



Higher rates of surgical and medical complications and mortality following TKA in patients aged ≥ 80 years: a systematic review of comparative studies

Olivier Courage¹

Louise Strom²

Floris van Rooij²

Matthieu Lalevée^{1,3}

Donatien Heuzé^{1,3}

Pierre Emanuel Papin^{1,3}

Michael Butnaru^{1,3}

Jacobus Hendrik Müller²

- The purpose of this systematic review was to synthesize studies published since the last systematic review in 2015 that compare outcomes of primary total knee arthroplasty (TKA) in older patients (≥ 80 years) and in younger patients (< 80 years), in terms of complication rates and mortality.
- An electronic literature search was conducted using PubMed, Embase®, and Cochrane Register. Studies were included if they compared outcomes of primary TKA for osteoarthritis in patients aged 80 years and over to patients aged under 80 years, in terms of complication rates, mortality, or patient-reported outcomes (PROs).
- Thirteen studies were eligible. Surgical complications in older patients ranged from 0.6–21.1%, while in younger patients they ranged from 0.3–14.6%. Wound complications in older patients ranged from 0.5–20%, while in younger patients they ranged from 0.8–22.0%. Medical complications (cardiac, respiratory, thromboembolic) in older patients ranged from 0.4–17.3%, while in younger patients they ranged from 0.2–11.5%.
- Mortality within 90 days in older patients ranged between 0–2%, while in younger patients it ranged between 0.0–0.03%.
- Compared to younger patients, older patients have higher rates of surgical and medical complications, as well as higher mortality following TKA. The literature also reports greater length of stay for older patients, but inconsistent findings regarding PROs. The present findings provide surgeons and older patients with clearer updated evidence, to make informed decisions regarding TKA, considering the risks and benefits within this age group. Patients aged

over 80 years should therefore not be excluded from consideration for primary TKA based on age alone.

Keywords: elderly; geriatric; length of stay; mortality; nonagenarian; octogenarian; outcomes; TKA; total knee arthroplasty

Cite this article: *EFORT Open Rev* 2021;6:1052-1062.

DOI: 10.1302/2058-5241.6.200150

Introduction

The elderly population continues to grow globally,¹ increasing the overall prevalence of osteoarthritis (OA).² It is estimated that 17.7% of this population suffer from end-stage OA of the knee,³ resulting in a rising demand for total knee arthroplasty (TKA), which is forecast to increase exponentially for this group of patients up to 2050.⁴

The success of TKA for patients aged over 80 years is a matter of controversy, as prior studies have reported inconsistent associations between advanced age and outcomes. Whereas some studies found patient-reported outcomes (PROs) following TKA in older patients to be comparable to those in their younger counterparts,^{5–7} others reported them to be significantly inferior in elderly patients.^{8,9} Furthermore, some studies reported higher complication rates, length of stay (LoS) in hospital, and mortality following TKA in older patients,^{6,10–12} whilst other studies argued that these outcomes depend more on morbidities and health status, rather than age per se.^{13–15}

Moreover, McCalden et al⁸ reported lower revision rates for TKA at five and 10 years for patients aged over 80 years, compared to younger patients.

In 2018, Murphy et al¹⁶ published a systematic review on the outcomes of total hip arthroplasty and TKA, and found higher risks of complications and mortality in older patients. In 2016, Kuperman et al¹⁷ published a meta-analysis of comparative studies performed over the two preceding decades and concluded that primary TKA had comparable risks and similar improvements in outcomes in both older and younger populations. In both the systematic review and the meta-analysis, much of the available data was deemed to be of poor quality, and some of the included studies are outdated in terms of implant design, surgical techniques and postoperative management. Both surgeons and patients would benefit from clearer, updated evidence to make informed decisions regarding surgical intervention in end-stage OA of the knee. The purpose of the present systematic review was to synthesize studies published since 2015 that compare outcomes of primary TKA in older patients (\geq 80 years) and in younger patients ($<$ 80 years) in terms of complication rates and mortality. The hypothesis was that older patients receiving TKA would have similar outcomes to younger patients.

Material and methods

The protocol for this systematic review was submitted to PROSPERO prior to commencement (registration number: CRD42020201381) and conforms to the principles outlined in the handbook of the Cochrane Collaboration,¹⁸ along with the guidelines established by the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA).¹⁹

Search strategy

The authors conducted a structured electronic literature search using the PubMed, Embase®, and Cochrane Central Register of Controlled Trials databases, applying the keywords and medical subject heading (MeSH) terms presented in Appendix 1. The search was limited to articles published between 1 January 2015 and 3 August 2020, to ensure a contemporary systematic review in consideration of modernization of surgical techniques, implant design, and postoperative management strategy. After removal of duplicate records, two researchers (LS & FVR) each screened the titles and abstracts to determine the suitability for the review against predefined eligibility criteria:

Inclusion criteria

- Studies comparing patients aged 80 years and over to patients aged under 80 years, who received primary TKA for OA, and reporting one or more of the following outcomes: length of

hospital stay, mortality, complication rates, or revision rates.

