

Supplementary Table S1. Search terms

Database	Search term	
<b>Pubmed</b>	((("Education, Medical, Graduate"[Mesh] OR (house[tiab] AND officer*[tiab]) OR resident*[tiab] OR residency[tiab] OR trainee*[tiab] OR registrar*[tiab] OR education[sh] OR (junior[tiab] AND surgeon*[tiab]))) AND (("Arthroplasty, Replacement, Knee"[Mesh] OR "Arthroplasty, Replacement, Hip"[Mesh] OR "Knee Prosthesis"[Mesh] OR "Hip Prosthesis"[Mesh] OR TKA[tiab] OR TKR[tiab] OR THA[tiab] OR THR[tiab] OR total hip*[tiab] OR total knee*[tiab] OR (("Knee Joint"[Mesh] OR "Knee"[Mesh] OR "Hip"[Mesh] OR "Hip Joint"[Mesh] OR "Joints"[Mesh] OR knee[tiab] OR knees[tiab] OR joint[tiab] OR hip[tiab] OR hips[tiab] OR femur*[tiab] OR femoral[tiab]) AND ("Arthroplasty, Replacement"[Mesh] OR replacement*[tiab] OR arthroplast*[tiab] OR artroplast*[tiab] OR prosthes*[tiab] OR prosthet*[tiab] OR alloplast*[tiab] OR implant*[tiab])))	1236
<b>Embase</b>	('graduate medical education'/exp OR 'resident'/exp OR 'residency education'/exp OR 'surgical training'/exp OR ((house NEAR/2 officer*):ab,ti) OR resident*:ab,ti OR residency:ab,ti OR trainee*:ab,ti OR registrar*:ab,ti OR ((junior NEAR/2 surgeon*):ab,ti) AND ('knee replacement'/exp OR 'hip replacement'/exp OR 'knee prosthesis'/exp OR 'hip prosthesis'/exp OR tka:ab,ti OR tkr:ab,ti OR tha:ab,ti OR thr:ab,ti OR 'total hip*':ab,ti OR 'total knee*':ab,ti OR (('knee'/exp OR 'hip'/exp OR 'joint'/exp OR knee:ab,ti OR knees:ab,ti OR joint:ab,ti OR hip:ab,ti OR hips:ab,ti OR femur*:ab,ti OR femoral:ab,ti) AND ('replacement arthroplasty'/exp OR replacement*:ab,ti OR arthroplast*:ab,ti OR artroplast*:ab,ti OR prosthes*:ab,ti OR prosthet*:ab,ti OR alloplast*:ab,ti OR implant*:ab,ti))	1632
<b>CENTRAL</b>	#1 ((house NEAR/2 officer* ) OR resident* OR residency OR trainee* OR registrar* OR (junior NEAR/2 surgeon*)):ti,ab,kw	20407
	#2 ((TKA OR TKR OR THA OR THR OR total NEXT hip* OR total NEXT knee* ) OR ((knee OR knees OR joint OR hip OR hips OR femur* OR femoral) AND (replacement* OR arthroplast* OR artroplast* OR prosthes* OR prosthet* OR alloplast* OR implant*)):ti,ab,kw	24707
	#1 AND #2 in Trials	144
<b>Cinahl</b>	S1 (MH "Interns and Residents") OR (MH "Internship and Residency")	29835
	S2 TI ( (house N2 officer* ) OR resident* OR residency OR trainee* OR registrar* OR (junior N2 surgeon* ) ) OR AB ( (house N2 officer* ) OR resident* OR residency OR trainee* OR registrar* OR (junior N2 surgeon* ) )	110668
	S3 S1 OR S2	122499
	S4 (MH "Arthroplasty, Replacement, Hip") OR (MH "Arthroplasty, Replacement, Knee+")	37056
	S5 TI ( TKA OR TKR OR THA OR THR OR total-hip* OR total-knee* ) OR AB ( TKA OR TKR OR THA OR THR OR total-hip* OR total-knee* )	34558
	S6 S4 OR S5	45639
	S7 (MH "Hip") OR (MH "Knee") OR (MH "Knee Joint+") OR (MH "Hip Joint") OR (MH "Joints+")	92015
	S8 TI ( knee OR knees OR joint OR hip OR hips OR femur* OR femoral ) OR AB ( knee OR knees OR joint OR hip OR hips OR femur* OR femoral )	231570
	S9 S7 OR S8	261457
	S10 (MH "Arthroplasty, Replacement+")	43488
	S11 TI ( replacement* OR arthroplast* OR artroplast* OR prosthes* OR prosthet* OR alloplast* OR implant* ) OR AB (replacement* OR arthroplast* OR artroplast* OR prosthes* OR prosthet* OR alloplast* OR implant* )	194107
	S12 S10 OR S11	200285
	S13 S9 AND S12	60512
	S14 S6 OR S13	65414
	S15 S3 AND S14	374
<b>Web of Science</b>	#1 TOPIC: ((house NEAR/2 officer* ) OR resident* OR residency OR trainee* OR registrar* OR (junior NEAR/2 surgeon* )) Indexes=SCI-EXPANDED, SSCI, A&HCI, ESCI Timespan=All years	458103
	#2 TOPIC: (TKA OR TKR OR THA OR THR OR total-hip* OR total-knee* OR ((knee OR knees OR joint OR hip OR hips OR femur* OR femoral) AND (r eplacement* OR arthroplast* OR artroplast* OR prosthes* OR prosthet* OR allopla st* OR implant*))) Indexes=SCI-EXPANDED, SSCI, A&HCI, ESCI Timespan=All years	196746
	#3 #2 AND #1 Indexes=SCI-EXPANDED, SSCI, A&HCI, ESCI Timespan=All years	1045

Supplementary Table S2. Reported complication outcomes in methods and results sections in the articles

