Journal of Orthopaedic Experience & Innovation
Clinical, Economic, and Innovative Orthopaedic Experience

Kirchner, Gregory, Andrew Kim, Mark Dunleavy, Matthew Webb, Yehuda Kerbel, and Vincent Moretti. 2023. "The Cost-Effectiveness of Wound Dressings for Infection Prophylaxis in Total Joint Arthroplasty: An Economic Evaluation." *Journal of Orthopaedic Experience & Innovation* 4 (1). https://doi.org/10.60118/001c.56922.

Research Article

The Cost-Effectiveness of Wound Dressings for Infection Prophylaxis in Total Joint Arthroplasty: An Economic Evaluation

Gregory Kirchner[1][a], Andrew Kim[1][b], Mark Dunleavy, MD[1][c], Matthew Webb, MD[2][d], Yehuda Kerbel, MD[3][e], Vincent Moretti[4][f]

[1] Department of Orthopaedics & Rehabilitation, The Penn State Milton S. Hershey Medical Center, [2] Stanford University, [3] Rush University Medical Center, [4] Department of Orthopaedic Surgery, The University of Pennsylvania

Keywords: periprosthetic joint infection, total joint replacement, wound dressings, cost effectiveness, break-even analysis

https://doi.org/10.60118/001c.56922

Journal of Orthopaedic Experience & Innovation

Vol. 4, Issue 1, 2023

Background

Periprosthetic joint infection (PJI) is a medical and economical challenge. Specific post-operative wound dressings have been developed to mitigate risk of PJI following total hip arthroplasty (THA) and total knee arthroplasty (TKA), but these come with added cost and unknown benefit. The purpose of this study was to determine which dressings may be economically justifiable.

Methods

The average added cost of Xeroform with gauze (Xeroform+gauze), Mepilex Border, Aquacel Ag, and Dermabond Prineo dressings compared to standard dressing (Xeroform+gauze) only were obtained from institutional records and contemporary literature. Baseline infection rates following THA and TKA and average costs of PJI treatment were obtained from the literature. A break-even analysis was utilized to

a Conflicts of Interest Statement for Gregory Kirchner

b Andrew Kim is a 4th year medical student at the Penn State College of Medicine interested in pursuing a career in Orthopaedic Surgery.

Conflicts of Interest Statement for Andrew Kim

Connect with Andrew Kim on LinkedIn

c Mark Dunleavy is a PGY5 resident at Penn State Hershey Medical Center. He will be attending adult reconstruction fellowship at Rush.

Visit the Open Payments Data Page for Dr. Dunleavy

Visit Dr. Dunleavy's Website

Conflicts of Interest Statement for Dr. Dunleavy

d Dr. Webb is an orthopaedic surgeon and assistant professor of orthopaedic surgery.

Visit Dr. Webb's Website

Connect with Dr. Webb on LinkedIn

Visit the Open Payments Data Page for Dr. Webb

Conflicts of Interest Statement for Dr. Webb

e Yehuda "Yudi" Kerbel is a joint replacement fellow at Rush University Medical Center.

Visit Dr. Kerbel's Website

Connect with Dr. Kerbel on LinkedIn

Visit the Open Payments Data Page for Dr. Kerbel

Conflicts of Interest Statement for Dr. Kerbel

f Conflicts of Interest Statement for Dr. Moretti

Visit the Open Payments Data Page for Dr. Moretti

determine the absolute risk reduction (ARR) needed in infection rate to make each dressing cost-effective.

Results

At $3.00, a single Xeroform+gauze is economically justified if the initial infection rate for TKA (1.10%) and THA (1.62%) are reduced by an ARR of 0.01% and 0.009%, respectively. Two to three additional post-operative dressing changes increases the cost of Xeroform+gauze to $9.00-12.00 and increases the required ARR for TKA to 0.04-0.05% and for THA to 0.028-0.038%. Mepilex Border costs $29.00 and requires an ARR of 0.11% for TKA and 0.09% for THA. Aquacel Ag costs $40.00 and requires an ARR of 0.16% for TKA and 0.13% for THA. Dermabond Prineo costs $79.00 and requires an ARR of 0.31% for TKA and 0.25% for THA. Variations in estimation of initial infection rate did not impact ARR for any dressing type.