Exclusion criteria

- Narrative or systematic reviews, non-comparative case series, case reports, expert opinions, editorials or letters to editors.
- Studies published in languages other than English.
- Studies that reported aggregate outcomes of hip and knee arthroplasty, for which authors were contacted to obtain data specific to TKA, and for which no response was received after two reminders.

Study selection

Full-text review of studies meeting the criteria in the initial screening was carried out by two researchers (LS & FVR) and any disagreement about the final eligibility of studies was first discussed between the researchers, and, where required, a third researcher (JHM) resolved any disagreement. The reference lists of studies for full-text review were searched, and an expert in TKA (OC) was consulted to further establish relevant studies not captured by the database searches.

Data extraction and quality assessment

Data extraction was performed by two researchers (LS & FVR) independently and their results compared to ensure accuracy. Where there was disagreement in the documented value, the true value was ascertained by simultaneous review of the data in question by both researchers. The following data were extracted from the included studies: author(s), journal, year of publication, level of evidence, country in which the study was performed, conflicts of interest and funding declaration. Patient characteristics of the over 80 and under 80 populations were retrieved, including number of patients in each group, sex, age, body mass index (BMI), and American Society of Anesthesiologist (ASA) grade. Type and incidence of complications, mortality, LoS, and pre- and postoperative PROs were extracted where available. Methodological quality of the eligible studies was assessed by two researchers (LS & FVR) according to the Downs and Black Quality Checklist for Health Care Intervention Studies,²⁰ to appraise the reporting quality (10 items), external validity (three items), bias (seven items), confounding and selection bias (six items), and power (one item) of each study. Using modified scoring for power (1 – power calculated/recorded in study, 0 – power not calculated/reported) each study was given an overall score out of 28, and the quality of a study was rated as excellent (\geq 26); good (20–25); fair (15–19); or poor (\leq 14).²¹ Where there was disagreement between the researchers, consensus was achieved by discussion and review.

Table 1. Study characteristics studies comparing patients aged > 80 and < 80 years following primary TKA

Author and year	Groups	Patients	Female sex	Age mean [median]	BMI	ASA grade I	ASA grade II	ASA grade III	ASA grade IV	Location	COI declared	Funding declared
Andreozzi et al 2020	>80 years	103	68%	83		16%	45%	39%		Italy	Yes	Yes
	<80 years	103	68%	64.6		43%	52%	5%				
Austin et al 2018 ⁴⁵	>80 years	175	56%	>80						United States	Yes	Yes
	<80 years	2133	58%	<80								
Bovonratwet et al 2019 ⁴⁶	>80 years	1005	53%	82.8	28.5	ASA 1 + 2: 44%		51%	2%	United States	Yes	Yes
	<80 years	17191	51%	64	32.2	ASA 1 + 2: 59%		40%	1%			
Cher et al 2018 ⁴⁴	>80 years	209		82.1	26.4					Singapore	Yes	Yes
	<80 years	209		66.1	26.6							
Goh et al 2020 ⁵⁰	>80 years	594	80%	81.5	26.4					Singapore	Yes	Yes
	<80 years	594	80%	69.7	26.3							
Klasan et al 2019 ⁴⁹	>80 years	644	64%	83.3		3%	49%	47%	0%	Australia	Yes	
	<80 years	644	64%	69.9		3%	49%	47%	0%			
Kodaira et al 2019 ⁴⁸	>80 years	679	77%	82	25.1					Japan	Yes	Yes
	<80 years	673	81%	71	27.0							
Maempel et al 2015 ⁴⁰	>80 years	358		[83]						Scotland	Yes	
	75–80 years	694		[77]								
	<75 years	2092		[66]								
Murphy et al 2018 ⁴⁷	>80 years	292	62%	83	30.4	1%	45%	52%	1%	Australia	Yes	Yes
	<80 years	2062	67%	67.8	33.7	3%	54%	42%	1%			
Sezgin et al 2019 ⁷	>80 years	22		92						Sweden		
	<80 years	1035		65–74								
Skinner et al 2016 ⁴¹	>80 years	31	61%	91	27.2					England		
	<80 years	36	36%	74.56	26.1							
Townsend et al 2018 ⁴²	>79 years	24	54%	>79	29.0					United States	Yes	
	70–79 years	94	62%	70–79	31.6							
	60–69 years	138	69%	60–69	34.6							
	50–59 years	68	72%	50–59	35.7							
	<50 years	32	72%	<50	35.9							
Yun et al 2018 ⁴³	>80 years	38	84%	82.8	25.6	0%	61%	34%	5%	Republic of Korea	Yes	
	<80 years	41	92%	67.9	25.8	0%	61%	39%	0%			

Note. TKA, total knee arthroplasty; ASA, American Society of Anesthesiologists; BMI, body mass index; COI, conflict of interest.

