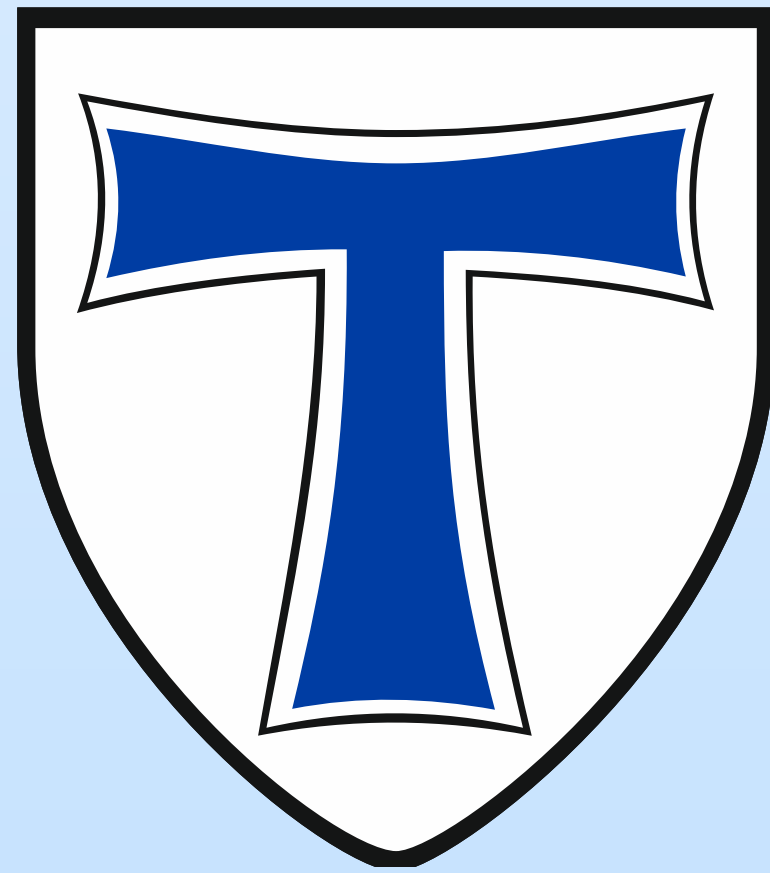




# Management of the Failed Two-Stage Exchange for Periprosthetic Joint Infection: A Systematic Review of Treatment Options and Outcomes



