

Economic Burden of Fracture-Related Infections in Germany: Health-Economic Modeling and the Cost-Saving Potential of Antibiotic-Eluting Biomaterials



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Background

Fracture-related infection (FRI) is a serious complication in orthopedic trauma surgery, associated with major clinical challenges and substantial economic burden. This study developed a comprehensive health-economic model to quantify the financial impact of FRI in Germany, focusing on Diagnosis-Related Group (DRG) reimbursement, direct hospital costs, and hospital bed utilization. Antibiotic-eluting biomaterials, such as CERAMENT G® and CERAMENT V® (BONESUPPORT AB, Lund, Sweden) may support infection control and dead space management within a single procedure (2), potentially increasing the use of one-stage treatment strategies. A key objective was to evaluate the economic impact of shifting from two-stage to one-stage treatment through the use of antibiotic-eluting biomaterials.

Methods

Epidemiological incidence data for FRI in Germany were applied to the most relevant anatomical regions: femoral shaft, tibial shaft, distal tibia, and calcaneus. DRG reimbursement was calculated using DRG grouping simulations (Table 1). Four treatment scenarios were analyzed for each region: one-stage and two-stage approaches, each with and without relevant comorbidities. The base-case model assumed a 20:80 distribution for one-stage versus two-stage treatment and 20:80 for patients without versus with comorbidities. Direct hospital costs were based on university hospital data, including personnel, implants, medication, and technical services (1). Costs for complications such as reinfection, aseptic revision, and amputation were additionally modeled. A scenario analysis evaluated the economic and structural effects of reversing the treatment ratio to 80:20 in favor of one-stage treatment enabled by antibiotic eluting biomaterials.

Results

An estimated 7,253 FRI cases occur annually in Germany (3). Total DRG reimbursement is approximately €210 million (Fig. 1), with complications adding €33.3 million, resulting in overall reimbursement of €243 million. Total hospital bed utilization reached 188,346 days, while direct hospital costs were estimated at €109 million. Two-stage treatment generated substantially higher reimbursement than one-stage treatment due to reimbursement for two separate inpatient stays (Table 1). Patients with significant comorbidities also increased reimbursement. Shifting toward predominantly by the use of antibiotic-eluting CERAMENT® one-stage treatment could reduce reimbursement expenditures by approximately €56.8 million (27%) and decrease hospital bed utilization by 60,900 days (33%) (Figure 2).

Conclusion

FRI represents a considerable economic burden for the German healthcare system. Treatment strategy and patient comorbidity strongly influence costs and resource utilization. Increasing one-stage treatment approaches through antibiotic-eluting CERAMENT® may offer substantial economic savings while significantly reducing hospital bed occupancy.

			Without comorbidities				With comorbidities			
			LOS*	DRG	Reimbursement	Total reimbursement	LOS*	DRG	Reimbursement	Total reimbursement
Femoral shaft	1-stage		10/0 days	I08D	15,339 EUR	15,339 EUR	14/2 days	I08D	24,688 EUR	24,688 EUR
		Stage 1	10/0 days	I08D	15,339 EUR	30,678 EUR	14/2 days	I08D	24,688 EUR	41,872 EUR
	2-stage	Stage 2	10/0 days	I08D	15,339 EUR		14/1 days	I08D	17,184 EUR	
Tibia shaft	1-stage		10/0 days	I13C	11,973 EUR	11,973 EUR	14/2 days	I12B	20,026 EUR	20,026 EUR
		Stage 1	10/0 days	I13C	11,973 EUR	22,748 EUR	14/2 days	I12B	16,880 EUR	33,391 EUR
	2-stage	Stage 2	10/0 days	I13C	10,775 EUR		14/1 days	I12B	16,551 EUR	
Distal tibia	1-stage		10/0 days	I13C	11,973 EUR	11,973 EUR	14/2 days	I12B	16,880 EUR	16,880 EUR
		Stage 1	10/0 days	I13C	11,973 EUR	22,748 EUR	14/2 days	I12B	16,880 EUR	33,391 EUR
	2-stage	Stage 2	10/0 days	I13D	10,775 EUR		14/1 days	I12B	16,551 EUR	
Calcaneus	1-stage		10/0 days	I20C	9,281 EUR	9,281 EUR	14/1 days	I20C	15,164 EUR	15,164 EUR
		Stage 1	10/0 days	I20C	9,281 EUR	18,023 EUR	14/1 days	I20C	15,164 EUR	27,636 EUR
	2-stage	Stage 2	10/0 days	I20C	8,742 EUR		14/1 days	I20C	12,472 EUR	

Table 1. DRG reimbursement for FRI treatment per case for different anatomical sites for 1- and 2-stage treatment with higher DRG reimbursement for 2-stage versus 1-stage treatment