Conclusions

Orthopaedic surgeons have multiple options for surgical dressings following total joint replacement. With respect to infection prophylaxis, Xeroform+gauze is the most cost-effective. Other specialized dressings such as Mepilex Border, Aquacel Ag, or Dermabond Prineo, require significantly higher reductions in infection rate to be economically justifiable.

INTRODUCTION

Periprosthetic Joint Infection (PJI) is a devastating and costly complication after Total Joint Arthroplasty (TJA) (Morcos et al. 2021; Parisi, Konopka, and Bedair 2017; Parvizi et al. 2010; Walter et al. 2021). A large body of literature has been published regarding the optimal methods for preventing infection by optimizing patient care prior to surgery (Antonelli and Chen 2019; Batty and Lanting 2020; Chan et al. 2020; Shahi and Parvizi 2015). However, one method of infection prophylaxis that has recently become a larger clinical focus is post-operative wound management (Chowdhry and Chen 2015; Sharma et al. 2017). This is especially important in TJA, where patients are mobile immediately after surgery, placing significant stress on the surgical wound. Optimal wound management is critical, since wound breakdown, if left untreated, could lead to PJI (Chowdhry and Chen 2015).

Historically, simple gauze and tape dressings were considered the standard of care post-operatively, but there have been recent advances in dressing technology that offer a theoretical advantage in wound management and infection prevention (Sharma et al. 2017). Unlike classic gauze-based dressings, which only offer a passive protective barrier, new dressing technologies can actively maintain an optimal moist wound environment for up to a week after surgery, sometimes with additional antimicrobial properties (Chen et al. 2018; Herndon et al. 2020). There is a growing body of research that investigates the clinical effectiveness of these new dressings in comparison to traditional wound care methods. However, the economic aspects of these dressings must also be considered prior to their implementation.

Few prior studies have examined the cost effectiveness of individual types of surgical dressings after lower extremity arthroplasty. Toppo et al. found that silver impregnated occlusive dressings were a cost-effective measure for preventing infection after TJA, while Nherera et al. found that single-use negative pressure wound therapy can be a cost-saving intervention to prevent wound complications after primary total joint replacements (Nherera, Trueman, and

Karlakki 2017; Toppo et al. 2020). However, these studies only examined a single dressing type and did not examine a range of available products. The purpose of our study was to conduct a break-even analysis comparing a range of advanced technology dressings that are widely used in TJA. The dressings analyzed included: 1) Xeroform with gauze, a simple gauze dressing impregnated with petrolatum and the antimicrobial agent bismuth; 2) Mepilex Border, a bordered foam dressing; 3) Aquacel Ag, a hydrofiber dressing impregnated with ionic silver; and 4) Dermabond Prineo, a polyester mesh and liquid adhesive wound closure system. We used a simple economic model to determine the required reduction in infection for each of these wound care technologies to make them cost-effective for routine use in TJA patients. We present the following article in accordance with the CHEERS reporting checklist.

METHODS

As a model for cost-effectiveness, we utilized a break-even formula originally described by Hatch et al (Hatch et al. 2017). for our analysis of wound dressings (Figure 1). This formula solves for a break-even infection rate, which is the infection rate that would need to be achieved with the use of a particular intervention (e.g., a particular dressing) to neutralize cost of using that intervention compared to the cost of treating an infection. Three variables are factored in the break-even equation: initial infection rate of the procedure, the total cost of treating an infection resulting from the procedure, and the total cost of the intervention meant to ameliorate infection risk. Calculating the difference between initial infection rate and the break-even infection rate provides the absolute risk reduction (ARR), which is the percent difference that the use of a particular intervention must yield for its prophylactic use to be economically justified.