Statistical analysis

Heterogeneity was evaluated by visual inspection of the forest plots and quantified using the I^2 statistic to provide a measure of the degree of inconsistency across the studies.²² Where possible, summary pooled estimates of proportions with 95% confidence intervals were calculated via logit transformation using inverse-variance weighting within a random effects model framework. Where the domains of studies were not sufficiently comparable to pool, results were displayed in a forest plot and the summary estimate withheld.²³ Statistical analyses were performed using R version 3.5.0 (R Foundation for Statistical Computing, Vienna, Austria) using the meta package.

Results

The systematic search returned 1421 records, of which 27 were duplicates, leaving 1394 for screening. A total

of 1366 studies were excluded by examining their titles and/or abstracts, and a further 18 studies^{9,12,24–39} were excluded after full-text review. A search of the reference lists of the 10 eligible studies, and a discussion with an expert on TKA, identified three additional studies. This left 13 studies^{7,15,40–50} eligible for this systematic review, all of which were cohort or case-control studies (Table 1, Fig. 1). Due to substantial heterogeneity and insufficient information to further investigate this heterogeneity, pooling of results was not performed and only non-statistical syntheses was provided.

Surgical complications

Seven studies reported rates of surgical, and/or wound complications (Table 2).^{15,40,43,45,47–49} The rate of surgical complications in older patients (≥ 80 years) ranged from 0.6–21.1%, while in younger patients (< 80 years) it ranged from 0.3–14.6%, with no heterogeneity ($I^2 = 0\%$) (Fig. 2). Wound complications in older patients ranged

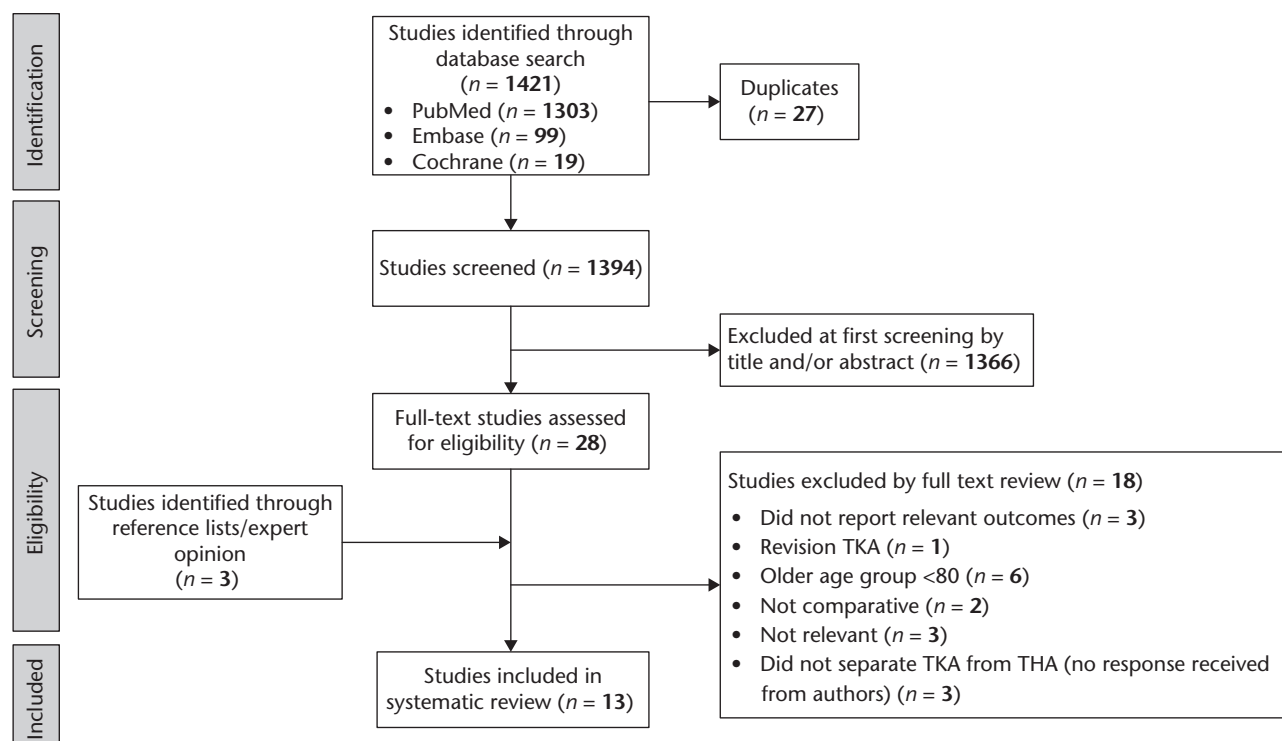


Fig. 1 Flowchart.

Note. TKA, total knee arthroplasty; THA, total hip arthroplasty.