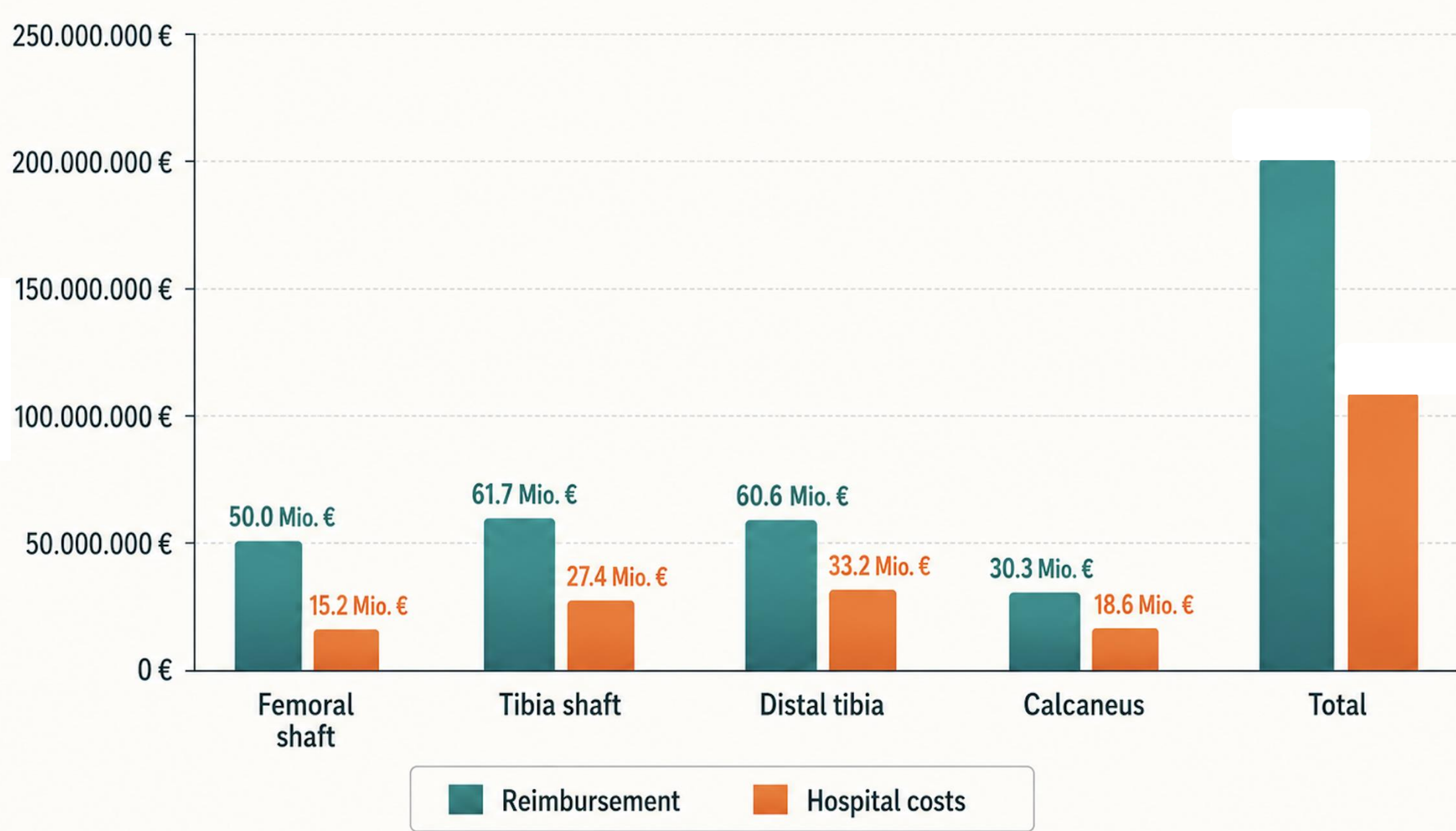


Fig. 1. Comparison between DRG reimbursement and hospital costs for FRI treatment for 7,253 FRI cases in Germany.

Potential Savings with One-Stage Treatment Compared with Two-Stage Treatment

FRI site	Potential reimbursement savings (€ million)	Hospital bed days saved (days)
Femoral shaft	14.6 million	12,200 days
Tibial shaft	11.9 million	18,300 days
Distal tibia	20.1 million	18,300 days
Calcaneus	10.2 million	12,200 days
Total	€56.8 million	60,900 days

Fig. 2. Potential savings in DRG reimbursement and hospital bed days with shift from 20:80 ratio to 80:20 ratio of 1-stage vs. 2-stage treatment with potential savings of around €56.8 million and hospital bed utilization by 60,900 days per year.

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