

The Arthroplasty Candidacy Help Engine tool to select candidates for hip and knee replacement surgery: development and economic modelling

Andrew Price,^{1*} James Smith,¹ Helen Dakin,²
Sujin Kang,¹ Peter Eibich,² Jonathan Cook,¹
Alastair Gray,² Kristina Harris,¹ Robert Middleton,¹
Elizabeth Gibbons,³ Elena Benedetto,¹
Stephanie Smith,¹ Jill Dawson,³ Raymond Fitzpatrick,³
Adrian Sayers,⁴ Laura Miller,⁴ Elsa Marques,⁴
Rachael Gooberman-Hill,⁴ Ashley Blom,⁴
Andrew Judge,¹ Nigel Arden,¹ David Murray,¹
Sion Glyn-Jones,¹ Karen Barker,¹ Andrew Carr¹
and David Beard¹

¹Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Sciences, University of Oxford, Oxford, UK

²Health Economics Research Centre, University of Oxford, Oxford, UK

³Nuffield Department of Population Health, University of Oxford, Oxford, UK

⁴Musculoskeletal Research Unit, University of Bristol, Bristol, UK

*Corresponding author andrew.price@ndorms.ox.ac.uk

Declared competing interests of authors: Andrew Price reports personal fees from Zimmer Biomet, DePuy Synthes and Smith & Nephew plc, and grants from the National Institute for Health Research (NIHR) and Arthritis Research UK, outside the submitted work. Alastair Gray reports grants from NIHR, during the conduct of the study. Rachael Gooberman-Hill reports grants from the NIHR Health Services and Delivery Research programme for this work during the conduct of the study. Helen Dakin reports grants from NIHR during the conduct of the study and consultancy for Halyard Health outside the submitted work. David Beard reports grants from NIHR outside the submitted work. Jonathan Cook was a member of the NIHR Health Technology Assessment (HTA) Efficient Trial Designs Board (2014–16). Jill Dawson reports grants from the NIHR HTA programme during the conduct of the study and royalty payments from Oxford University Innovation (a university technology transfer company) outside the submitted work, and is one of the original developers of the Oxford Hip and Knee Scores. Raymond Fitzpatrick is one of the developers of the Oxford Hip and Knee Scores. Ashley Blom is the principal investigator in a research project funded by Stryker Corporation. Andrew Judge reports personal fees for consultancy from Anthera Pharmaceuticals, Inc., and Freshfields Bruckhaus Deringer LLP, outside the submitted work. Nigel Arden reports grants from Bioibérica and Novartis Pharmaceuticals UK Ltd, and personal fees from Bioventus, Flexion Therapeutics, Freshfields Bruckhaus Deringer LLP, Janssen Pharmaceutica, Merck & Co. Inc. and Regeneron Pharmaceuticals, Inc., outside the submitted work. David Murray reports grants from the NIHR HTA programme and grants and personal fees from Zimmer Biomet outside the submitted work.

Published June 2019

DOI: 10.3310/hta23320

Plain English summary

The Arthroplasty Candidacy Help Engine tool

Health Technology Assessment 2019; Vol. 23: No. 32

DOI: 10.3310/hta23320

NIHR Journals Library www.journalslibrary.nihr.ac.uk

Plain English summary

Patients with severe hip and knee arthritis may require joint replacement. General practitioners make the decision to refer patients to hospital based on an assessment of their symptoms. Pain and function can be measured using patient questionnaires and the questionnaire scores can indicate whether or not the severity of disease warrants referral (i.e. whether or not the patient is a candidate for joint replacement based on their 'capacity to benefit'). However, we do not know whether or not basing treatment decisions on such scores is correct, nor do we know what exact pain score thresholds should be used for referral.

After a thorough search, we found that the Oxford Hip and Knee Scores were the best instruments. A high score (i.e. a maximum score of 48) indicates less pain and better function. The threshold values for referral for surgery were scores of 40 for hips and 41 for knees. The process of evaluating scoring systems, the choice of scoring systems and the threshold values were discussed and agreed by a panel of patients and by doctors throughout the study.

Most patients with severe joint pain benefit from joint replacement, and these operations are cost-effective. However, above a certain level (a score of 40 for hips and 41 for knees), patients are not thought to typically benefit from surgery. Below these values, lower presurgery scores indicate a steadily increasing likelihood of benefit in terms of reduced pain and better function.

This information provides the basis for a tool to help doctors decide who to refer for joint replacement: the Arthroplasty Candidacy Help Engine (ACHE). Use of the ACHE tool prevents patients who are unlikely to benefit from joint replacement being referred unnecessarily and allows the NHS to concentrate resources on those who will benefit most from arthroplasty treatment.

ISSN 1366-5278 (Print)

ISSN 2046-4924 (Online)

Impact factor: 4.513

Health Technology Assessment is indexed in MEDLINE, CINAHL, EMBASE, The Cochrane Library and the Clarivate Analytics Science Citation Index.

This journal is a member of and subscribes to the principles of the Committee on Publication Ethics (COPE) (www.publicationethics.org/).

Editorial contact: journals.library@nhr.ac.uk

The full HTA archive is freely available to view online at www.journalslibrary.nhr.ac.uk/hta. Print-on-demand copies can be purchased from the report pages of the NIHR Journals Library website: www.journalslibrary.nhr.ac.uk

Criteria for inclusion in the *Health Technology Assessment* journal

Reports are published in *Health Technology Assessment* (HTA) if (1) they have resulted from work for the HTA programme, and (2) they are of a sufficiently high scientific quality as assessed by the reviewers and editors.