Table 2. Complications in patients aged > 80 and < 80 years following primary TKA

Author	Groups	Surgical complications	Wound complications	Cardiac	Medical complications		Confusion/delirium
					Respiratory	Thromboembolic	
Andreozzi et al 2020 ¹⁵	>80 years	10.00%		4.00%	6.00%		12.00%
	<80 years	8.00%		2.00%	3.00%		5.00%
Austin et al 2018 ⁴⁵	>80 years						
	<80 years						
Bovontarwet et al 2019 ⁴⁶	>80 years		0.50%	1.44%	0.40%	1.29%	
	<80 years		0.78%	0.96%	0.20%	0.56%	
Klasan et al 2019 ⁴⁹	>80 years	2.44%				2.00%	
	<80 years	2.27%				2.00%	
Kodaira et al 2019 ⁴⁸	>80 years	0.60%	2.20%				11.70%
	<80 years	0.30%	2.20%				1.60%
Maempel et al 2015 ⁴⁰	>80 years	1.70%		3.10%	1.60%	0.90%	3.10%
	75–80 years	2.00%		1.60%	2.30%	0.60%	2.20%
	<75 years	1.10%		1.40%	0.90%	1.00%	0.60%
Murphy et al 2018 ⁴⁷	>80 years		20.00%	17.30%	3.30%	13.10%	11.10%
	<80 years		22.00%	11.50%	1.90%	9.40%	2.60%
Yun et al 2018 ⁴³	>80 years	21.10%					10.50%
	<80 years	14.60%					4.90%

Note. TKA, total knee arthroplasty.

from 0.5–20%, while in younger patients they ranged from 0.8–22.0%, with no heterogeneity ($I^2 = 1\%$).

Medical complications

Seven studies reported rates of medical (cardiac, respiratory, or thromboembolic) complications (Table 2).^{15,40,43,45,47–49} Medical complications in older patients ranged

from 0.4–17.3%, while in younger patients they ranged from 0.2–11.5%, with moderate heterogeneity ($I^2 = 20$ to 70%) (Fig. 3). Five studies reported on confusion or delirium, which in older patients ranged from 3.1–12.0%, while in younger patients ranged from 0.6–5.0%, with considerable heterogeneity ($I^2 = 89\%$).^{15,40,43,47,49} The overall risk of medical complications is 2% lower in younger patients.

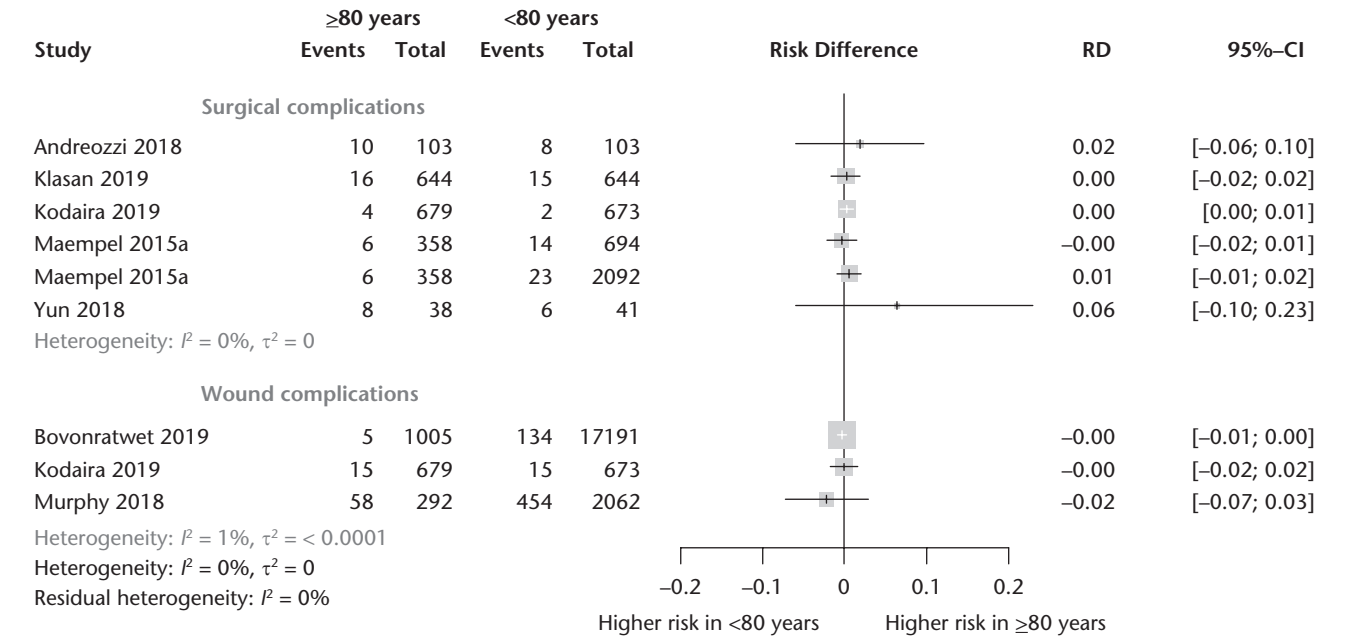


Fig. 2 Forest plot of the risk difference (RD) of surgical complications in patients aged > 80 years and < 80 years (a RD of 0.02 corresponds to a 2% higher risk for patients aged > 80).