Study	Reported complication (n for residents/n for consultant) in methods and results section
Lederer 2001	<p>Methods: perioperative Komplikationen (Schaft- und Trochanterfrakturen, Pfannenperforationen, Frühluxationen, klinisch manifeste Nervenläsionen, Thrombosen, Lungenembolien und tiefe Infektionen).</p> <p>Results: Fractures (21/24), acetabular perforations (9/10), dislocations (22/34), nerve palsy (26/40), deep infections (27/22), thrombosis, (34/38) pulmonary emboly (14/24)</p>
Moran 2004	<p>Methods: incidence of re-operation, dislocation, deep infection, and death</p> <p>Results: Mortality 3 months (2/5), surgical site complications (6/17), deep infection (2/7), fracture (0/1), dislocation (2/7), aseptic loosening (2/1), re-operation (4/11)</p>
Robinson 2007	<p>Methods: registration of “complications”, but type not specified in the methods section</p> <p>Results: overall complications (9/7) dislocation (1/2), thrombosis (0/2), pulmonary embolism (0/0), deep infection (0/0), superficial infection (2/2), fracture (0/1), nerve palsy (2/0), hematoma (1/0), <b>other unrelated to surgery (3/1)</b></p>
Woolson 2007	<p>Methods: All intraoperative and postoperative complications were recorded; however, we did not analyze differences in medical complications such as confusion, ileus, urinary complications, and deep venous thrombosis.</p> <p>Results:            Hip: dislocation (10/7), subluxation (4/1), nerve palsy (1/2), trochanteric fracture (0/2), calcar crack (0/1), hematoma/serious drainage (2/2), early re-operation 0/2, severe heterotopic ossification (3/0), late infection (1/0)            Knee: hematoma (2/1), reoperation (0/2), manipulation (1/2), arthrofibrosis (2/0), patellar wear (1/1), insert wear (0/1), cement removal (1/0), extensor re-alignment (0/2), revision (0/1)</p>
Palan 2009	<p>Methods: Secondary outcome measures included complications such as dislocation and revision surgery.</p> <p>Results: Dislocation (9/15), revision (7/13)</p>
Inglis 2012	<p>Methods: The revision rate and the reason for revision was summarized. The reason for revision was divided into 6 broad groups: femoral loosening, acetabular loosening, dislocation, infection, femoral fracture, and other.</p> <p>Results: revision surgery (396/62) for dislocation (30/147), deep infection (13/60), femoral fracture (4/68), acetabular component loosening (11/44), femoral component loosening (7/41), pain (5/30)</p>
Schoenfeld 2013	<p>Methods: Thirty-day postoperative outcomes included mortality and complications, with complications categorized as major systemic, major local, minor systemic, or minor local. Postoperative infections were also recorded as a separate outcome measure.</p> <p>Results: Mortality (13/45) cardiac arrest/myocardial infarction (5/23), pulmonary embolism (45/105), cerebrovascular accident (6/27), acute renal failure (4/15), postoperative sepsis (37/81), septic shock (4/29), <b>other (33/83)</b> deep infection (22/71), nerve palsy (8/23), pneumonia (17/79), urinary tract infection (91/289), renal insufficiency (7/29), deep venous thrombosis (65/192), wound dehiscence (16/34), superficial infection (37/148)</p>
Bohl 2014	<p>Methods: mortality, coma &gt;24 hours, on ventilator &gt;48 hours, unplanned intubation, stroke/cerebrovascular accident, pulmonary embolism, cardiac arrest, myocardial infarction, acute renal failure, sepsis, septic shock, or return to the operating room, wound disruption, superficial surgical site infection, deep surgical site infection, organ/space infection (other than surgical site), urinary tract infection, pneumonia, progressive renal insufficiency, graft/prosthesis/flap failure, peripheral nerve injury, and deep vein thrombosis.</p> <p>Results: Mortality (8/33), coma &gt;24 hours (1/0), on ventilator &gt;48 hours (9/14), unplanned intubation (15/40), stroke (6/20), pulmonary embolism (38/94), cardiac arrest (4/23), myocardial infarction (15/29), acute renal failure (5/24), sepsis (31/69), septic shock (3/22), return to operating room (63/269), wound disruption (13/32), superficial infection (31/121), deep infection (10/34), organ/space infection (7/23), urinary tract infection (81/256), pneumonia (14/63), renal insufficiency (4/13), <b>graft/prosthesis/flap failure (5/6)</b>, nerve palsy (7/20), deep venous thrombosis (56/171)</p>
Haughom 2014	<p>Methods: the outcomes identified at thirty days include surgical site infection, wound dehiscence, reoperation, unplanned hospital readmission, pneumonia, unplanned intubation, deep vein thrombosis (DVT), pulmonary embolism (PE), ventilation over 48 hours, renal insufficiency, acute renal failure,</p>