The values for each variable were collected from the contemporary literature. No experiment or intervention was implemented and no patient data was used in this study; this study is therefore exempt from Institutional Review Board review. Regarding initial infection rates following TJA, rates range from high national incidences of 2.18% for both TKA and THA to lower incidences of 1.10% and 1.63% for TKA and THA, respectively (Kurtz et al. 2012; Ong et al. 2009; Pulido et al. 2008). For our calculations, the lower incidence rates were used as baseline infection rates to create a more conservative analysis. The cost of treating infection

Figure 1. Equation used to calculate break-even infection rate

$$S_{total} \times C_t \times IR_i = (S_{total} \times C_d) + (S_{total} \times C_t \times IR_f)$$

Solving for IR_f yields:

$$IR_f = \frac{(IR_i \times C_t) - C_d}{C_t}$$

Where S_{total} = total annual surgeries; C_t = total cost of treating an infection; C_d = cost of dressing; IR_i = initial infection rate; IR_f = breakdown infection rate.
Adapted from Hatch MD, Daniels SD, Glerum KM, Higgins LD. The cost effectiveness of vancomycin for preventing infections after shoulder arthroplasty: a break-even analysis. *J Shoulder Elbow Surg*. 2017;36(3):472-477.

was obtained from literature on the cost of double-stage revision arthroplasty. Cost burden due to PJI has been found to be nearly twice as high as those without PJI, with costs reaching as high as $80,000 in the United States (Leta et al. 2021). These costs represent inpatient fees, excluding professional and non-covered charges. For our calculations we used the greater of these costs for both TKA and THA given that they represent more recent estimates.

Regarding the wound dressings, four distinct dressings were analyzed. These ranged from simple dressings that may be constructed from materials readily available in most operating rooms to highly specialized dressings. We denoted a single-use Xeroform with gauze (Xeroform+gauze) as the standard dressing, which costs approximately $3.00 (Grosso et al. 2017). When Xeroform+gauze is utilized at our institution, a dressing change occurs on each post-operative day until discharge. Accounting for this, we also included Xeroform+gauze with 2 or 3 dressing changes, costing a total of $9.00 and $12.00, respectively. At our institution, the most readily available prefabricated dressing that is utilized for total joint arthroplasty is the Mepilex Border dressing, which cost $29.00 per dressing (Holte et al. 2017). Silver-impregnated Aquacel Ag dressings were also analyzed, with a cost of $40.00 per dressing (Grosso et al. 2017). Finally, a polyester mesh dressing, the Dermabond Prineo, was analyzed at a cost of $79.00 per dressing (Herndon et al. 2020).

Rates of infection and cost of treating infection are subject to variations based on a multitude of factors that are challenging to capture within a cost-effectiveness model. Therefore, each of these variables were manipulated along a range of theoretical costs to determine how variations might impact the ARR. For example, we performed our calculations using initial infection rates that ranged of 0.50-2.5%. Furthermore, we varied the cost of treating infection from $20,000 to $40,000. These ranges account for differences in infection rates and costs of treatment between institutions and practice-settings, and we conducted break-even analyses across these ranges to determine if the cost-effectiveness of each dressing type is impacted by variations in infection rates and costs of infection treatment.

RESULTS

At a cost of $3.00, Xeroform+gauze is cost-effective if the initial infection rates for THA and TKA (1.63% and 1.10%, respectively) have an ARR of 0.01% each (Table 1). If Xeroform+gauze is changed 3 or 4 times for a total cost of $9.00 and $12.00, respectively, cost-effectiveness would be achieved with an ARR of 0.03% and 0.04% at each respective price point for THA, and with an ARR of 0.04% and 0.05% for TKA. Furthermore, at a cost of $29.00, the Mepilex Border dressing would require an ARR of 0.09% for THA and 0.11% for TKA. The Aquacel Ag dressing, with a cost of $40.00, would require an ARR of 0.13% and 0.16% for THA and TKA, respectively. Finally, for a Dermabond Prineo dressing at $79.00, the ARR would be 0.25% for THA and 0.31% for TKA.

Varying the initial infection rate for both THA and TKA from 0.5% to 2.5% did not impact the ARR required to break-even on cost regardless of the dressing type (Table 2). For example, at an initial infection rate of 0.50%, the Dermabond Prineo requires an ARR of 0.25% to break-even for THA and TKA, which is the same ARR calculated with an initial infection rate of 1.0%, 1.5%, 2.0% and 2.5%.

