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Systemic Review

Cost-Effectiveness of Bone Cement With and Without Antibiotics: A Broader Perspective

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Background

Periprosthetic joint infections (PJIs) and periprosthetic femur fractures (PFFs) increase total costs of care. Retrospective registry/institutional studies with selection bias and underpowered meta-analyses have corrupted the evidence base regarding antibiotic-laden bone cement (ALBC) use in total knee arthroplasties (TKAs). Clinical practice guidelines (CPGs) recommend using cement fixation of femoral components in hip fracture patients to prevent PFFs, but have no recommendations regarding ALBC. Hip osteoarthritis CPGs have no bone cement recommendations regarding prevention of PJIs or PFFs. ALBC is potentially cost-effective by reducing PJIs, PFFs, and reducing implant costs.

Methods

A systematic review was conducted to identify randomized controlled trials (RCTs), meta-analyses, and registry reports related to the efficacy of ALBC in reducing PJIs and cemented femoral fixation in reducing PFFs. Numbers needed to treat (NNT) are calculated. Cost-effectiveness margins per case are calculated.

Results

A pooled analysis of four TKA RCTs found ALBC reduces PJI by 0.94% (p=0.027), NNT 106. A total hip arthroplasty (THA) meta-analysis found ALBC reduces PJI by 0.58% (p<0.0001), NNT 172. A hip hemiarthroplasty (HH) RCT found high-dose dual-antibiotic ALBC reduces PJI by 2.35% (p=0.0474), NNT 43. A THA registry report found that cemented fixation compared to ingrowth fixation reduced PFFs by 0.44% (p<0.0001), NNT 229. A pooled analysis of three HH RCTs found that cemented femoral stem fixation reduced PFFs by 5.09% (p-0.0099), NNT 20. Mean PJI treatment costs are $80,000. Mean PFF treatment costs are $27,596. Mean HH cemented femoral stem cost reduction: $685. Using ALBC: TKA margin/case is $755; THA margin/case is $586; and HH margin/case is $3,925. Using plain bone cement: TKA margin/case is $0; THA margin/case is $121; and HH margin/case is $2,065.

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Conclusions

A broader perspective demonstrates that ALBC provides significant financial margins in TKAs, THAs, and hip hemiarthroplasties. ALBC is cost-effective when including the additional costs of using ALBC in TKAs, THAs, and hip hemiarthroplasties. Hand-mixed ALBC is more cost-effective than pre-mixed ALBC in all scenarios.

INTRODUCTION

The American Academy of Orthopaedic Surgeons (AAOS) released the *Surgical Management of Osteoarthritis of the Knee* Evidence-Based Clinical Practice Guideline (CPG) in 2015 (McGrory et al. 2016). Regarding antibiotic-laden bone cement (ALBC), the CPG recommended: "Limited evidence does not support the routine use of antibiotics in the cement for primary total knee arthroplasty (TKA)." The CPG was recently updated (American Academy of Orthopaedic Surgeons 2022) and the ALBC recommendation was withdrawn. The ALBC recommendation was withdrawn because there is insufficient high-quality evidence to make a recommendation for or against the use of ALBC in TKAs. The prior recommendation was in essence a type II statistical error (finding no difference when a difference may exist).

The literature has been flooded with articles claiming that ALBC is ineffective in TKA. The majority of articles are non-randomized and have selection bias. The selection bias occurs because some orthopaedic surgeons use ALBC on high-risk patients only and use plain bone cement (PBC) on patients without periprosthetic joint infection (PJI) risk factors. Five categories of articles have corrupted the evidence base: (1) registry studies with selection bias (Bohm et al. 2014; Chan et al. 2019; Gutowski et al. 2014; Jameson et al. 2019; Jämsen et al. 2009; Namba et al. 2009, 2020; Sanz-Ruiz et al. 2017; Tayton et al. 2016), (2) institutional studies that are underpowered with selection bias (Anis et al. 2019; Bendich et al. 2020; Eveillard et al. 2003; T. Hoskins et al. 2020; Srivastav et al. 2009; Turhan 2019; Wu et al. 2016; H. Wang et al. 2015; Yayac et al. 2019), (3) randomized controlled trials (RCTs) that are underpowered (Chiu et al. 2001, 2002; Chiu and Lin 2009; Hinarejos et al. 2013), (4) meta-analyses of RCTs that are underpowered (J. Wang et al. 2013; Zhou et al. 2015; Kleppel et al. 2017), and (5) meta-analyses including registry data with selection bias (Sultan et al. 2019; Farhan-Alanie, Burnand, and Whitehouse 2021; Li et al. 2022).