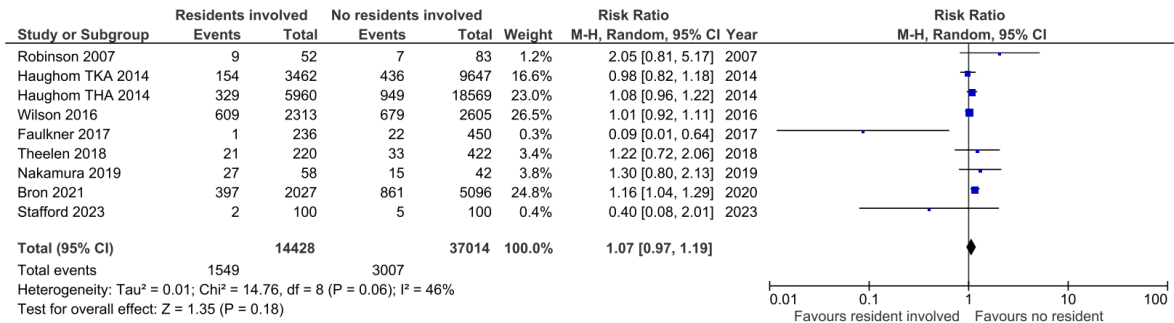
	<p>urinary tract infection, coma, stroke, peripheral neurological deficit, cardiac arrest, myocardial infarction, sepsis, and death.</p> <p>Results: Complications (all combined 154/436), surgical complication (58/134) superficial infection (29/73), deep infection (14/28), wound dehiscence (6/10), re-operation (20/37), unplanned re-admission (37/67), <b>medical complication (103/332)</b>, pneumonia (7/41), unplanned intubation (5/24), deep venous thrombosis (14/49), pulmonary embolism (11/15), ventilated &gt;48h (3/9), renal insufficiency (3/9), acute renal failure (2/9), urinary tract infection (63/147), coma (0/0), stroke (3/17), peripheral neurological deficit (0/0), cardiac arrest (1/8), myocardial infarction (8/18)</p>
Haughom 2014	<p>Methods: outcomes recorded at thirty days postoperatively include surgical site infection, wound dehiscence, pneumonia, unplanned intubation, deep vein thrombosis (DVT), pulmonary embolism (PE), ventilation over 48 hours, renal insufficiency, acute renal failure, urinary tract infection, coma, stroke, peripheral neurological deficit, cardiac arrest, myocardial infarction, sepsis, death, unplanned hospital readmission, and reoperation.</p> <p>Results: Complication (all combined 329/949), surgical complication (72/256) superficial infection (41/154), deep infection (8/30), wound dehiscence (15/45), re-operation (17/48), unplanned re-admission (55/163), <b>medical complication (265/720)</b>, pneumonia (28/59), unplanned intubation (14/35), deep venous thrombosis (76/199), pulmonary embolism (49/124), ventilated &gt;48h (9/11), renal insufficiency (5/28), acute renal failure (3/20), urinary tract infection (81/254), coma (1/0), stroke (6/15), peripheral neurological deficit (0/0), cardiac arrest (5/19), myocardial infarction (21/43), sepsis (30/58), death (9/28)</p>
Hasegawa 2015	<p>Methods: registration of “complications”, but type not specified in the methods section</p> <p>Results: Dislocation (3/1), acetabular fracture (3/1), femoral fracture (0/1), death (0/0), large vessel injury (2/0), nerve palsy (2/1), deep infection (0/1), skin necrosis (1/0)</p>
Reidy 2016	<p>Methods: complications including dislocation and infection</p> <p>Results: re-operations (7/21), deep infections (5/8), dislocations (9/17)</p>
Wilson 2016	<p>Methods: Surgical complications included events such as intraoperative fractures, vessel damage, implant error, broken implant and intraoperative skin tear. Medical complications included events such as respiratory infections, delirium, urinary tract infections and septicemia. Wound complications included events such as wound ooze, wound infections, wound breakdown and stitch abscess.</p> <p>Results: Hip: Surgical complications (51/59), medical complications (113/123), wound complications (113/124), <b>surgical readmissions 22/26</b> Knee: Surgical complications (62/66), medical complications (171/172), wound complications (47/51), <b>surgical readmissions (47/51)</b></p>
Faulkner 2017	<p>Methods: Outcomes including revision rate and mortality were also recorded</p> <p>Results: superficial wound infection (0/1), deep wound infection (2/7), superficial infection (0/1), (peri-prosthetic) fracture (0/2), pulmonary embolism (0/5), instability (0/2), malalignment (0/2), limited mobility (0/1), loosening (1/0), reoperation (1/0)</p>
Weber 2017	<p>Methods: registration of “complications”, but type not specified in the methods section</p> <p>Results: intraoperative femur fracture (1/4), dislocation (0/5), joint infection (2/4)</p>
Weber 2017	<p>Methods: registration of “complications rates”, but type not specified in methods section</p> <p>Results: intraoperative fractures (0/2), thrombosis (1/1), nerve palsy (1/1), joint infection (1/3)</p>
Windisch 2017	<p>Methods: Early revision reported (for each case the reason for revision was specified (traumatic inlay dislocation, wound healing problems, infection)</p> <p>Results: surgical site complications (3/5)</p>
Beattie 2018	<p>Methods: no mentioning of complication in methods section</p> <p>Results: Mortality (3/8)</p>
Smith 2018	<p>Methods: revision for early infection</p> <p>Results: revision for infection (28/104)</p>
Theelen 2018	<p>Methods: Complication rates were evaluated based on official registration in patient records, with special interest for deep infections</p>