Mortality

Six studies reported on mortality following primary TKA with rates varying across follow-ups (Table 3).^{40,41,43,46,47,49} Mortality within 90 days in older patients ranged between 0–2%, while in younger patients it ranged between 0–0.03%.^{15,43,46} Mortality within two years in older patients ranged between 3.2–12.9%, while in younger patients it ranged between 0–1.5%.^{40,41} Mortality within 10 years in older patients ranged between 28–32%, while in younger patients it ranged between 7–12%.^{47,49}

Length of stay in hospital

Eight studies reported LoS following primary TKA, all of which found a greater LoS for older patients (Table 4).^{7,15, 41–43,45,47,48} The mean LoS for older patients ranged from 2–20.9 days, while for younger patients it ranged from 1.5–14.4 days.

Patient-reported outcomes

Twelve studies assessed one or more PROs following primary TKA (Table 5). Six studies reported on Oxford Knee Score (OKS), four of which found ‘no difference’ between age groups,^{15,41,42,44} while two found worse scores for older patients,^{49,50} none of which exceeded the minimal clinically important difference (MCID) of 5.0 points.⁵¹ Five studies reported on Knee Society Score (KSS), four of which reported ‘no difference’ between age groups,^{15,43,44,50} while one reported better scores for older patients,⁴⁰ which did not exceed the MCID of

7.2 points.⁵² Four studies reported on the function sub-component of the KSS, two of which found ‘no difference’ between age groups,^{15,44} while two found worse scores for older patients.^{40,50} Two studies reported on Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) scores, one of which found ‘no difference’ between age groups,⁴² while the other found better scores for older patients,⁴³ which did not exceed the MCID of 10.8 points.⁵³

Quality assessment

The overall level of quality was defined as good in two studies (15%), fair in 10 (77%), and poor in one (8%) (Table 6). Reporting quality was excellent (≥ 9) in seven studies (54%), and good (7–8) in six (46%). External validity was poor in seven studies (54%) suggesting that their findings may not broadly apply to the general population of patients undergoing TKA, and internal validity was good in all studies (100%), indicating these studies were methodologically appropriate. Power analyses were only performed in five studies (38%).

Discussion

The most important findings of this systematic review are that older patients (≥ 80 years) receiving TKA have higher rates of surgical and medical complications, as well as higher mortality, compared to younger patients (< 80 years). These findings therefore refute the hypothesis