Critical review of the evidence suggests that ALBC does lower PJI rates for TKA. A power analysis of the three meta-analyses of RCTs cited above (J. Wang et al. 2013; Zhou et al. 2015; Kleppel et al. 2017) shows that the number of patients per subgroup required for 80% statistical power is decreasing, and the absolute difference in PJI rates is increasing with each subsequent meta-analysis (Table 1). This would suggest that as more RCTs comparing ALBC and PBC are completed, the clinically-significant differences will become statistically significant.

Reducing TKA PJIs is not the only potential benefit of using PBC or ALBC in hip and knee arthroplasty. ALBC can reduce PJIs in total hip arthroplasty (THA) and hip hemiarthroplasty (HH). Osteoporosis is common in THA patients (Bernatz et al. 2019). The AAOS *Management of Osteoarthritis of the Hip* clinical practice guideline has no recommendation regarding the use of bone cement for THA (Rees 2020). Hip fracture patients have osteoporosis by definition. The AAOS *Management of Hip Fractures in Older Adults* CPG strongly recommends using cemented femoral stems in patients with femoral neck fractures. However, the CPG does not address the use of ALBC (O'Connor and Switzer 2022). Cement fixation (ALBC or PBC) for femoral stems in THA and HH has been shown to reduce the risk of periprosthetic femur fractures (PFFs) (Abdel et al. 2016; Langslet et al. 2014; Barenius et al. 2018; Santini et al. 2005). For patients with femoral neck fractures, cemented fixation of femoral stems allows the use of low-demand fracture stems, thereby reducing implant costs.

The primary aim of the cost-effectiveness analysis is to calculate the potential cost savings (margins) per case for TKA, THA, and HH procedures. The secondary aim of the cost-effectiveness analysis is to provide a methodology to calculate ALBC case margins for TKA, THA, and HH procedures at individual hospitals. Hospital-specific PJI rates, PFF rates, and costs can be substituted into the analyses to calculate hospital-specific case margins.

METHODS

Systematic reviews for five clinical scenarios were conducted: PJI rates in TKA, THA, and HH using ALBC and PBC; and PFF rates in THA and HH using bone cement. The purpose of each systematic review was to determine the best available evidence for estimating PJI rates or PFF rates for each scenario. The best evidence is an adequately-powered RCT or adequately-powered meta-analysis of RCTs. If an adequately-powered RCT/meta-analysis is not available, a pooled analysis of RCTs is the next best evidence. If adequately-powered RCT, meta-analysis, or pooled analysis is not available, a large observational registry cohort with no exclusions provides the next best available evidence.

Systematic reviews were performed using PubMed and Embase for each scenario using keywords from each scenario. Articles were included from inception to February 1, 2022. Full text articles published in English were included. The PRISMA flowchart of each systematic review is provided in Table 2.

Economic analyses were conducted using the number needed to treat (NNT) and the mean costs of TKA/THA revisions for periprosthetic joint infection or periprosthetic femur fracture. NNT is calculated as the inverse of the absolute difference in rates (r):

$$\mathrm{NNT} = 1/(\mathrm{r}_{\mathrm{PJI,PBC}} - \mathrm{r}_{\mathrm{PJI,ALBC}})$$

The number needed to treat is the number of patients that would need to be treated with ALBC to prevent one periprosthetic joint infection or one periprosthetic femur

Table 1. Meta-analyses comparing ALBC and PBC periprosthetic joint infection (PJI) rates (Brown and Chen 2022)

Author (Year)	Included trials	ALBC PJI Rates	PBC PJI Rates	Patients Needed per Subgroup	Absolute Difference in PJI Rates
Wang (2013)	2	20/1661 (1.20%)	25/1627 (1.54%)	18,327	0.33%
Zhou (2015)	5	46/3461 (1.33%)	60/3176 (1.89%)	7,620	0.56%
Kleppel (2017)	9	23/1979 (1.16%)	35/1924 (1.82%)	5,282	0.66%

ALBC – antibiotic-laden bone cement, PBC – plain bone cement, PJI – periprosthetic joint infection.

fracture. The margin per case is the revision cost divided by the NNT (margin/case = $COST_{revision}$/NNT).