Changing the cost of treating infection resulted in the greatest change in the ARR required to break-even on the cost of implementing a particular wound dressing (Table 3). For example, at a treatment cost of $20,000 for a periprosthetic hip infection, the Dermabond Prineo requires an ARR of 0.40% to break-even on cost. However, when cost of treating infection increases to $40,000 for a periprosthetic hip infection, the Dermabond Prineo requires a smaller ARR of 0.20% to break-even. This trend is maintained for the other dressing types, as well as for periprosthetic knee infections.

DISCUSSION

PJI is a devastating complication of TJA the presents substantial costs to the patient and surgeon. Toppo et al. found that silver impregnated occlusive dressings were a cost-effective measure for preventing infection after TJA, while Nherera et al. found that single-use negative pressure wound therapy can be a cost-saving intervention to prevent wound complications after primary total joint replacements (Nherera, Trueman, and Karlakki 2017; Toppo et al. 2020). However, these studies only examined a single dressing type and did not examine a range of available products. Our study presents that absolute risk reductions that would be necessary for post-operative wound dressings that cost between $12 and $80 (USD) to be cost-effective in situation where the baseline post-operative infection rate in 0.5% to 2.5% and the cost of treating the infection can reach up to $80,000 (USD). Depending upon these inputs, post-operative surgical dressings are cost-effective if they reduced that relative risk of infection by 0.03 – 0.40% (Tables 2 and 3).

This study is a theoretical exercise and should not be interpreted as a report of the clinical effectiveness of any specific post-operative dressing. This study is not an experimental study and does not describe the result of any particular intervention, rather this study presents a cost-effectiveness model that computes the absolute risk reduction that should be observed in an experimental study in order for a given dressing type to be considered cost-effective. Kuo et al. found that antimicrobial dressings had the lowest odds ratio for the incidence of infections, followed by hydrofiber/hydrocolloid, foam, impregnated gauze, and film dressings (Kuo et al. 2021). Nevertheless, a clinical or experimental study would be necessary to determine if an intervention related to post-operative surgical dressing type is truly cost-effective in practice.

Furthermore, the design of this study assumes that the value of post-operative dressings is related only to their ability to prevent post-operative infection. There may be other characteristics of different dressing types that present advantages to the surgeon and patient – such as aesthetics, resistance to bathing and showering, and a lesser need for dressing changes – and these may be properties that surgeons and patients value, but this study does not account for these differences because in our opinion the primary function of a post-operative wound dressing is as physical barrier to prevent post-operative infection.

Similarly, the findings of this study are generalized to the average patient, but there may be clinical scenarios in which alternative dressings or wound management strategies – such as incisional wound vacs – may be preferable. This may be the cases in revision surgery or in patients with specific allergies, complex medical comorbidities, or those who are otherwise at increased risk for wound complications. The value and cost-effectiveness of alternative wound management strategies in specific patient populations and clinical scenarios may be a topic for further study.

In addition, the findings of this model are dependent upon the input values for dressing cost, infection rates, and the costs of treating infection that we found in the literature available. It is possible that in the future the baseline rate of infection and the monetary costs of treating infection could change, and this could impact the study findings. Septic revision arthroplasty is complex, and the decision-making process is dynamic and individualized. There are many costs and considerations that can vary substantially over time and in different scenarios, and for these reasons a decision-tree analysis or time-dependent Markov model could be used to more accurately reflect the complexity of the decision-making in septic revision arthroplasty, however we present a break-even analysis because it is a statistical method that most decision-makers can fully understand and could easily apply to their own practices. Future studies could investigate how the nonmonetary elements related to treating infection, including the loss of physiology, psychology, and work time, further contributes to the overwhelming costs and consequences of treating a PJI.

Table 1. Cost-Effectiveness of Dressings Used in Total Joint Arthroplasty

		Total Hip Arthroplasty		Total Knee Arthroplasty	
Dressing	Cost ($)	BE IR (%)	BE ARR (%)	BE IR (%)	BE ARR (%)
Xeroform+gauze	$3.00	1.61	0.009	1.09	0.012
Xeroform+gauze x3	$9.00	1.59	0.028	1.06	0.035
Xeroform+gauze x4	$12.00	1.58	0.038	1.05	0.047
Mepilex Border	$29.00	1.53	0.091	0.99	0.113
Aquacel Ag	$40.00	1.49	0.126	0.94	0.156
Dermabond Prineo	$79.00	1.37	0.249	0.79	0.307

