) for each treatment. Next, we calculated whether an orthopaedic surgeon was a leader for the implementation of medication guidelines (use of both acetaminophen and NSAIDs) and referral guidelines (referral to both physical therapy and dietician) or a laggard for the implementation of medication (no use of acetaminophen and NSAIDs or use of only acetaminophen or NSAIDs) and referral guidelines (no referral to physical therapy and dietician or referral to only physical therapy or dietician).

The same procedure was used for the de-implementation study<sup>3,4</sup> in which respondents answered on a 7-point Likert scale the extent to which they used low value blood management practices (i.e. EPO and CS). Based on their answers, respondents were categorised as 'leaders' (categories 0-3) and 'laggards' (categories 4-6). Leaders for de-implementation of low value blood management practices were considered those orthopaedic surgeons not using EPO and not using CS; laggards were those who still used either EPO or CS.

After we defined leaders and laggards in both the implementation and de-implementation study, we first compared leaders and laggards within implementation and de-implementation, on differences in age, years of working experience as orthopaedic surgeon and the number of new patients with primary hip and knee OA per month using unpaired t-tests. Chi-square tests were used to test for differences in gender, work setting and the extent to which they considered their clinical experience to be more reliable than outcomes from clinical trials. In case of expected cell counts less than five, the Fisher-exact test was used. In addition, we compared leaders/laggards in implementation and de-implementation to assess whether these were the same persons, using chi-square tests. P-values  $\leq 0.05$  were considered statistically significant in all analyses.

### **Do the same factors drive change in implementation and de-implementation?**

To identify factors associated with implementation and de-implementation, we used multivariate logistic regression models with (de-)implementation (yes/no) as the dependent variable. Medication

and referral guidelines were considered to be implemented if respondents answered they used these often or almost always. Low value blood management practices (EPO and CS) were considered to be de-implemented if the respondents answered they used these only for some patients but not frequently (answer categories 0-3) As described previously<sup>3</sup>, to prevent overfitting of the logistic regression models by including too many and possibly related barriers or facilitators, we first created coherent factors of barriers / facilitators according Grol's framework<sup>5</sup> related to:

- the innovation (e.g. clarity of the guideline about NSAID dosage),
- the individual health professional
  - – outcome expectancy (e.g. patients benefit from weight loss, acetaminophen has only a few side effects, convinced about the effectiveness of EPO),
  - – motivation (e.g. important to prevent blood transfusions in hip and knee arthroplasties, department priority is to prevent blood transfusions),
- the patient (e.g. patient does not want physical therapy, patient's comorbidities),
- the social context (e.g. positive attitudes of colleagues about non-surgical treatments, difficulty of letting treatment team stop with CS),
- the organizational context (e.g. clarity on what the patient has done at the physical therapist, availability of non-surgical treatments, hindered by blood management policy),
- the economic and political context (e.g. pressure for production, importance to save costs of EPO/CS).

Groups were created using factor analysis and each group included 3-8 barriers or facilitators from individual survey questions. We calculated Chronbach's alpha for each group to assess their internal consistency, which varied between 0.62 and 0.82 for factors influencing implementation, and between 0.53 and 0.72 for de-implementation. These groups were entered into logistic regression analysis to assess whether these were associated with implementation of medication or referral guidelines and de-implementation of low value blood management practices. Next, as individual groups may be related to others, we included all groups that significantly ( $p < 0.05$ ) influenced implementation and de-implementation into a multivariable logistic regression model.

## REFERENCES

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