The NNT for the reduced implant costs in hip hemiarthroplasty is unity (NNT = 1) because the costs are reduced for each case.

Statistical power calculations were performed per Rosner (Rosner 1990). Fisher's exact tests (2x2) and chi-squared tests (2x2) were used to determine statistical significance ($p<0.05$) (GraphPad - https://www.graphpad.com).

This study is exempt from institutional review board review.

RESULTS

PERIPROSTHETIC JOINT INFECTION IN TOTAL KNEE ARTHROPLASTY USING ALBC OR PBC

Three underpowered meta-analyses comparing PJI rates using ALBC and PBC in TKA were identified but excluded because of the lack of statistical power. Four RCTs comparing PJI rates using ALBC and PBC in TKA were identified (Chiu et al. 2001, 2002; Chiu and Lin 2009; Hinarejos et al. 2013). The RCTs were heterogeneous, including primary TKAs (Chiu et al. 2002), primary TKAs in patients with diabetes (Chiu et al. 2001), revision TKAs (Chiu and Lin 2009), and erythromycin/colistin ALBC in primary TKAs (Hinarejos et al. 2013). Because of the heterogeneity, a pooled analysis was performed (Table 3). The periprosthetic joint infection rates are 1.11% and 2.05% for ALBC and PBC, respectively (p=0.0304). The absolute difference in PJI rates is 0.94%. The NNT is 106.

PERIPROSTHETIC JOINT INFECTION IN TOTAL HIP ARTHROPLASTY USING ALBC OR PBC

Three adequately powered meta-analyses comparing PJI rates using ALBC and PBC in THA were identified (Farhan-Alanie, Burnand, and Whitehouse 2021; Parvizi et al. 2008; Kunutsor et al. 2019). Farhan-Alanie *et al.* was excluded because revision rates were reported, not PJI rates (Farhan-Alanie, Burnand, and Whitehouse 2021). Kunutsor *et al.* was excluded because non-randomized observational cohorts were included in the meta-analysis (Kunutsor et al. 2019). Parvisi *et al.* (Parvizi et al. 2008) reported PJI rates of 0.47% and 1.05% for ALBC and PBC, respectively (p=0.001). The absolute difference in PJI rates is 0.58%. The NNT is 172.

PERIPROSTHETIC JOINT INFECTION IN HIP HEMIARTHROPLASTY USING ALBC OR PBC

One RCT comparing PJI rates using low-dose, single-antibiotic bone cement and high-dose, dual-antibiotic bone cement in hip hemiarthroplasty was identified (Sprowson† et al. 2016). The RCT reported PJI rates of 1.11% and 3.46% for high-dose, dual-antibiotic and low-dose, single-antibiotic ALBC, respectively (p=0.0474). The absolute difference in PJI rates is 2.35%. The NNT is 43.

PERIPROSTHETIC FEMUR FRACTURES IN THA USING CEMENTED AND INGROWTH FEMORAL FIXATION

No meta-analyses or RCTs comparing periprosthetic femur fracture (PFF) rates using cemented or ingrowth femoral fixation in THA were identified. One large, prospective registry cohort was identified (32,644 THAs) (Abdel et al. 2016). The PFF rates from surgery to one year after surgery were 0.601% and 0.165% for ingrowth and cemented

Table 2. PRISMA flow diagrams for systematic reviews.

PRISMA Categories	ALBC & PBC PJI Rates in TKA	ALBC & PBC PJI Rates in THA	ALBC & PBC PJI Rates in HH	Cemented & Ingrowth PFF Rates in THA	Cemented & Ingrowth PFF Rates in HH
Identification					
Number of records identified through database searching	32	258	0	139	36
Number of additional records identified through other sources	179	131	1	55	10
Number of duplicates removed	30	85	0	48	8
Screening					
Number of records screened	149	326	0	91	28
Number of records excluded	138	292	0	78	19
Eligibility					
Number of full-text articles assessed for eligibility	11	34	1	13	9
Number of full-text articles excluded	7	33	0	12	6
Included					
Number of studies included in qualitative synthesis	4	3	1	1	3
Number of studies included in quantitative synthesis	4	1	1	1	3
• Randomized Controlled Trials	4	0	1	0	3
• Meta-Analyses	0	1	0	0	0
• Observational/Registry Cohorts	0	0	0	1	0

ALBC – antibiotic-laden bone cement, PBC – plain bone cement, PJI – periprosthetic joint infection, TKA – total knee arthroplasty, THA – total hip arthroplasty, PFF – periprosthetic femur fracture, HH – hip hemiarthroplasty.

femoral fixation, respectively (p<0.0001). The absolute difference in PFF rates is 0.436%. The NNT is 229.