BE, break-even; IR, infection rate, ARR, absolute risk reduction

Table 2. Varying Initial Infection Rate does not Affect Absolute Risk Reduction

		Total Hip Arthroplasty		Total Knee Arthroplasty	
Initial IR (%)	Dressing Cost† ($)	BE IR (%)	BE ARR (%)	BE IR (%)	BE ARR (%)
0.50	12	0.46	0.04	0.46	0.04
	30	0.41	0.09	0.41	0.09
	40	0.37	0.13	0.37	0.13
	80	0.25	0.25	0.25	0.25
1.0	12	0.96	0.04	0.96	0.04
	30	0.91	0.09	0.91	0.09
	40	0.87	0.13	0.87	0.13
	80	0.75	0.25	0.75	0.25
1.5	12	1.46	0.04	1.46	0.04
	30	1.41	0.09	1.41	0.09
	40	1.37	0.13	1.37	0.13
	80	1.25	0.25	1.25	0.25
2.0	12	1.96	0.04	1.96	0.04
	30	1.91	0.09	1.91	0.09
	40	1.87	0.13	1.87	0.13
	80	1.75	0.25	1.75	0.25
2.5	12	2.46	0.04	2.46	0.04
	30	2.41	0.09	2.41	0.09
	40	2.37	0.13	2.37	0.13
	80	2.25	0.25	2.25	0.25

BE, break-even; IR, infection rate, ARR, absolute risk reduction
†Approximate costs for Xeroform+gauze x4 ($12), Mepilex Border ($30), Aquacel Ag ($40), and Dermabond Prineo ($80)

It is also possible that the costs of specific dressings could change or that institutions or practices could adjust the unit cost of dressing types via collective bargaining or group-purchasing agreements. It is for these reasons that we computed break-even points for a range of dressing costs, baseline infection rates, and costs of treating infection. Surgeons interpreting our study findings may compare their local or institutional costs and rates to those pre-

Table 3. Increasing Cost of Treating Infection Decreases Absolute Risk Reduction Required to Break-Even on Cost of Wound Dressing Utilization

		Total Hip Arthroplasty		Total Knee Arthroplasty	
Cost of Treating Infection ($)	Dressing Cost† ($)	BE IR (%)	BE ARR (%)	BE IR (%)	BE ARR (%)
20,000	12	1.56	0.06	1.04	0.06
	30	1.47	0.15	0.95	0.15
	40	1.42	0.20	0.90	0.20
	80	1.22	0.40	0.70	0.40
25,000‡	12	1.57	0.05	1.05	0.05
	30	1.50	0.12	0.98	0.12
	40	1.46	0.16	0.94	0.16
	80	1.30	0.32	0.78	0.32
30,000§	12	1.58	0.04	1.06	0.04
	30	1.52	0.10	1.00	0.10
	40	1.49	0.13	0.97	0.13
	80	1.35	0.27	0.83	0.27
35,000	12	1.59	0.03	1.07	0.03
	30	1.53	0.09	1.01	0.09
	40	1.51	0.11	0.99	0.11
	80	1.39	0.23	0.87	0.23
40,000	12	1.59	0.03	1.07	0.03
	30	1.55	0.08	1.03	0.08
	40	1.52	0.10	1.00	0.10
	80	1.42	0.20	0.90	0.20

BE, break-even; IR, infection rate, ARR, absolute risk reduction
†Approximate costs for Xeroform+gauze x4 ($12), Mepilex Border ($30), Aquacel Ag ($40), and Dermabond Prineo ($80)
‡Approximate cost of treating periprosthetic knee infection
§Approximate cost of treating periprosthetic hip infection

sented in tables 2 and 3 to find an approximate break-even point for the costs and rates observed in any given practice. Using the equation in figure 1, surgeons considering a change in dressing type could determine the precise break-even point given the costs are rates observed in their practices. This could be a basis for a future practical study.

CONCLUSION

This break-even analysis investigates the cost-effectiveness of various dressings used in TJA, ranging from standard dressings that are available with materials found in most operating rooms to highly specialized wound dressings. Standard dressings, such as Xeroform and gauze, are predictably cost-effective. However, cost-effectiveness diminishes greatly with the increasing costs of specialized dressings, such as the Aquacel Ag and Dermabond Prineo. Notably, the break-even analysis utilized in our study can be applied to any joint replacement surgeon's practice using their outcome data and product costs to determine which wound dressings is cost-effective for their practice.