Reviews in *Health Technology Assessment* are termed 'systematic' when the account of the search appraisal and synthesis methods (to minimise biases and random errors) would, in theory, permit the replication of the review by others.

HTA programme

The HTA programme, part of the National Institute for Health Research (NIHR), was set up in 1993. It produces high-quality research information on the effectiveness, costs and broader impact of health technologies for those who use, manage and provide care in the NHS. 'Health technologies' are broadly defined as all interventions used to promote health, prevent and treat disease, and improve rehabilitation and long-term care.

The journal is indexed in NHS Evidence via its abstracts included in MEDLINE and its Technology Assessment Reports inform National Institute for Health and Care Excellence (NICE) guidance. HTA research is also an important source of evidence for National Screening Committee (NSC) policy decisions.

For more information about the HTA programme please visit the website: <http://www.nets.nhr.ac.uk/programmes/hta>

This report

The research reported in this issue of the journal was funded by the HTA programme as project number 11/63/01. The contractual start date was in November 2016. The draft report began editorial review in February 2017 and was accepted for publication in April 2018. The authors have been wholly responsible for all data collection, analysis and interpretation, and for writing up their work. The HTA editors and publisher have tried to ensure the accuracy of the authors' report and would like to thank the reviewers for their constructive comments on the draft document. However, they do not accept liability for damages or losses arising from material published in this report.

This report presents independent research funded by the National Institute for Health Research (NIHR). The views and opinions expressed by authors in this publication are those of the authors and do not necessarily reflect those of the NHS, the NIHR, NETSCC, the HTA programme or the Department of Health and Social Care. If there are verbatim quotations included in this publication the views and opinions expressed by the interviewees are those of the interviewees and do not necessarily reflect those of the authors, those of the NHS, the NIHR, NETSCC, the HTA programme or the Department of Health and Social Care.

© Queen's Printer and Controller of HMSO 2019. This work was produced by Price *et al.* under the terms of a commissioning contract issued by the Secretary of State for Health and Social Care. This issue may be freely reproduced for the purposes of private research and study and extracts (or indeed, the full report) may be included in professional journals provided that suitable acknowledgement is made and the reproduction is not associated with any form of advertising. Applications for commercial reproduction should be addressed to: NIHR Journals Library, National Institute for Health Research, Evaluation, Trials and Studies Coordinating Centre, Alpha House, University of Southampton Science Park, Southampton SO16 7NS, UK.

Published by the NIHR Journals Library (www.journalslibrary.nhr.ac.uk), produced by Prepress Projects Ltd, Perth, Scotland (www.prepress-projects.co.uk).

NIHR Journals Library Editor-in-Chief

Professor Ken Stein Professor of Public Health, University of Exeter Medical School, UK

NIHR Journals Library Editors

Professor John Powell Chair of HTA and EME Editorial Board and Editor-in-Chief of HTA and EME journals. Consultant Clinical Adviser, National Institute for Health and Care Excellence (NICE), UK, and Honorary Professor, University of Manchester, and Senior Clinical Researcher and Associate Professor, Nuffield Department of Primary Care Health Sciences, University of Oxford, UK

Professor Andrée Le May Chair of NIHR Journals Library Editorial Group (HS&DR, PGfAR, PHR journals) and Editor-in-Chief of HS&DR, PGfAR, PHR journals

Professor Matthias Beck Professor of Management, Cork University Business School, Department of Management and Marketing, University College Cork, Ireland

Dr Tessa Crilly Director, Crystal Blue Consulting Ltd, UK

Dr Eugenia Cronin Senior Scientific Advisor, Wessex Institute, UK

Dr Peter Davidson Consultant Advisor, Wessex Institute, University of Southampton, UK

Ms Tara Lamont Director, NIHR Dissemination Centre, UK

Dr Catriona McDaid Senior Research Fellow, York Trials Unit, Department of Health Sciences, University of York, UK

Professor William McGuire Professor of Child Health, Hull York Medical School, University of York, UK

Professor Geoffrey Meads Professor of Wellbeing Research, University of Winchester, UK

Professor John Norrie Chair in Medical Statistics, University of Edinburgh, UK

Professor James Raftery Professor of Health Technology Assessment, Wessex Institute, Faculty of Medicine, University of Southampton, UK

Dr Rob Riemsma Reviews Manager, Kleijnen Systematic Reviews Ltd, UK

Professor Helen Roberts Professor of Child Health Research, UCL Great Ormond Street Institute of Child Health, UK

Professor Jonathan Ross Professor of Sexual Health and HIV, University Hospital Birmingham, UK

Professor Helen Snooks Professor of Health Services Research, Institute of Life Science, College of Medicine, Swansea University, UK

Professor Ken Stein Professor of Public Health, University of Exeter Medical School, UK

Professor Jim Thornton Professor of Obstetrics and Gynaecology, Faculty of Medicine and Health Sciences, University of Nottingham, UK

Professor Martin Underwood Warwick Clinical Trials Unit, Warwick Medical School, University of Warwick, UK

Please visit the website for a list of editors: www.journalslibrary.nihr.ac.uk/about/editors

Editorial contact: journals.library@nihr.ac.uk