

Online Supplementary Material

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Methods: Search strategy using Ovid (Medline + Embase). Performed by TF & AS.**Hip Search****Hip replacement**

Hip Prosthesis/ OR Arthroplasty, Replacement, Hip/ OR
(hip adj2 arthroplast\$.mp) OR (hip adj2 replacement?.mp) OR (hip adj2 prosthes\$.mp) OR
THA.mp OR THR.mp OR (TJR\$.mp AND hip\$.mp)

AND**Training**

exp Education, Medical/ OR exp Inservice Training/ OR Clinical Competence/ OR
training.mp OR trainee.mp OR
experience.mp OR
junior.mp OR
senior\$.mp OR
(surgeon adj2 grade).mp OR
consultant.mp OR attending?.mp OR registrar.mp OR SpR.mp OR StR.mp OR ST?.mp OR
residen\$.mp OR fellow\$.mp OR intern.mp OR
(house adj2 officer).mp OR (foundation adj2 doctor).mp

AND**Survival**

exp Prosthesis Failure/ OR exp Survival Analysis/ OR Reoperation/ OR
cox.mp OR proportional?hazard?.mp OR proportional hazard?.mp OR
cumulative?incidence?function.mp OR cumulative incidence function.mp OR CIF.mp OR
failure.mp OR
survival.mp OR survivor?ship.mp OR
revision?.mp OR
re?operation.mp OR re operation.mp OR
Kaplan?meier.mp OR Kaplan meier.mp OR KM.mp OR
product?limit?method.mp OR product limit method.mp

AND**Case-series**

exp Cohort Studies/ OR Controlled Clinical Trials
follow?up.mp OR follow up.mp OR series.mp OR cohort.mp OR observational.mp OR longitudinal.mp
OR prospective.mp OR retrospective.mp OR registry.mp OR registries.mp

Knee search**Knee replacement**

Knee Prosthesis/ OR Arthroplasty, Replacement, Knee/ OR
(knee adj2 arthroplast\$.mp) OR (knee adj2 replacement?.mp) OR (knee adj2 prosthesis\$.mp) OR
TKA.mp OR TKR.mp OR (TJR\$.mp AND knee\$.mp) OR
UKA.mp OR UKR.mp

AND**Training**

exp Education, Medical/ OR exp Inservice Training/ OR Clinical Competence/ OR
training.mp OR trainee.mp OR
experience.mp OR
junior.mp OR
senior\$.mp OR
(surgeon adj2 grade).mp OR
consultant.mp OR attending?.mp OR registrar.mp OR SpR.mp OR StR.mp OR ST?.mp OR
residen\$.mp OR fellow\$.mp OR intern.mp OR
(house adj2 officer).mp OR (foundation adj2 doctor).mp

AND**Survival**

exp Prosthesis Failure/ OR exp Survival Analysis/ OR Reoperation/ OR
cox.mp OR proportional?hazard?.mp OR proportional hazard?.mp OR
cumulative?incidence?function.mp OR cumulative incidence function.mp OR CIF.mp OR
failure.mp OR
survival.mp OR survivor?ship.mp OR
revision?.mp OR
re?operation.mp OR re operation.mp OR
Kaplan?meier.mp OR Kaplan meier.mp OR KM.mp OR
product?limit?method.mp OR product limit method.mp

AND**Case-series**

exp Cohort Studies/ OR Controlled Clinical Trials
follow?up.mp OR follow up.mp OR series.mp OR cohort.mp OR observational.mp OR
longitudinal.mp OR prospective.mp OR retrospective.mp OR registry.mp OR registries.mp

Eligibility criteria

Inclusion criteria:

- Study of predominantly adult patients (≥ 18 years old) undergoing primary hip or knee replacement (including THR, TKR, UKR and hip resurfacing), predominantly for the treatment of osteoarthritis.
- Included articles needed to report the primary and/or secondary outcome measure for two different groups of surgeons defined according to their grade (e.g. trainee vs. consultant). Additional terms used to describe this variable were deemed eligible during screening:
 - **Trainee:** registrar; resident; junior/young surgeon; fellow.
 - **Consultant:** attending; senior surgeon; trainer.
- Minimum follow-up of five years with clearly defined length of follow up.

Exclusion criteria:

- Index operation performed prior to 1990.
- Follow-up not clearly defined.
- Irrelevant study design, or outcomes (therefore not meeting inclusion criteria above).