Submitted: September 17, 2022 EDT, Accepted: November 29, 2022 EDT

REFERENCES

Antonelli, Brielle, and Antonia F. Chen. 2019. "Reducing the Risk of Infection after Total Joint Arthroplasty: Preoperative Optimization." *Arthroplasty* 1 (1): 1–13. https://doi.org/10.1186/s42836-019-0003-7.

Batty, Lachlan M., and Brent Lanting. 2020. "Contemporary Strategies to Prevent Infection in Hip and Knee Arthroplasty." *Current Reviews in Musculoskeletal Medicine* 13 (4): 400–408. https://doi.org/10.1007/s12178-020-09653-9.

Chan, Vincent WK, PK Chan, H Fu, MH Cheung, A Cheung, CH Yan, and KY Chiu. 2020. "Preoperative Optimization to Prevent Periprosthetic Joint Infection in At-Risk Patients." *Journal of Orthopaedic Surgery* 28 (3): 230949902094720. https://doi.org/10.1177/2309499020947207.

Chen, Kevin K., Ameer M. Elbuluk, Jonathan M. Vigdorchik, William J. Long, and Ran Schwarzkopf. 2018. "The Effect of Wound Dressings on Infection Following Total Joint Arthroplasty." *Arthroplasty Today* 4 (1): 125–29. https://doi.org/10.1016/j.artd.2017.03.002.

Chowdhry, M., and A.F. Chen. 2015. "Wound Dressings for Primary and Revision Total Joint Arthroplasty." *Ann Transl Med* 3 (268).

Grosso, Matthew J., Ari Berg, Samuel LaRussa, Taylor Murtaugh, David P. Trofa, and Jeffrey A. Geller. 2017. "Silver-Impregnated Occlusive Dressing Reduces Rates of Acute Periprosthetic Joint Infection After Total Joint Arthroplasty." *The Journal of Arthroplasty* 32 (3): 929–32. https://doi.org/10.1016/j.arth.2016.08.039.

Hatch, M. Daniel, Stephen D. Daniels, Kimberly M. Glerum, and Laurence D. Higgins. 2017. "The Cost Effectiveness of Vancomycin for Preventing Infections after Shoulder Arthroplasty: A Break-Even Analysis." *Journal of Shoulder and Elbow Surgery* 26 (3): 472–77. https://doi.org/10.1016/j.jse.2016.07.071.

Herndon, Carl L., Josephine R. Coury, Nana O. Sarpong, Jeffrey A. Geller, Roshan P. Shah, and H. John Cooper. 2020. "Polyester Mesh Dressings Reduce Delayed Wound Healing Rates after Total Hip Arthroplasty Compared with Silver-Impregnated Occlusive Dressings." *Arthroplasty Today* 6 (2): 158–62. https://doi.org/10.1016/j.artd.2020.01.013.

Holte, Andrew J., Josef N. Tofte, Greta J. Dahlberg, and Nicolas Noiseux. 2017. "Use of 2-Octyl Cyanoacrylate Adhesive and Polyester Mesh for Wound Closure in Primary Knee Arthroplasty." *Orthopedics* 40 (5): e784–87. https://doi.org/10.3928/01477447-20170531-03.

Kuo, Feng-Chih, Chih-Wei Hsu, Timothy L. Tan, Pao-Yen Lin, Yu-Kang Tu, and Po-Cheng Chen. 2021. "Effectiveness of Different Wound Dressings in the Reduction of Blisters and Periprosthetic Joint Infection After Total Joint Arthroplasty: A Systematic Review and Network Meta-Analysis." *The Journal of Arthroplasty* 36 (7): 2612–29. https://doi.org/10.1016/j.arth.2021.02.047.

Kurtz, Steven M., Edmund Lau, Heather Watson, Jordana K. Schmier, and Javad Parvizi. 2012. "Economic Burden of Periprosthetic Joint Infection in the United States." *The Journal of Arthroplasty* 27 (8): 61-65.e1. https://doi.org/10.1016/j.arth.2012.02.022.