Table 3. Pooled analysis of RCTs comparing ALBC and PBC periprosthetic joint infection (PJI) rates in TKAs.

Author (Year)	ALBC PJI Events	ALBC Total Patients	ALBC PJI Rate	PBC PJI Events	PBC Total Patients	PBC PJI Rate	Absolute Difference in PJI Rates
Chiu (2001)	0	41	0.00%	5	37	13.51%	13.51%
Chiu (2002)	0	178	0.00%	5	162	3.09%	3.09%
Chiu (2009)	0	93	0.00%	6	90	6.67%	6.67%
Hinarejos (2013)	20	1483	1.35%	20	1465	1.37%	0.02%
Total	20	1795	1.11%	36	1754	2.05%	0.94%
p=0.0304							

RCTs – randomized controlled trials, ALBC – antibiotic-laden bone cement, PBC – plain bone cement,
PJI – periprosthetic joint infection.

Table 4. Pooled analysis of RCTs comparing hip hemiarthroplasty periprosthetic femur fracture (PFF) rates.

Author (Year)	Cement Fixation PFF Events	Cement Fixation Total Patients	Cement Fixation PFF Rate	Ingrowth Fixation PFF Events	Ingrowth Fixation Total Patients	Ingrowth Fixation PFF Rate	Absolute Difference in PFF Rates
Santini (2005)	0	53	0.00%	2	53	3.77%	3.77%
Langslet (2014)	1	112	0.89%	8	108	7.41%	6.51%
Barenius (2018)	2	67	2.99%	5	74	6.76%	3.77%
Total	3	232	1.29%	15	235	6.38%	5.09%
p=0.0065							

PFF – periprosthetic femur fracture.

PERIPROSTHETIC FEMUR FRACTURES IN HIP HEMIARTHROPLASTY USING CEMENTED AND INGROWTH FEMORAL FIXATION

No meta-analyses comparing PFF rates using cemented or ingrowth femoral fixation in hip hemiarthroplasty were identified. Three RCTs comparing PFF rates using cemented or ingrowth femoral fixation in hip hemiarthroplasty were identified (Langslet et al. 2014; Barenius et al. 2018; Santini et al. 2005). A pooled analysis was performed (Table 4). The PFF rates were 1.29% and 6.38% for cemented and ingrowth femoral fixation, respectively (p=0.0065). The absolute difference in PFF rates is 5.09%. The NNT is 20.

CEMENTED FRACTURE FEMORAL STEM AND INGROWTH FEMORAL STEM COST DIFFERENTIAL

Two vendors at the senior author's institution were queried for average contract pricing for their most common cemented fracture femoral stem and their most common ingrowth (porous) femoral stem. Smith and Nephew reported that the average contract price differential between the Synergy porous femoral stem and the Conquest cemented fracture femoral stem was $770. Stryker reported that the average contract price differential between the Accolade 2 porous femoral stem and the Exeter cemented fracture femoral stem was $600. The mean price differential was $685. The NNT is 1 for the use of a cemented fracture femoral stem because costs are reduced for each case.

REVISION THA AND TKA COSTS FOR PJI AND PFF

Cost estimates of revision total joint arthroplasty for periprosthetic joint infection and periprosthetic femur fracture were obtained from the literature. All costs were included in the estimates, not only hospital costs. Preference was given to more recent estimates. The cost of a PJI-related revision joint arthroplasty is estimated to be $80,000 (Leta et al. 2021). The cost of a PFF-related revision joint arthroplasty is estimated to be $27,596 (Hevesi et al. 2019).

MARGINS PER CASE

The margins per case were calculated by dividing the cost of the revision surgery by the NNT and summing the potential

Table 5. Margin per case when using ALBC for hip and knee arthroplasty procedures.

	Treatment Costs	TKA NNT	TKA Margin per Case	THA NNT	THA Margin per Case	HH NNT	HH Margin per Case
Periprosthetic Joint Infection	$ 80,000	106	$755	172	$465	43	$1,860
Periprosthetic Femur Fracture	$ 27,596			229	$121	20	$1,380
Reduced Implant Costs	$ 685					1	$685
Total Margin per Case			$755		$586		$3,925

ALBC – antibiotic-laden bone cement, TKA – total knee arthroplasty, NNT – number needed to treat, THA – total hip arthroplasty, HH – hip hemiarthroplasty.