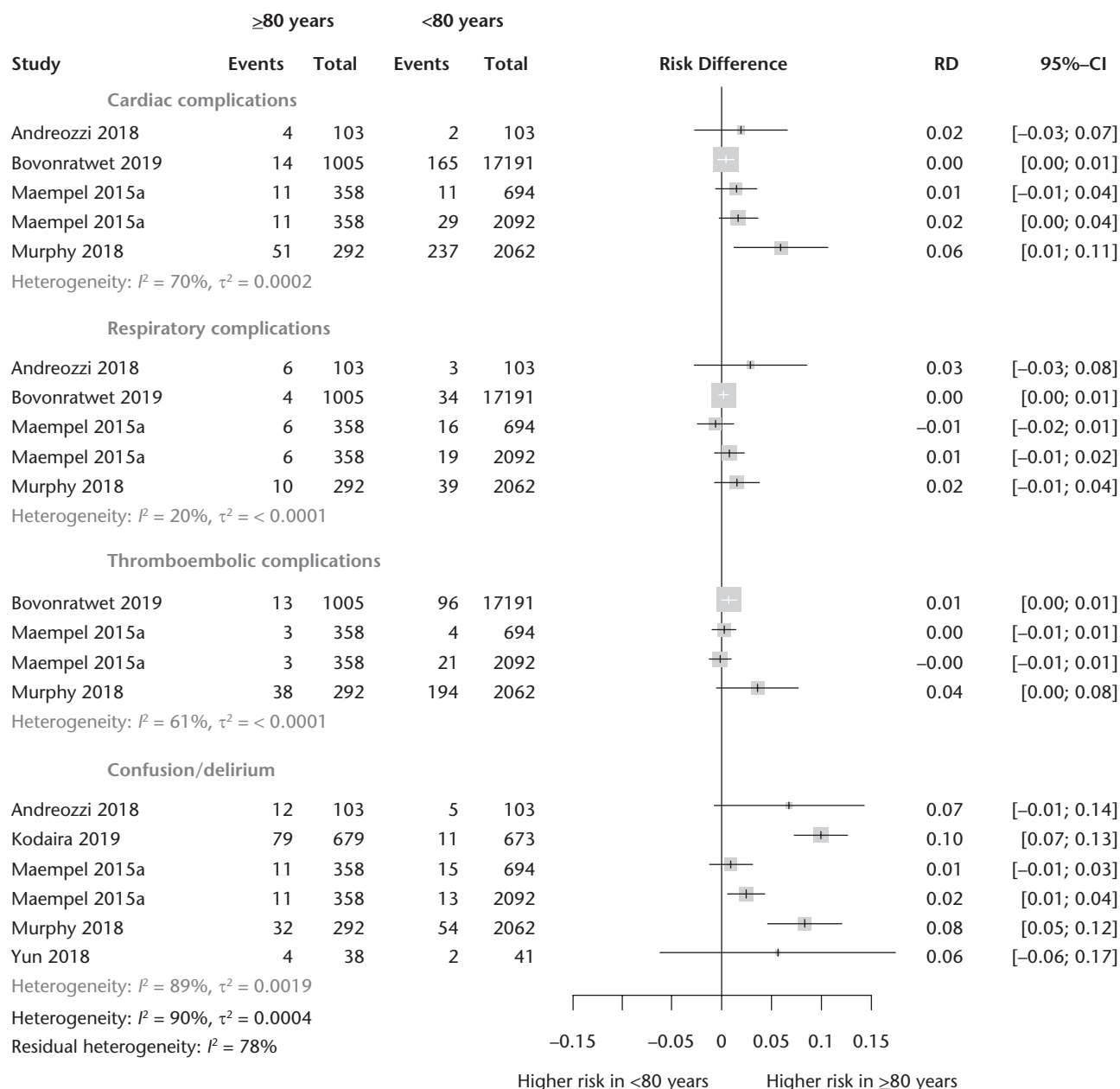


Fig. 3 Forest plot of the risk difference (RD) of medical complications in patients aged > 80 years and < 80 years (a RD of 0.02 corresponds to a 2% higher risk for patients aged > 80).

that older patients receiving TKA have similar outcomes to younger patients. The literature also reports greater LoS for older patients, but inconsistent findings regarding PROs. The majority of studies reported no difference in PROs between the two age groups, while some studies reported worse PROs in older patients, and fewer studies reported better PROs for older patients. It is worth noting that contrasting trends were reported for different PROs within three studies.^{43,44,50}

In the present study, it was difficult to compare the rate of complications between older and younger patients due to differing definitions and groupings. This prohibited quantitative analysis of differences between these two groups, which is a barrier also experienced by Kuperman et al.¹⁷ Additionally, drawing conclusions based on small differences in absolute numbers was deemed to have limited value. Furthermore, selection bias may exist, as patients with fewer comorbidities are more likely to be

Table 3. Mortality in patients aged > 80 and < 80 years following primary TKA

Author and date	Groups	Time	Mortality	p-value
Andreozzi et al 2020 ¹⁵	>80 years	Within 90 days	2.00%	0.108
	<80 years		0.00%	
Bovonratwet et al 2019 ⁴⁶	>80 years	Within 90 days	0.20%	<0.001
	<80 years		0.03%	
Klasan et al 2019 ⁴⁹	>80 years	Within 10 years	32.00%	
	<80 years		12.00%	
Maempel et al 2015 ⁴⁰	>80 years	Within 1 year	3.20%	
	75–80 years		2.00%	
	<75 years		1.50%	
Murphy et al 2018 ⁴⁷	>80 years	Within 10 years	28.00%	
	<80 years		7.00%	
Skinner et al 2016 ⁴¹	>80 years	Within 2 years	12.90%	
	<80 years		0.00%	
Yun et al 2018 ⁴³	>80 years	Within 90 days	0.00%	
	<80 years		0.00%	

Note. TKA, total knee arthroplasty.

Table 4. Length of stay (LoS) in patients aged > 80 and < 80 years following primary TKA

Author	Groups	LoS (days)	p-value
Andreozzi et al 2020 ¹⁵	>80 years	5.8	<0.001
	<80 years	4.1	
Austin et al 2018 ⁴⁵	>80 years	3.3	
	<80 years	2.9	
Kodaira et al 2019 ⁴⁸	>80 years	18.8	
	<80 years	16.8	
Murphy et al 2018 ⁴⁷	>80 years	[5]	0.001
	<80 years	[4]	
Sezgin et al 2019 ⁷	>80 years	6.2	0.318
	<80 years	4.1	
Skinner et al 2016 ⁴¹	>80 years	8.4	
	<80 years	5.6	
Townsend et al 2018 ⁴²	>79 years	2.0	<0.001
	70–79 years	1.7	
	60–69 years	1.5	
	50–59 years	1.9	
	<50 years	1.6	
Yun et al 2018 ⁴³	>80 years	20.9	
	<80 years	14.4	

Note. TKA, total knee arthroplasty.

