Economic Analysis of Anatomic Plating vs. Tubular Plating for the Treatment of Fibula Fractures
Suneel Bhat, MD, MPhil (Philadelphia, Pennsylvania)
Justin M. Kane, MD; Joseph N. Daniel, DO; Steven M. Raikin, MD; Andrew Kay, BS; David I. Pedowitz, MS, MD; Jamal Ahmad, MD; James Krieg, MD

Summary
Utilization of one-third tubular plating whenever possible for fibula fractures instead of anatomic plating would result in cost savings of nearly $40 million annually in the US.

Introduction
Ankle fractures involving the fibula are among the most common injuries requiring surgical management. Implant choices include one-third tubular plates and anatomically precontoured plates, with or without locking screws. Although in cases such as poor bone stock locking constructs may confer benefit, clinical data suggesting advantages relative to one third tubular plates with standard screws is lacking. Cadaveric studies fail to demonstrate significant biomechanical differences, previous suggestions that lower profile plating reduces hardware removal rates seem anecdotal, and a parallel study by the corresponding author found no difference in anatomic reduction between one-third tubular vs. precontoured plating. There are, however, substantial differences in the cost of various plate constructs. In our practice, the range of implants utilized to manage fibula fractures have been driven by a multitude of factors, chief among them being surgeon preference. This study aims to characterize the economic implications of implant choice.

Methods
A retrospective review was undertaken of 201 consecutive patients with operatively treated OTA type 44B and 44C ankle fractures between 2007 and 2013, by four foot and ankle fellowship trained orthopaedic surgeons. Radiographs and charts were reviewed for demographic data, plate and screw construct choice, and costs. The cost of one-third tubular and anatomic plates was identified and associated screw costs were assumed constant across all constructs. A National Inpatient Sample query for ICD-9 codes 824.2 through 824.7 among operatively managed adult patients was performed to estimate an incidence of ankle fractures requiring lateral plating. A Monte Carlo simulation was conducted with the estimated at risk US population for associated plate specific costs.

Results
121 patients underwent fixation with one-third tubular plate, while 80 underwent fixation with a precontoured anatomic plate. Utilization of one-third tubular plating resulted in an average per plate cost of $90.86 (95%CI $90.84 to $90.87) compared to anatomic plating which resulted in a per plate cost of $746.97 (95%CI $746.55 to $747.39). We estimated an annual incidence of admitted operatively treated ankle fractures requiring fibula plating in the US of 59,029. Across the US, utilization of only one-third tubular plating would result in plate costs of $5,363,375 (95%CI $5,362,513 to $5,364,237) while anatomic plating would result in plate costs of $44,092,892 (95%CI $44,068,163 to $44,117,621), a statistically significant difference of $38,729,517 (95%CI 38,704,773 to 38,754,261, p<0.0001).
Conclusion
In the current healthcare climate the economics of operative management are becoming increasingly scrutinized. The burden of efficiency in implant choice falls on the surgeon when multiple clinically appropriate options exist. Although anatomic plating may be advantageous in certain cases, there is no published justification for its wholesale use, and in our experience it does not influence anatomic reduction. On the other hand, general use of one-third tubular plating whenever possible for fibula fractures instead of anatomic plating would result in cost savings of nearly $40 million annually in the US. This margin will become more significant to providers with shifts towards bundled payments. Unless clinically justifiable on a per case basis, or until the advent of studies showing significant clinical benefit, there is no reason for the substantially increased expense from widespread use of anatomic plating for fractures amenable to one-third tubular plating.