Table 6. Margin per case when using PBC for hip and knee arthroplasty procedures.

	Treatment Costs	TKA NNT	TKA Margin per Case	THA NNT	THA Margin per Case	HH NNT	HH Margin per Case
Periprosthetic Joint Infection	$ 80,000		$0		$0		$0
Periprosthetic Femur Fracture	$ 27,596			229	$121	20	$1,380
Reduced Implant Costs	$ 685					1	$685
Total Margin per Case			$0		$121		$2,065

PBC – plain bone cement, TKA – total knee arthroplasty, NNT – number needed to treat, THA – total hip arthroplasty, HH – hip hemiarthroplasty.

savings for PJI reduction, PFF reduction, and lower implant costs. Using ALBC: TKA margin per case is $755; THA margin per case is $586; and hip hemiarthroplasty margin per case is $3,925 (Table 5). Using PBC: TKA margin per case is $0; THA margin per case is $121; and hip hemiarthroplasty margin per case is $2,065 (Table 6).

ADDITIONAL COSTS FOR USING PRE-MIXED OR HAND-MIXED ALBC

Representative costs for bone cement and high-viscosity (HV) bone cement are $50 per batch. A representative cost for bone cement with 1 g of tobramycin is $250 per batch. A representative cost of HV bone cement with 0.8 g of gentamicin is $150 per batch. Representative costs of tobramycin 1.2 g and gentamicin 0.8 g are $30 and $5, respectively. Since most TKAs are cemented, the differential cost of using two batches of pre-mixed HV ALBC with gentamicin is $200 ($150-$50)x2. The differential cost of using two batches of hand-mixed HV ALBC with gentamicin is $10 ($5)x2. Since most THAs and hip hemiarthroplasties are not cemented, the differential cost of using two batches of pre-mixed ALBC with tobramycin is $500 ($250)x2. The differential cost of using two batches of hand-mixed ALBC is $160 ($50+$30)x2. The net cost savings per case for pre-mixed ALBC and hand-mixed ALBC are reported in Table 7 and Table 8, respectively.

DISCUSSION

The withdrawal of the recommendation to not use ALBC in primary TKAs in the recently released *Surgical Management of Osteoarthritis of the Knee* CPG (American Academy of Orthopaedic Surgeons 2022) acknowledges the lack of evidence regarding ALBC in primary TKAs. This lack of evidence of ALBC effectiveness is confused with evidence of lack of effectiveness. The level IV non-randomized studies need to be removed from the discussion. The underpowered meta-analyses need to be removed from the discussion (J. Wang et al. 2013; Zhou et al. 2015; Kleppel et al. 2017). The pooled analysis in this study found a statistically significant difference when using ALBC in TKAs, but the pooled analysis constitutes level II evidence due to the heterogeneity of the studies.

Clinical significance and statistical significance must not be confused. The three meta-analyses (J. Wang et al. 2013; Zhou et al. 2015; Kleppel et al. 2017) listed in Table 1 all found clinically-significant differences in PJI rates when using ALBC (0.33%-0.66%). Clinically-significant differences in PJI rates provide positive margins per case for TKA, THA, and hip hemiarthroplasty. The ALBA trial is a registry-based RCT being conducted in Norway comparing ALBC and PBC with a minimum of 9,172 patients undergoing primary TKA (Leta et al. 2021). This trial should provide robust evidence on the effectiveness of ALBC in primary TKAs.

The use of ALBC in primary THA has not been controversial in the United States, probably because the use of ce-

Table 7. Net cost savings per case using pre-mixed antibiotic-laden bone cement (ALBC).

	Total Knee Arthroplasty	Total Hip Arthroplasty	Hip Hemiarthroplasty
Margin per case	$ 755	$ 586	$ 3,925
Additional costs of ALBC	$ 200	$ 500	$ 500
Net cost savings per case	$ 555	$ 86	$ 3,425

Table 8. Net cost savings per case using hand-mixed antibiotic-laden bone cement (ALBC).