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## 1 Background/Study Aims

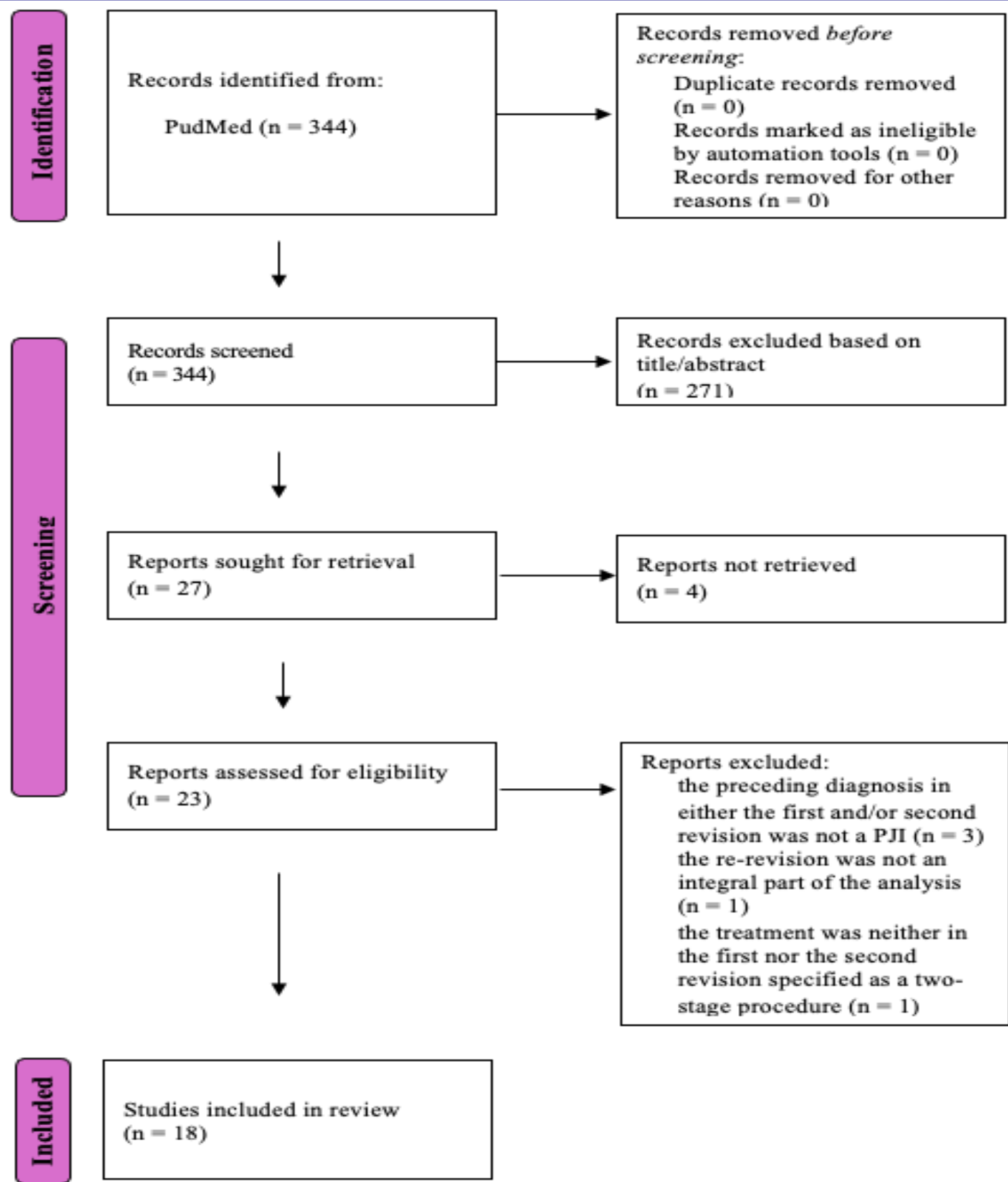
### Background & Clinical Dilemma

Periprosthetic joint infection (PJI) is a severe complication in arthroplasty with immense socioeconomic costs and drastically impaired patient quality of life. Although two-stage exchange is the gold standard, up to one-third of patients fail reimplantation. This creates a severe clinical dilemma between a repeat exchange and salvage procedures like amputation, a situation heavily exacerbated by sparse evidence for this re-failure scenario.

### Study Aims

To address this clinical uncertainty, this systematic review analyzes the management of failed two-stage exchanges. The primary objectives are to determine the overall success rates of repeat exchanges, assess clinical outcomes such as mortality and joint function, and explicitly identify patient- and pathogen-specific risk factors for recurrent failure.

## 2 Methodology



## 3 Results

### Procedures & Success Rates

Repeated two-stage exchange (18 studies, 2,178 patients) achieved a mean infection control of 61.5% (range: 30%–88%) (**Fig. 1**). Long-term re-revision rates reached up to 46.5% at seven years. Temporary restorations significantly influenced outcomes: static spacers (TKA) and any spacers (THA) outperformed articulating TKA spacers and Girdlestone resections.

### Pathogen Distribution

The microbiological spectrum was heavily dominated by Gram-positive pathogens, primarily CONS and *S. aureus* (**Fig. 2**). Targeted eradication was severely complicated by high rates of multidrug-resistant organisms (MDRO, up to 76%), polymicrobial infections (up to 47%), and culture-negative findings (9%–24%).

### Clinical Outcomes & Risk Factors

Patients had extensive surgical histories (mean 5.9 prior operations) and severe comorbidities (BMI > 30 kg/m<sup>2</sup>, diabetes up to 56%, median CCI 4). McPherson Grade C host status was a critical predictor of failure, increasing reinfection risk five-fold. Prolonged surgery, fungal infections, and identical recurrent pathogens also strongly correlated with failure. Outcomes were sobering: two-year mortality reached 33.3%, aseptic complications occurred in up to 31%, and 74% remained dependent on gait aids (mean KSS 73–88). Following failure, salvage options like amputation (1.9%–21%), arthrodesis, or lifelong suppressive antibiotics (10%–55%) became inevitable.

| Treatment strategy                       | Total cases analyzed (n) | Success rate (2-15 years follow-up) |
|------------------------------------------|--------------------------|-------------------------------------|
| <b>Primary curative strategy</b>         |                          |                                     |
| Repeat two-stage exchange                | 2,178                    | 61.5%                               |
| <b>Alternative curative Strategies</b>   |                          |                                     |
| Third two-stage Exchange                 | 47                       | ~57%                                |
| <b>DAIR (for acute re-infection)</b>     | 18                       | 33 %                                |
| Single-stage re-revision                 | 7                        | 29 %                                |
| <b>Interim management outcomes</b>       |                          |                                     |
| Girdlestone resection arthroplasty (Hip) | 26                       | 65 %                                |
| Spacer (Hip)                             | 5                        | 100 %                               |
| Articulating spacer (Knee)               | 9                        | 78 %                                |
| Static spacer (Knee)                     | 7                        | 100 %                               |
| <b>Salvage procedures</b>                |                          |                                     |
| Amputation                               | 42                       | ~9.2%                               |
| Arthrodesis (Knee)                       | 5                        | 5.6%                                |
| Resection arthroplasty                   | 9                        | ~4.5%                               |