Leta, Tesfaye H, Jan-Erik Gjertsen, Håvard Dale, Geir Hallan, Stein Håkon Låstad Lygre, Anne Marie Fenstad, Gro Sævik Dyrhovden, et al. 2021. "Antibiotic-Loaded Bone Cement in Prevention of Periprosthetic Joint Infections in Primary Total Knee Arthroplasty: A Register-Based Multicentre Randomised Controlled Non-Inferiority Trial (ALBA Trial)." *BMJ Open* 11 (1): e041096. https://doi.org/10.1136/bmjopen-2020-041096.

Morcos, Mina W., Paul Kooner, Jackie Marsh, James Howard, Brent Lanting, and Edward Vasarhelyi. 2021. "The Economic Impact of Periprosthetic Infection in Total Knee Arthroplasty." *Canadian Journal of Surgery* 64 (2): E144–48. https://doi.org/10.1503/cjs.012519.

Nherera, Leo M., Paul Trueman, and Sudheer L. Karlakki. 2017. "Cost-Effectiveness Analysis of Single-Use Negative Pressure Wound Therapy Dressings (sNPWT) to Reduce Surgical Site Complications (SSC) in Routine Primary Hip and Knee Replacements." *Wound Repair and Regeneration* 25 (3): 474–82. https://doi.org/10.1111/wrr.12530.

Ong, Kevin L., Steven M. Kurtz, Edmund Lau, Kevin J. Bozic, Daniel J. Berry, and Javad Parvizi. 2009. "Prosthetic Joint Infection Risk After Total Hip Arthroplasty in the Medicare Population." *The Journal of Arthroplasty* 24 (6): 105–9. https://doi.org/10.1016/j.arth.2009.04.027.

Parisi, Thomas J., Joseph F. Konopka, and Hany S. Bedair. 2017. "What Is the Long-Term Economic Societal Effect of Periprosthetic Infections After THA? A Markov Analysis." *Clinical Orthopaedics & Related Research* 475 (7): 1891–1900. https://doi.org/10.1007/s11999-017-5333-6.

Parvizi, Javad, Ian Pawasarat, Khalid Azzam, Erik N. Hansen, Kevin J. Bozic, and Matthew S. Austin. 2010. "Periprosthetic Joint Infection: The Economic Impact of Methicillin Resistant Infections." *The Journal of Arthroplasty* 25 (3): e42. https://doi.org/10.1016/j.arth.2010.01.050.

Pulido, Luis, Elie Ghanem, Ashish Joshi, James J. Purtill, and Javad Parvizi. 2008. "Periprosthetic Joint Infection: The Incidence, Timing, and Predisposing Factors." *Clinical Orthopaedics & Related Research* 466 (7): 1710–15. https://doi.org/10.1007/s11999-008-0209-4.

Shahi, A., and J. Parvizi. 2015. "Prevention of Periprosthetic Joint Infection." *Arch Bone Jt Surg* 3:72–81.

Sharma, Gaurav, Sang Wook Lee, Oliver Atanacio, Javad Parvizi, and Tae Kyun Kim. 2017. "In Search of the Optimal Wound Dressing Material Following Total Hip and Knee Arthroplasty: A Systematic Review and Meta-Analysis." *International Orthopaedics* 41 (7): 1295–1305. https://doi.org/10.1007/s00264-017-3484-4.

Toppo, Alexander J., Nicholas R. Pagani, Michael A. Moverman, Richard N. Puzzitiello, Mariano E. Menendez, and Joseph J. Kavolus. 2020. "Response to Letter to the Editor on 'The Cost-Effectiveness of Silver-Impregnated Occlusive Dressings for Infection Prevention After Total Joint Arthroplasty.'" *The Journal of Arthroplasty* 36 (5): e57. https://doi.org/10.1016/j.arth.2021.01.001.

Walter, Nike, Markus Rupp, Katja Hierl, Matthias Koch, Maximilian Kerschbaum, Michael Worlicek, and Volker Alt. 2021. "Long-Term Patient-Related Quality of Life after Knee Periprosthetic Joint Infection." *Journal of Clinical Medicine* 10 (5): 907. https://doi.org/10.3390/jcm10050907.