	Total Knee Arthroplasty	Total Hip Arthroplasty	Hip Hemiarthroplasty
Margin per case	$ 755	$ 586	$ 3,925
Additional costs of ALBC	$ 10	$ 160	$ 160
Net cost savings per case	$ 745	$ 426	$ 3,765

mented femoral fixation in primary THA has been so low. All three meta-analyses comparing ALBC and PBC in THA found ALBC was protective in reducing PJIs (Farhan-Alanie, Burnand, and Whitehouse 2021; Parvizi et al. 2008; Kunutsor et al. 2019). Additionally, a cost-effectiveness modeling study evaluating strategies to reduce the risk of PJI in primary THAs found that the most effective approach was systemic antibiotics, ALBC, and conventional ventilation (Graves et al. 2016).

Most ALBC cost-effectiveness analyses focus on primary TKAs and fail to consider the broader perspective that includes THA or hip hemiarthroplasty. They also fail to include the cost benefit of cemented femoral components reducing periprosthetic femur fractures and the lower cost of cemented fracture femoral stems. Given that primary TKAs, primary THAs, and hip hemiarthroplasties were all included in the Comprehensive Care for Joint Replacement (CJR) bundled payment program, ALBC cost-effectiveness should include all three procedures and all three cost benefits. The results of this study show that ALBC is most effective for hip hemiarthroplasty with a margin per case of $3,925. This cost benefit is consistent with the AAOS *Management of Hip Fractures in Older Adults* clinical practice guideline which gives a "Strong" recommendation to use cemented femoral stems in "patients undergoing arthroplasty for femoral neck fractures" (O'Connor and Switzer 2022).

High-dose ALBC spacers are routinely used in TKA and THA two-stage revisions for periprosthetic joint infections. The high-dose ALBC has to be hand-mixed in the operating room because pre-mixed ALBC is not available in high enough antibiotic concentrations to treat periprosthetic joint infections. Consequently, hand-mixing ALBC in the operating room is already a routine practice for using ALBC and does not represent a "new" practice in the operating room.

The evidence for using ALBC in hip hemiarthroplasty is so compelling that the British have instituted the WHiTE 8 COPAL RCT comparing low-dose, single-antibiotic ALBC and high-dose, dual-antibiotic ALBC in patients undergoing hip hemiarthroplasty for femoral neck fracture (Agni et al. 2021). A minimum of 4,920 patients will be recruited to detect an absolute difference of 1.5% in PJI rates with 90% power. The results of the study are intended to inform policy and CPGs for the National Institute for Health and Care Excellence (NICE).

These cost-effectiveness analyses are limited by the lack of adequately powered RCTs evaluating ALBC efficacy preventing PJIs in primary TKA and primary THA and ALBC/PBC efficacy preventing PFFs in THA. The analyses do find clinically-significant differences in PJI rates for TKA and clinically-significant differences in PJI and PFF rates for THA with the best available evidence. Namba *et al.* found that ALBC did reduce the risk of PJI in patients with diabetes undergoing primary TKA in the Kaiser Permanente Total Joint Replacement Registry (Namba et al. 2020).

The Australian Orthopaedic Association National Joint Replacement Registry asked the question: "What can we learn from surgeons who perform THA and TKA and have the lowest revision rates?" (W. Hoskins et al. 2021) They found: "Low revision rate THA surgeons were more likely to use cement fixation selectively." High-quality RCTs are needed to justify the widespread use of ALBC in primary TKA and primary THA (Sultan et al. 2019). Until more robust evidence is available, the selective use of ALBC for patients undergoing primary TKA and primary THA with PJI and/or PFF risk factors is cost-effective.

The cost-effectiveness analyses included in this study have intentionally used simplified average costs. Average cost-effectiveness ratios (ACERs) and incremental cost-effectiveness ratios (ICERs) have been avoided (Bang and Zhao 2014). The methods used in this article allow individual institutions and health systems to substitute their specific PJI rates, PFF rates, and implant costs to determine if ALBC is cost effective for their institution/health system.

CONCLUSIONS

The use of antibiotic-laden bone cement is cost-effective by reducing periprosthetic joint infections in TKA, THAs, and hip hemiarthroplasties. Antibiotic-laden bone cement and plain bone cement are cost-effective by reducing periprosthetic femur fractures in THAs and hip hemiarthroplasties. Cemented fixation allows the use of lower cost fracture stems in hip hemiarthroplasties. Hand-mixed ALBC is more cost-effective than pre-mixed ALBC in all scenarios.

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