	Results: hypovolemic shock (1/0), hypotension (3/1), cardiac arrhythmia (1/0), pulmonary embolism (0/1), DVT (3/1), superficial surgical site infection (3/7), deep surgical site infection (1/4), wound defect (1/1), erysipelas (1/0), blistering (0/3), patella dislocation (0/2), loosening (1/2), disability in flexion/extension (5/4), peripheral nerve lesion (1/2)
MacDonald 2019	Methods: Patient electronic records were also analyzed to find recorded postoperative complications including 30-day mortality, dislocation, infection requiring reoperation, and revision.  Results: Mortality (0/0), surgical site complications (0/0), dislocation (0/0), revision (0/0), infection (0/0)
Nakamura 2019	Methods: All adverse events (AEs), serious AEs (such as surgical site infection, cardiovascular events and postoperative fracture), and AEs of special interest (revision surgery, iatrogenic severe sequelae or death) were recorded.  Results: overall complications (27/15)
Foissey 2020	Methods: major or minor complication (MMC) including intraoperative (e.g., femoral fracture) and post-operative complications (e.g., dislocations, infections, ilio-psoas impingement (IPI), lateral femoral cutaneous nerve (LFCN) neuropraxia)  Results: Greater trochanteric fractures (3/8), femoral perforation (0/1), periprosthetic fracture (1/4), dislocation (0/1), infection (7/1), aseptic loosening (0/3), psoas pain/iliopsoas impingement (4/18), gluteus tendinitis (8/2), lateral femorocutaneous nerve neuropraxia (10/2), revision (9/10), revision with implant removal (4/4)
Bron 2021	Methods: registration of “complications”, but type not specified in the methods section  Results: Knee: Surgical site (99/222), deep infection (13/45), nerve palsy (5/12), <b>intra-operative complication (5/10)</b> , re-operation (83/182), <b>other (69/140)</b> , revision (29/71), systemic complications (91/175), delirium (19/28), <b>deep venous thrombosis and pulmonary embolism (7/15)</b> , pulmonary (2/11), urological (42/67), cardiac (16/27), gastrointestinal (3/9), stroke (1/10), <b>other (16/36)</b> , mortality (3/2) Hip: Surgical site (91/248), deep infection (22/50), dislocation (27/68), nerve palsy (8/25), <b>intra-operative complication (10/29)</b> , re-operation (47/151), <b>other (26/77)</b> , revision (17/69), systemic complications (116/216), delirium (22/50), <b>deep venous thrombosis and pulmonary embolism (8/12)</b> , pulmonary (12/23), urological (48/82), cardiac (19/41), gastrointestinal (7/12), stroke (4/6), <b>other (21/33)</b> , mortality (3/6)
Hoerlesberger 2021	Methods: no mentioning of complication in methods section  Results: Aseptic loosening (0/2), early infection (1/0)
Sheridan 2022	Methods: all secondary procedures, including revision, re-revision, and the indication for all revision procedures were recorded.  Results: Mortality (0/0), deep infection (2/2), aseptic loosening (2/2), revision (6/6), manipulation under anesthesia (7/5)
Maheshwari 2022	Methods: Outcomes included 90-day readmission, medical complications including but not limited to deep vein thrombosis, pulmonary embolism, urinary tract infection, cardiopulmonary and gastrointestinal complications, complex regional pain syndrome, and 1-year surgical complications including revision, infections, manipulation under anesthesia, patellar clunk syndrome, and wound issues.  Results: Deep venous thrombosis (1/0), complex regional pain syndrome (1/1), manipulation under anesthesia (2/2), patella clunk (0/1)
Anis 2022	Methods: Outcomes of interest included surgical site infections and prosthetic joint infections  Results: Superficial surgical site infection (188/138), prosthetic joint infections (59/25)
Stafford 2023	Methods: Postoperative outcomes were rates of minor complications and infection.  Results: infections (0/1), other complications (2/5)

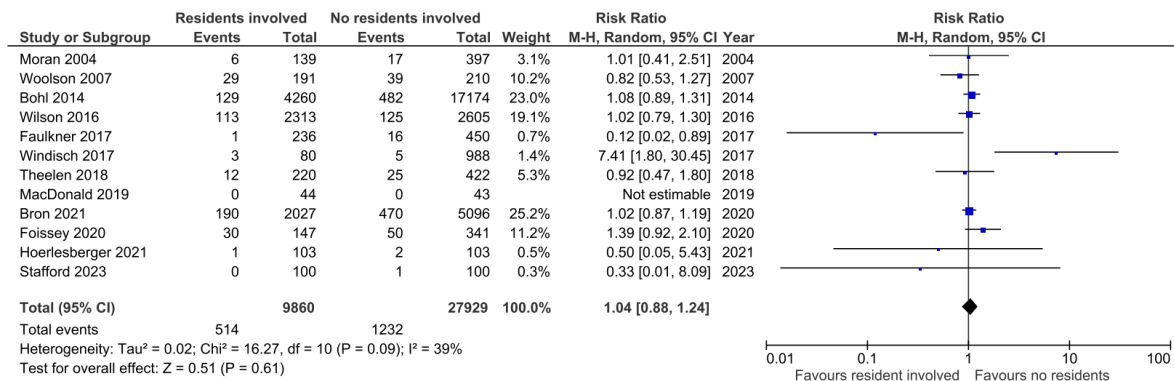
All extracted complications from the manuscripts. Complications highlighted in bold were not analyzed separately.