Fig. 1 Overview of surgical procedures and respective outcomes

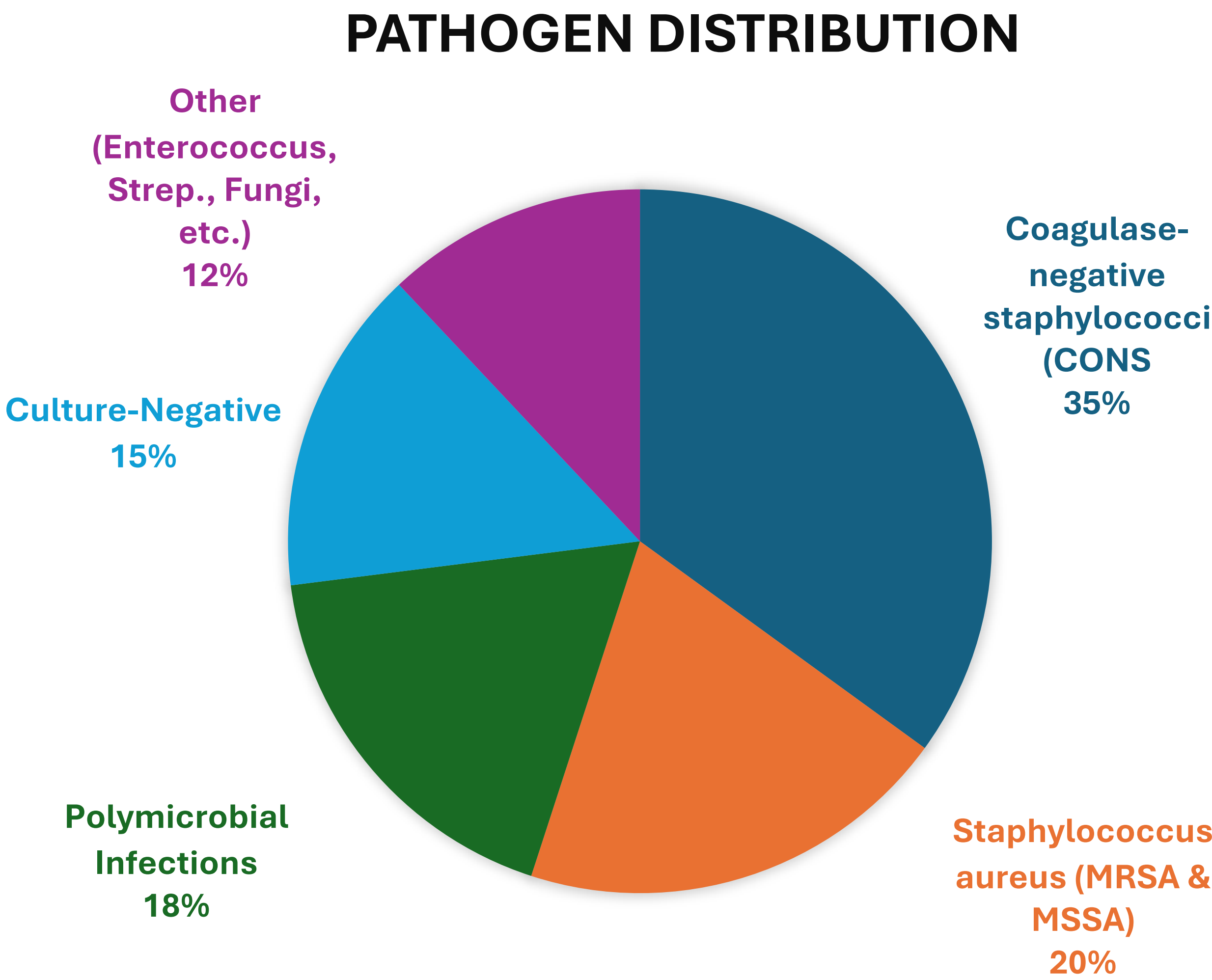


Fig. 2 Microbiological spectrum in rPJI ater failed two-stage exchange

## 4 Conclusion

This review identifies a low average success rate of 61.5% for repeated two-stage revision. This figure likely overestimates clinical success, as nearly half of patients require further surgery for mechanical complications within years. Consequently, no superior standard of care was identified. High mortality and failure risks necessitate strictly individualized treatment decisions. Integrating novel therapies and standardized PROMs is essential to improve outcomes and evaluate success from the patient’s perspective.