offered elective TKA.⁵⁴ Variations in peri- and postoperative management are rarely reported in the literature and may have an effect on complication rates; for example, physical therapy that commences soon after surgery, as well as prophylaxis strategies, can both decrease rates of deep vein thrombosis and pulmonary embolisms.⁵⁵

The findings from the present systematic review revealed that the older population is at a much greater risk of suffering postoperative cognitive dysfunction, such as confusion or delirium, in comparison to the younger population. Some studies have found that general anaesthesia may increase the risk of early postoperative cognitive dysfunction, and recommended the use of regional anaesthesia where possible, particularly in more frail or vulnerable patients.^{56,57} The present study also revealed

similar rates of wound complications in both older and younger populations, which are more likely influenced by surgeon experience and technique. In contrast, older patients experienced higher rates of surgical and medical complications, which depend more on the physical condition of the patients. This finding was also reflected in a recent systematic review of total joint replacements by Murphy et al.¹⁶ Older patients should therefore not be excluded from consideration for primary TKA based on age alone, but with consideration of preoperative physical condition.

Mortality outcomes are important when assessing the safety of joint replacement surgery for the elderly.⁴⁷ Overall, in the present study, mortality was consistently higher in the older population; however, the actual number of deaths within the first 90 days following TKA was relatively low, suggesting it is safe to offer TKA to the older population. Two studies^{47,49} reported higher mortality within 10 years following TKA for older patients when compared to younger patients, which is in line with the life expectancy for patients over 85 years of age.⁵⁸ Furthermore, Skinner et al⁴¹ reported high mortality in their nonagenarian population that received TKA, which was equal to that expected for the general population aged 90 years or older.

In the present systematic review, eight studies reported greater LoS for older patients compared to younger patients; however, only three studies found a statistically significant difference (range, $p < 0.001$ to $p = 0.001$), making it difficult to draw a definitive conclusion. Kupermen et al¹⁷ pointed out that whilst greater LoS increases the direct cost of TKA, this additional expense should be weighed against the costs of ongoing support for patients with functional deficits if they do not undergo surgery. Compared to studies performed in North America, Europe, and Australia, studies from Asia have reported considerably greater LoS (ranging from 16.8 to 20.9 days) in both age groups, possibly because patients receive in-hospital postoperative physical therapy, and are only discharged when able to walk steadily.⁴⁸ A study by Pitter et al reported that fast-track TKA and THA is feasible in most patients aged ≥ 85 ; however, to prevent readmissions, clinicians should monitor postoperative anaemia and medical complications.⁵⁹

In the present systematic review, most of the studies reported similar PROs following TKA in both older and younger patients. Although two studies reported significantly worse OKS for older patients ($p < 0.001$),^{49,50} both studies found that the mean OKS for older patients was above the patient acceptable symptom state (PASS) of 37 points.⁶⁰ Furthermore, three studies reported KSS function and found worse scores in older patients,^{15,40,50} likely because of comorbidities associated with advancing age,

Table 5. Clinical outcomes comparing patients aged > 80 and < 80 years following primary TKA

Author	Patient-reported outcome	>80		Comparator		p-value	Patient-reported outcome comparison
		Mean	±SD	Mean (range*)	±SD		
Andreozzi et al 2020 ¹⁵	OKS	40	2.6	41	2.7	0.122	No difference
	KSS	81.5	9.6	83.3	6.8		No difference
	KSFS	77.6	7.6	83.2	8.8		No difference
Austin et al 2018 ⁴⁵	PCS	Not reported		Not reported			No difference
Cher et al 2018 ⁴⁴	OKS	22.85		19.98		<0.05	No difference
	KSS	84.4		86.2			No difference
	KSFS	55.77		73.44			No difference
Goh et al 2020 ⁵⁰	SF-36	49.59		46.41		<0.001	Better for >80
	OKS	39.2	6.7	41.5	5.2		Worse for >80
	KSS	83.1	12.3	82.2	11.9		No difference
	KSFS	57.7	19.6	69.8	19	0.001	Worse for >80
	SF-36 PCS	45.2	11.1	48.1	10		Worse for >80
	SF-36 MCS	55	10.2	55.5	10.2		No difference
Klasan et al 2019 ⁴⁹	OKS	38.9		41		<0.001	Worse for >80
Kodaira et al 2019 ⁴⁸	JOA	82.8	0.4	87.4	0.3		No difference
Maempel et al 2015 ⁴⁰	AKSK	93 ^a		(92–93) ^a		0.001	Better for >80
	AKSF	65		80–80		<0.001	Worse for >80
Murphy et al 2018 ⁴⁷	SF-12 PCS						No difference
Sezgin et al 2019 ⁷	KOOS					0.005 (symptoms)	Better for >80 (KOOS symptoms)
Skinner et al 2016 ⁴¹	EQ-VAS	76		78		0.700	No difference
	OKS					n.s.	No difference
Townsend et al 2018 ⁴²	WOMAC	63.5		(53.0–64.4)			No difference
	OKS	26.5		(23.0–27.8)			No difference
Yun et al 2018 ⁴³	WOMAC	28.7		21.7		0.009	Worse for >80
	KSS	68.34		64.83		0.130	No difference
	SF-36	51.3		59.5		0.022	Worse for >80

