Methods to Reduce Cost of Treatment in Childhood Bone and Joint Infection: A Systematic Review

Sarah Hunter[1], Braden Te Ao[2], Haemish Alexander Crawford, Cameron Charles Charles Grant[3]
[1]Starship Orthopaedics, [2]Health Economics, [3]Paediatrics

INTRODUCTION: Childhood bone and joint infection (BJI) is a potentially severe disease with consequences for growth and development. Critically unwell children may require prolonged hospitalisation and multiple surgeries. Acknowledging rising healthcare costs and the financial impact of illness on caregivers, increased efforts are required to optimise treatment. This systematic review aims to characterise existing costs of hospital care and summarise strategies which reduce treatment expense.

METHODS: A systematic review of the literature was performed from 01/01/1980 to 31/1/2024. Data was extracted on hospitalisation costs for paediatric BJI by decade and global region. Results have been converted to cost per day in US dollars with purchase parity for 2023. Studies reporting innovations in clinical care to reduce length of stay (LOS) and simplify treatment were identified. Interventions are classed as changing the process of organism identification, antibiotic regimen, or imaging protocol in the workup for childhood BJI. Average length of stay before and after the innovation was implemented has been reported together with statistical significance. Studies trialling shorter antibiotic treatment were only included if they specifically reported changes in LOS.

RESULTS:

Twenty-three studies met inclusion criteria; of these, a daily hospitalisation cost could be derived from seven publications. The trendline for hospitalisation cost alone ascends steeply over the last two decades, from $2053/day in 1997 to $3632 in 2016. More concerning is the increase in hospital charges, which reached $12021/day in 2021. Conversely, average length of stay has been extracted from each publication, and appears to decrease (Y=-0.05, 1990-2021). Cost per day was higher in the United States than in Europe, and higher for cases with confirmed methicillin-resistant *Staphylococcus aureus* (MRSA).

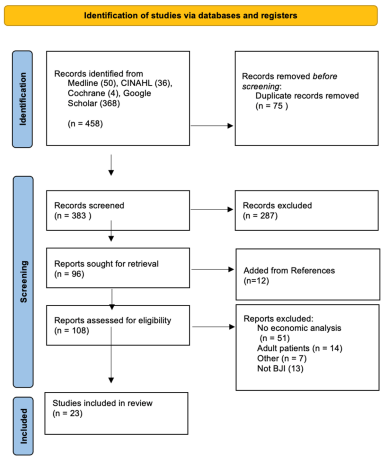
Sixteen studies report innovations to optimise care. Seven studies applied a faster MRI protocol in an effort to improve surgical efficacy and reduce LOS. For studies where reduced LOS was achieved, early magnetic resonance imaging with immediate transfer to theatre when necessary were consistent features. Overall, the rapid progression of MRI to theatre is important but seems to have greater effect when coupled with rapid progression from ED to the MRI scanner.

Eleven studies changed their institutional antibiotic regimens as part of new clinical protocols. A statistically significant reduction in LOS was reported in six studies. Of these, all but one included a plan for early oral switch. No studies included in this review had IV duration greater than 5 days if children met criteria for oral antibiotic therapy. Several explicitly mention avoidance of PICC lines, which are linked to higher cost and readmission rates.

DISCUSSION AND CONCLUSION:

To date, this is the most extensive review of direct medical hospitalisation cost for childhood BJI. Average hospitalisation cost for childhood BJI has increased over the last three decades without corresponding increase in LOS. Hospitals should advocate for standardised treatment protocols based on local resource. Where clinically appropriate, early oral antibiotic switch and streamlined MRI access support efficient treatment of this potentially serious condition.

Figure 1: PRISMA Flow Diagram



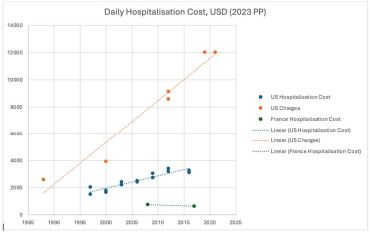


Figure 2: Daily Hospitalisation Cost Extracted from Studies between 1987-2021

Figure 3: Average Length of Stay in Days Extracted from Publications, 1987-2021