Supplementary Table S3: Forest plots of overall complications\*

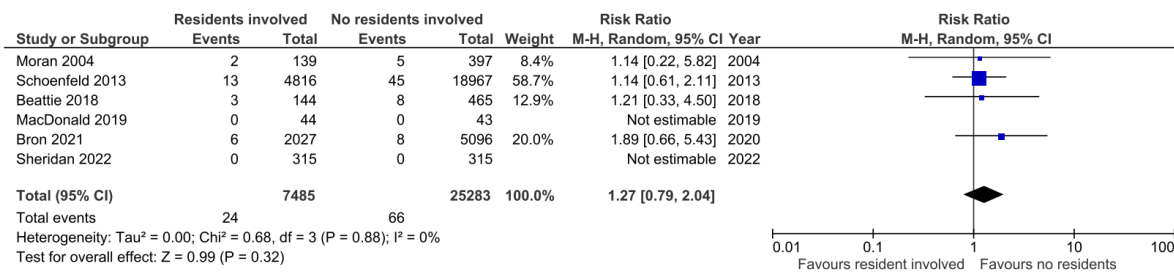
A: Overall complications\*



B: Surgical complications\*



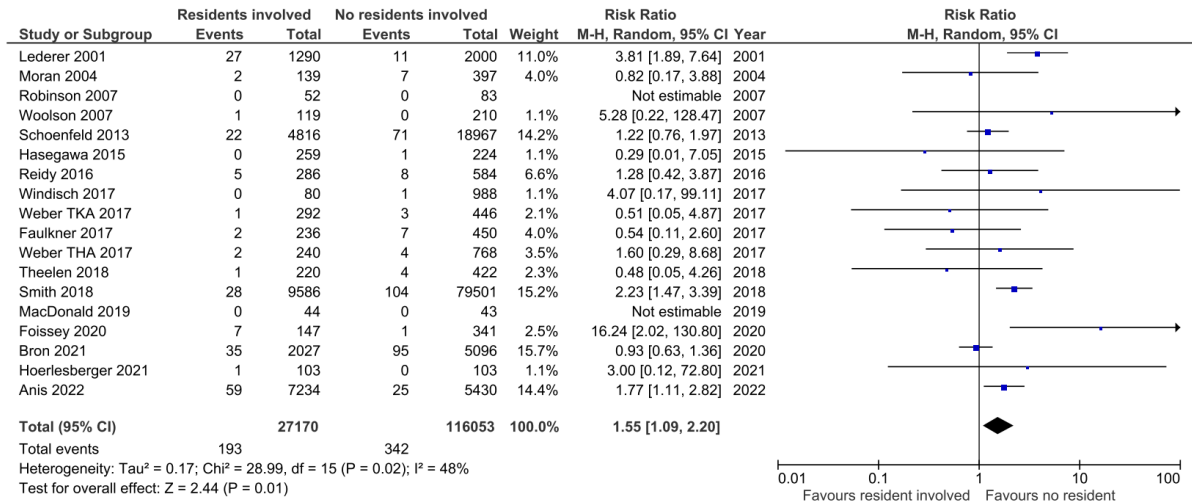
C: Mortality\*



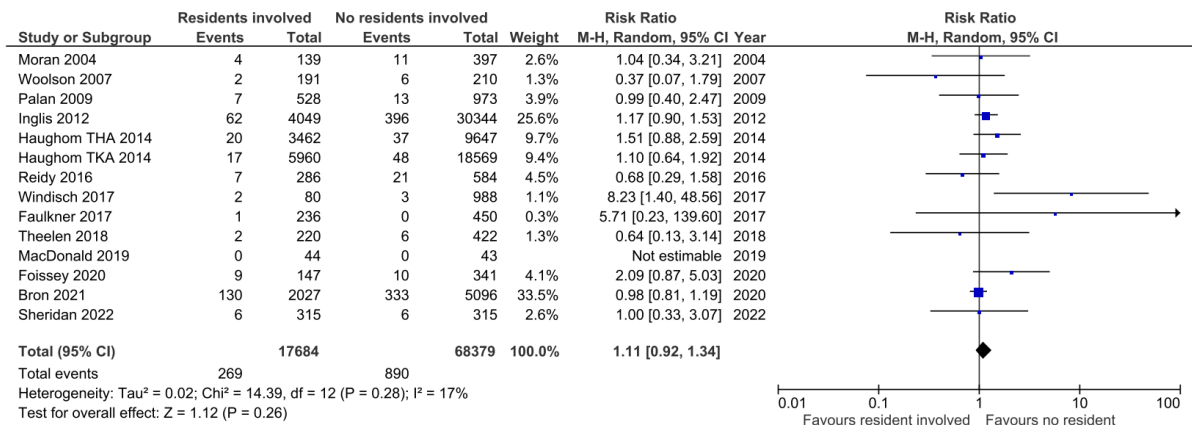
\* The 4 NSQIP studies (13-16) had overlapping cohorts. For A, both studies of Haughom et al. were included since they also included the cohorts of Bohl et al. and Schoenfeld et al. For B, the study by Bohl et al. was included since it reported the highest number of surgical complications from all NSQIP studies. For C, the study by Schoenfeld et al. was included since it reported the highest number of deaths from all NSQIP studies.