Note. TKA, total knee arthroplasty; OKS, Oxford Knee Score; KSS, Knee Society Score; KSFS, Knee Society Score (Function); KOOS, Knee injury and Osteoarthritis Outcome Score; JOA, Japanese Orthopaedic Association;

AKSK, American Knee Society Score (Knee); AKSF, American Knee Society Score (Function); PCS, Physical Component Score; MCS, Mental Component Score; EQ-VAS, EuroQol Visual Analogue Scale; SF-36, Short Form 36; WOMAC, Western Ontario and McMaster Universities Osteoarthritis Index.

*The range is reported in case of multiple comparator groups.

^aMedian values.

Table 6. Assessment of methodological quality of clinical studies using an modified version of the checklist by Downs and Black

Author and year	Evaluated domain					Total (/28)	Total (%)
	Internal validity						
	Reporting (/11)	External validity (/3)	Study bias (/7)	Selection bias (/6)	Power (/1)		
Andreozzi et al 2020 ¹⁵	10	0	6	2	1	19	68%
Austin et al 2018 ⁴⁵	11	2	5	3	0	21	75%
Bovonratwet et al 2019 ⁴⁶	8	2	5	2	0	17	61%
Cher et al 2018 ⁴⁴	10	1	5	2	1	19	68%
Goh et al 2020 ⁵⁰	9	1	5	3	1	19	68%
Klasan et al 2019 ⁴⁹	8	1	4	2	1	16	57%
Kodaira et al 2019 ⁴⁸	7	1	4	2	0	14	50%
Maempel et al 2015 ⁴⁰	7	2	5	3	0	17	61%
Murphy et al 2018 ⁴⁷	9	2	5	4	1	21	75%
Sezgin et al 2019 ⁷	7	2	5	1	0	15	54%
Skinner et al 2016 ⁴¹	10	1	4	2	0	17	61%
Townsend et al 2018 ⁴²	8	2	4	3	0	17	61%
Yun et al 2018 ⁴³	10	1	4	3	0	18	64%

which can cause functional decline.⁶¹ In fact, the older population have ‘similar to worse’ baseline functional scores compared to the younger population,⁶² as older patients may delay or be denied surgery in the earlier stages of OA, on account of perceived surgical risks.¹⁷ It is worth noting that in the last systematic review on the topic, Kuperman et al¹⁷ found improvements in function to be similar for both older and younger patients.

The results of the present systematic review should be interpreted with the following limitations in mind. First, there is considerable heterogeneity in the characteristics of the included cohorts, which made quantitative comparisons between cohorts difficult. Second, although the overall level of quality was good to fair for the majority of studies, only two were prospective comparative studies (both Level II). Third, it is possible that selection bias may exist, as patients with fewer comorbidities are more likely to be offered elective TKA, and the results are not necessarily pertinent to the general older population. Fourth, while the PROs employed by the included studies evaluated pain as a component of their overall score (e.g. KSS, WOMAC, OKS), none comprehensively assessed pain in explicit detail. As pain is one of the primary indications for arthroplasty,⁶³ future studies should aim to quantify improvement in pain using standardized measures. Finally, only five out of the 13 studies performed a priori power analysis to determine the required sample size.

Conclusion

In comparison with younger patients (< 80 years), older patients (≥ 80 years) receiving TKA have higher rates of surgical and medical complications, as well as higher mortality. The literature also reports greater LoS for older patients, but inconsistent findings regarding PROs. The present findings provide both surgeons and older patients with clearer updated evidence, to help them make informed decisions regarding surgical intervention in end-stage OA of the knee, considering the risks and benefits within this age group. Older patients should therefore not be excluded from consideration for primary TKA based on age alone, but with consideration of preoperative physical condition.

AUTHOR INFORMATION

¹Ramsay Santé, Hôpital Privé de l'Estuaire, LeHavre, France.

²ReSurg SA, Nyon, Switzerland.

³Hôpital Charles Nicolle, CHU de Rouen, Rouen, France.

Correspondence should be sent to: Floris van Rooij, ReSurg SA, Rue Saint Jean 22, 1260 Nyon, Switzerland.

Email: Floris@resurg.com

ICMJE CONFLICT OF INTEREST STATEMENT

OC reports personal fees from Zimmer, personal fees from Arthrex, personal fees from Tornier-Corin, outside the submitted work. All other authors declare no conflict of interest relevant to this work.

FUNDING STATEMENT

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

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SUPPLEMENTAL MATERIAL

Supplemental material is available for this paper at <https://online.boneandjoint.org.uk/doi/suppl/10.1302/2058-5241.6.200150>

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