Specific examples for exclusion (documented in online supplementary materials page 5 and figure 1):

- Principally a study of surgeon/hospital volume
- Principally a study of implant positioning
- No revision rates/survival analysis reported according to surgeon grade
- No reporting of outcomes according to surgeon grade
- Insufficient reporting of follow-up
- Study of operations performed prior to 1990
- Hip fracture cohort
- Single surgeon series
- Irrelevant systematic review
- Study of cost-analysis

Reasons for Exclusion – Hip Papers	
First author/Year of study	Reason for Exclusion
De Vries, 2011	Principally a study of surgeon/hospital volume
Fender, 2003	Principally a study of surgeon/hospital volume
Hooper, 2009	Principally a study of surgeon/hospital volume
Johnsson, 1994	Principally a study of surgeon/hospital volume
Namba, 2012	Principally a study of surgeon/hospital volume
Ravi, 2014	Principally a study of surgeon/hospital volume
Canadian Arthroplasty Soc., MacBride, 2010	Principally a study of surgeon/hospital volume
Enocson, 2009	No revision rates/survival analysis reported according to surgeon grade
Field, 2006	No revision rates/survival analysis reported according to surgeon grade
Leguerrand, 2018	No revision rates/survival analysis reported according to surgeon grade
Moran, 2004	No revision rates/survival analysis reported according to surgeon grade
Smith, 2018	No revision rates/survival analysis reported according to surgeon grade
Wilson, 2016	No revision rates/survival analysis reported according to surgeon grade
Wroblewski, 1998	No revision rates/survival analysis reported according to surgeon grade
Schoenfeld, 2013	No revision rates/survival analysis reported according to surgeon grade
Inglis, 2013	Insufficient reporting of follow-up
Marston, 1996	Study of operations performed prior to 1990
Khatod, 2014	No reporting of outcomes according to surgeon grade
Whitehouse, 2014	No reporting of outcomes according to surgeon grade
Williams, 2002	No reporting of outcomes according to surgeon grade
Zwartele, 2005	No reporting of outcomes according to surgeon grade
Kim, 2017	Principally a study of implant positioning
MacDonald, 2020	Hip fracture cohort
DeAngelis, 2020	Hip fracture cohort
N.B. Multiple reasons for some papers	

Reasons for Exclusion – Knee Papers	
First author/Year of study	Reason for Exclusion
Bini, 2013	Principally a study of surgeon/hospital volume
Namba, 2012	Principally a study of surgeon/hospital volume
Zambianchi, 2014	Principally a study of surgeon/hospital volume
Rissolio, 2021	Principally a study of surgeon/hospital volume
Liddle, 2014	No revision rates/survival analysis reported according to surgeon grade
Beattie, 2016	No revision rates/survival analysis reported according to surgeon grade
Haughom, 2014	No revision rates/survival analysis reported according to surgeon grade
Khakha, 2015	No revision rates/survival analysis reported according to surgeon grade
Schoenfeld, 2013	No revision rates/survival analysis reported according to surgeon grade
Windisch, 2017	No revision rates/survival analysis reported according to surgeon grade
Wilson, 2016	No revision rates/survival analysis reported according to surgeon grade
Woolson, 2007	No revision rates/survival analysis reported according to surgeon grade
Atrey, 2014	No reporting of outcomes according to surgeon grade
Back, 2000	No reporting of outcomes according to surgeon grade
Singh, 2021	No reporting of outcomes according to surgeon grade
Gaillard, 2016	Principally a study of implant positioning
Mahaluxmivala, 2001	Principally a study of implant positioning
Storey, 2018	Insufficient reporting of follow-up
Theelen, 2018	Insufficient reporting of follow-up
Jasper, 2016	Irrelevant systematic review
Lacko, 2018	Single surgeon series
Matas-Diez, 2018	Principally a study of learning curve
Lavernia, 2000	Study of cost-analysis
N.B. Multiple reasons for some papers	

Supplementary Table 1: Risk of Bias (ROBINS-I) assessment

ROBINS-I	Alvand, 2021	Bottomley, 2016	Faulkner, 2017	Hernigou, 2009	Hasegawa, 2015	Jain, 2018	Muller, 2013	Palan, 2009	Reidy, 2016
Bias due to confounding	⊕⊕	⊕⊕	⊕	⊕⊕	⊕⊕	⊕	⊕⊕	⊕	⊕
Bias in selection of patients	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕
Bias in classification of interventions	⊖	⊖	⊕	⊕	⊕⊕	⊕	⊕⊕	⊕	⊕
Bias due to deviations from interventions	⊕	⊕	⊕	⊕⊕	⊕⊕	⊕	⊕⊕	⊕	⊕
Bias due to missing data	⊖	⊖	⊕	⊕⊕	⊕⊕	⊕	⊕	⊖	⊕
Bias in measurement of outcome	⊖	⊖	⊕	⊖	⊕	⊖	⊖	⊖	⊕
Bias in selection of the reported result	⊖	⊖	⊖	⊖	⊕	⊖	⊕	⊖	⊖
Overall risk of Bias	⊕	⊕	⊕	⊕⊕	⊕⊕	⊕	⊕⊕	⊕	⊕
Key: ⊖ = low risk of bias; ⊕ = moderate risk of bias; ⊕⊕ = serious risk of bias; ⊕⊕⊕ = critical risk of bias									