Supplementary Table S4: Forest plots of surgical site complications

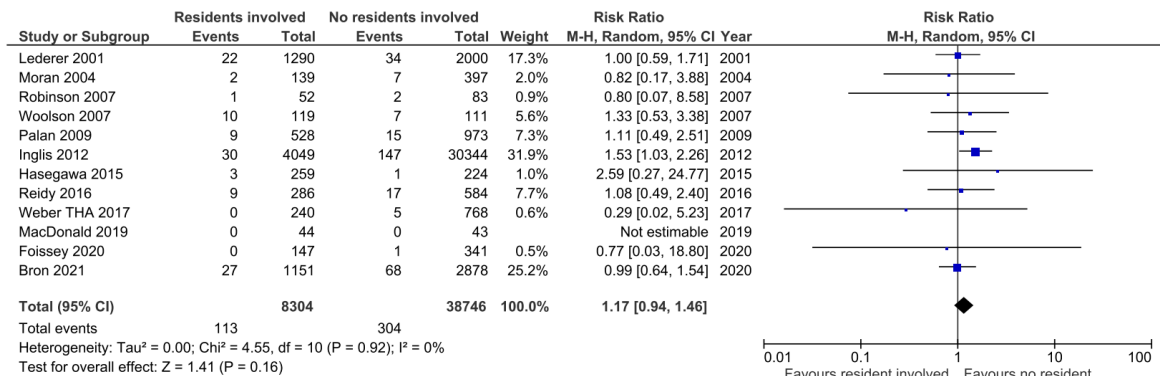
A: Deep infection\*



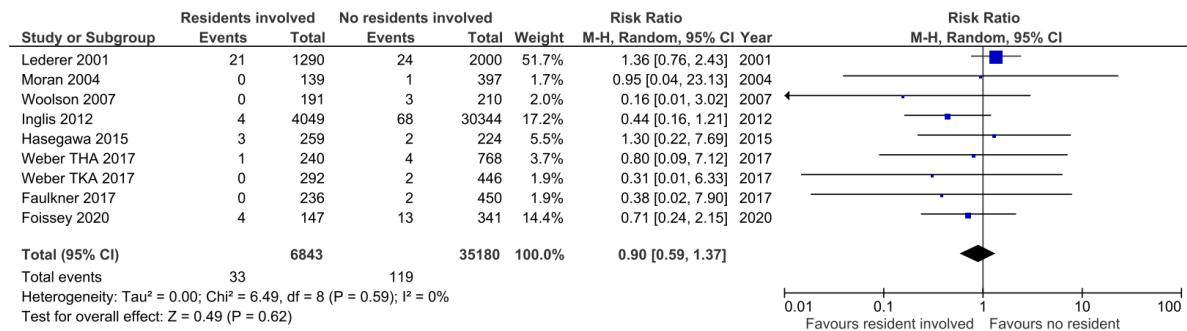
B: Re-operation\*



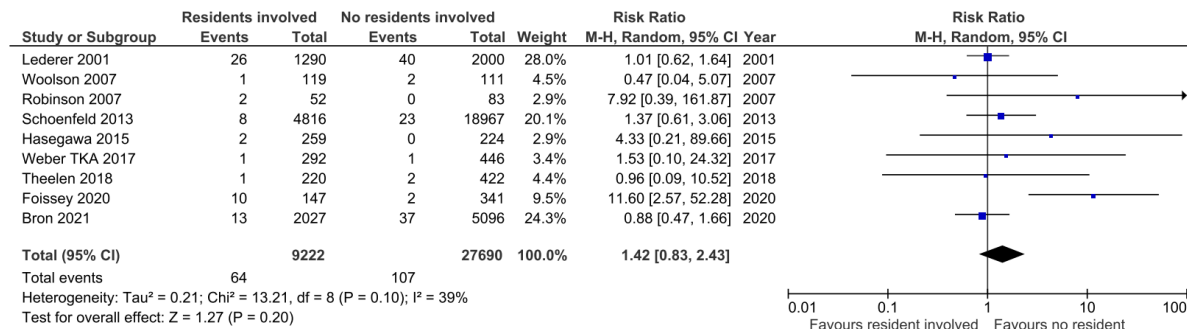
C: Dislocation total hip arthroplasty



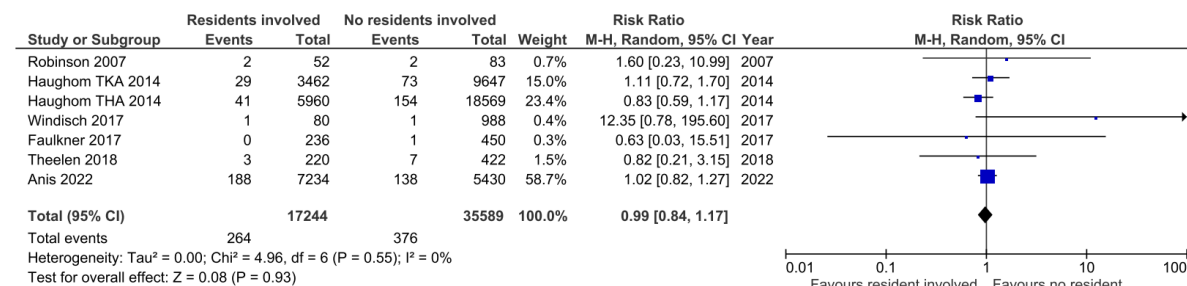
### D: Fracture



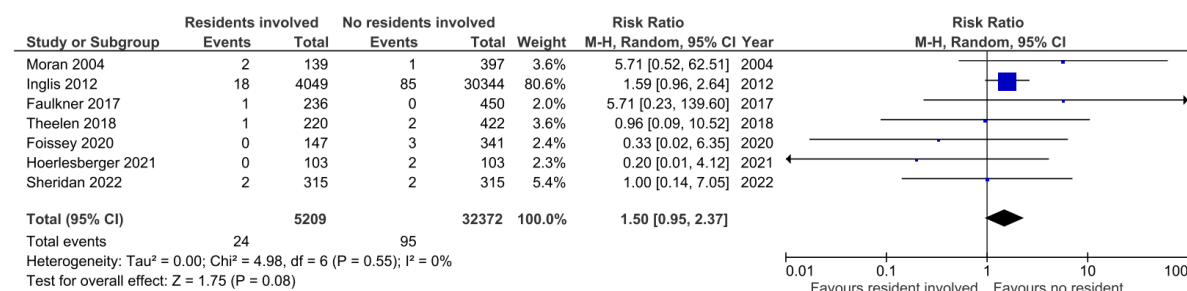
### E: Nerve palsy\*



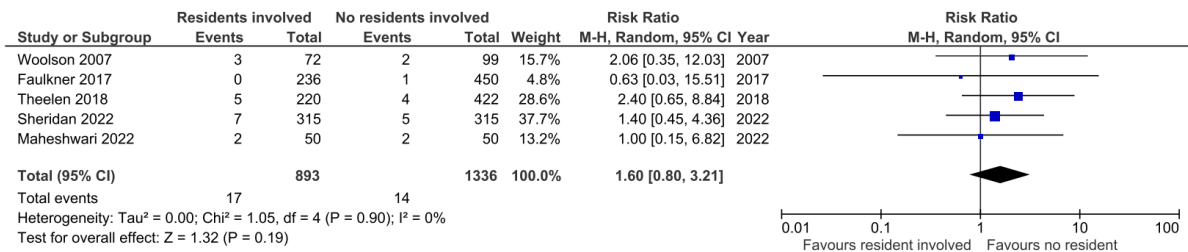
### F: Superficial infection\*



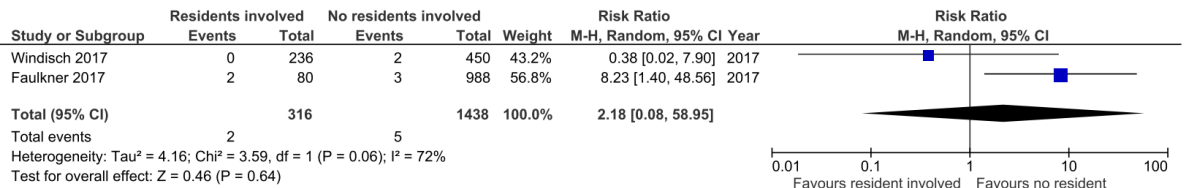
### G: Aseptic loosening



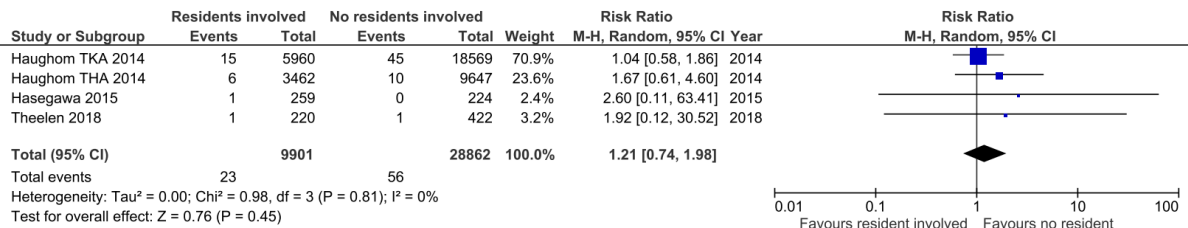
## H: Limited mobility total knee arthroplasty



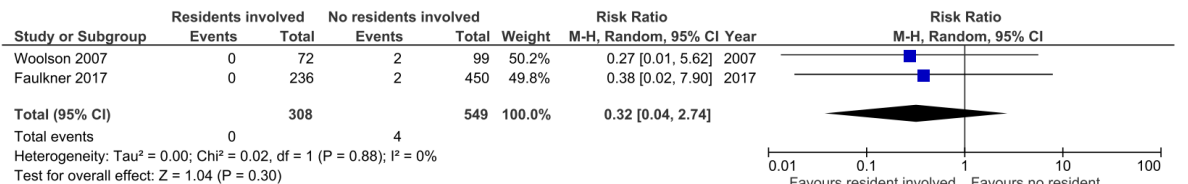
## I: Instability total knee arthroplasty



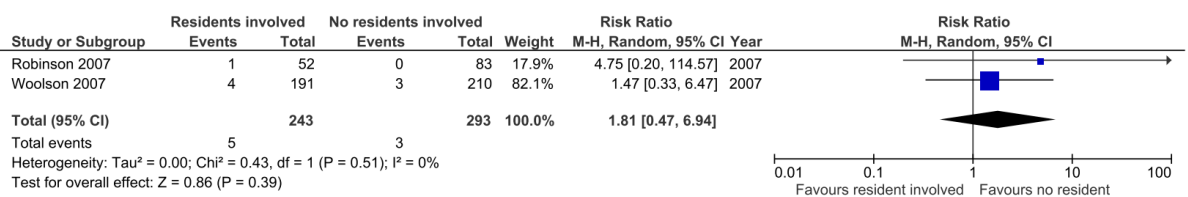
## J: Wound defect\*



## K: Malalignment total knee arthroplasty



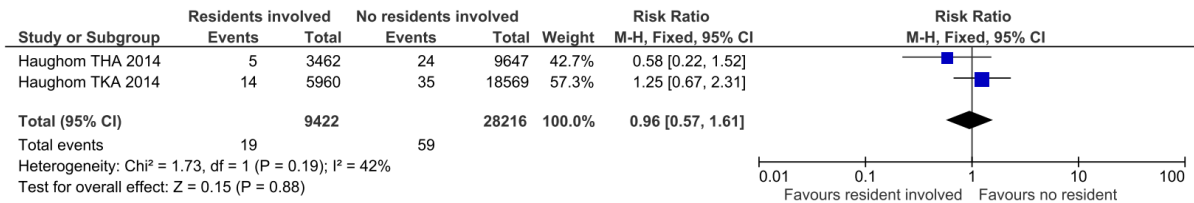
## L: Serious drainage / hematoma



\* The 4 NSQIP studies (13-16) had overlapping cohorts. For A and L, both studies of Haughom et al. were included since they also included the cohorts of Bohl et al. and Schoenfeld et al. For B and J, the study by Schoenfeld et al. was included since it reported the highest number of deep infections and nerve palsies from all NSQIP studies.

Supplementary Table S5: Forest plots of systemic complications

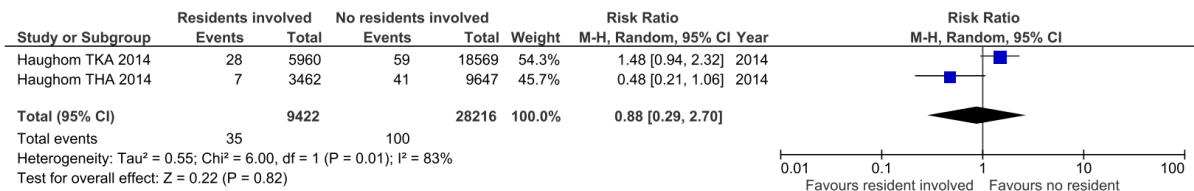
A: On ventilator >48 hours\*



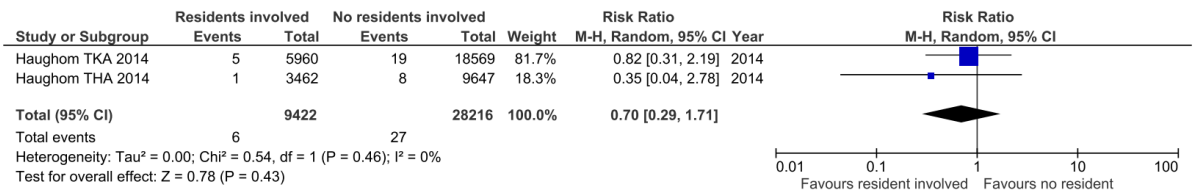
B: Unplanned intubation\*



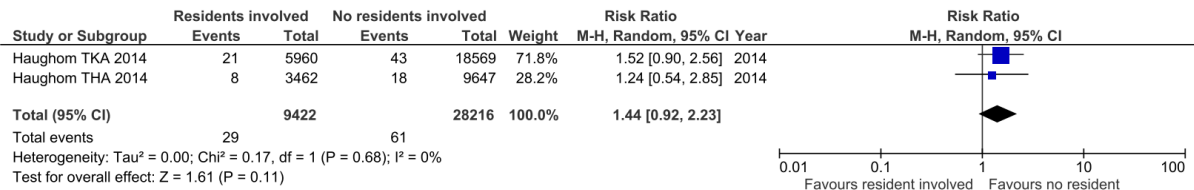
C: Pneumonia\*



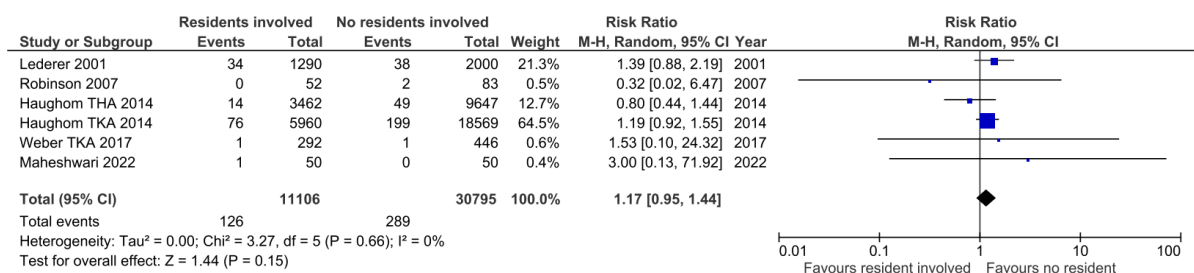
D: Cardiac arrest\*



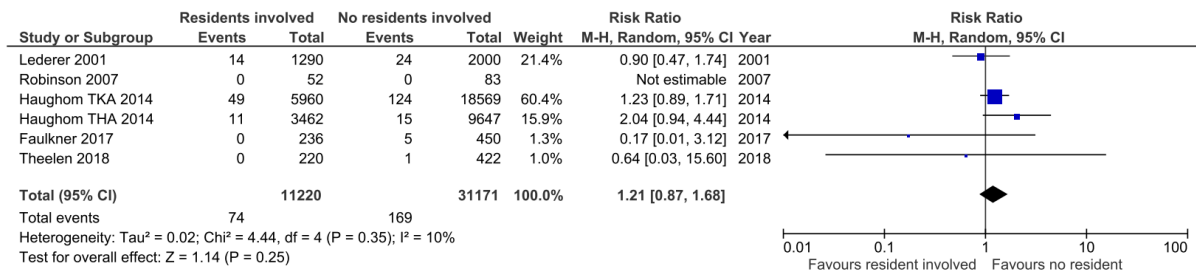
E: Myocardial infarction\*



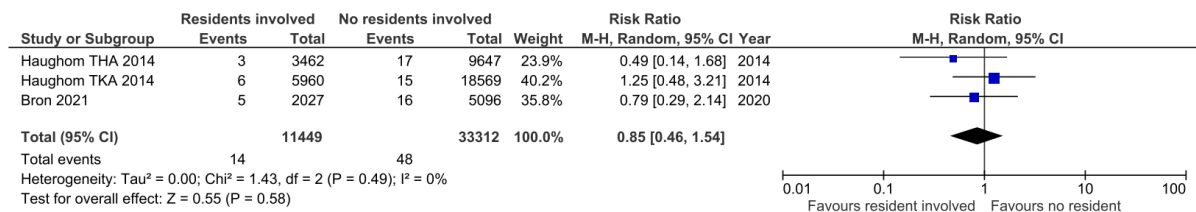
F: Deep venous thrombosis\*



### G: Pulmonary embolism\*



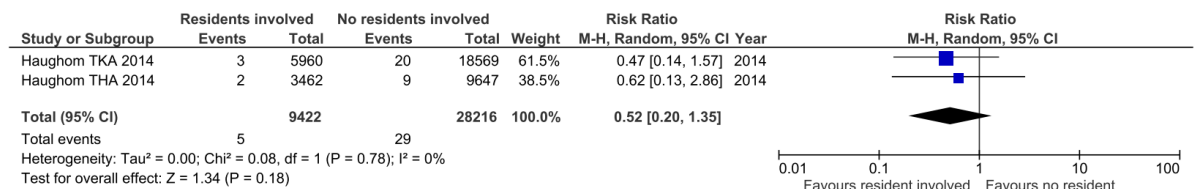
### H: Cerebrovascular accident\*



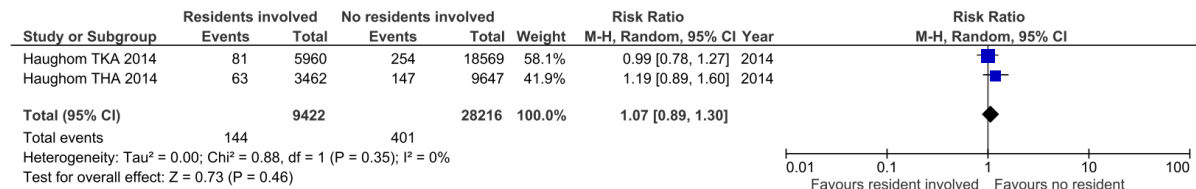
### I: Renal insufficiency\*



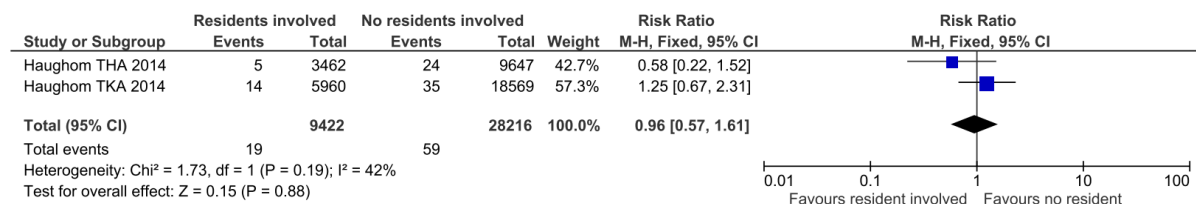
### J: Acute renal failure\*



### K: Urinary tract infection\*



### L: Unplanned re-admission\*



\* The 4 NSQIP studies (13-16) had overlapping cohorts. Both studies of Haughom et al. were included since they also included the cohorts of Bohl et al. and Schoenfeld et al.