

Supplementary data

Table S1 Summary of Australian Therapeutic Guidelines: Antibiotic Version 15 Recommendations in orthopaedic procedures

Table S1 was developed as a resource for those who do not have access to the Australian Therapeutic Guidelines version 15, in which the Surgical NAPS Appropriateness Assessments were in relation too. This serves as a brief summary of the guideline's recommendations in relation to the general principles of SAP prescribing for orthopaedic procedures.

Antibiotic Prescribing Principles	Summary of recommendations from the Australian Therapeutic Guidelines: Antibiotic Version 15	
Indication	Do not use SAP unless there is a clear indication for its use i.e. when there is a significant risk of infection or if post-operative infection would have serious consequences.	
	Procedure	Is SAP indicated?
	<i>routine arthroscopy procedures not involving insertion of prosthetic material or avascular tissue</i>	<i>No</i>
	<i>prosthetic large joint replacement*</i>	<i>Yes</i>
	<i>procedures involving insertion of prosthetic or allograft material</i>	<i>Yes</i>
	<i>internal fixation of fractures of large bones</i>	<i>Yes</i>
Antimicrobial choice	Directed against the organism(s) most likely to cause postoperative infection.	
	Cefazolin is the preferred drug for the majority of procedures that require prophylaxis.	
	For patients colonised or infected with methicillin-resistant <i>S. aureus</i> (MRSA), or at increased risk of being colonised or infected with MRSA (e.g. patients undergoing a joint arthroplasty procedure that is a reoperation [return to theatre or early revision]); add vancomycin to the cefazolin regimen.	
	Modification may be necessary in relation to: <ul style="list-style-type: none"> - <u>Patient clinical factors</u>: e.g., pre-existing infections, recent antimicrobial use, potential for colonisation of multi-drug resistant organisms, prolonged hospitalisation., presence of prostheses and antibiotic allergy and; - <u>Environmental factors</u>: e.g., organisms causing infection within the institution and the patterns of antibiotic susceptibility, the potential selection pressure of antibiotic use. 	
	Strong recommendation to avoid use of broad-spectrum antibiotics for SAP	
Dose/Frequency	Common dosing for cefazolin is 2 grams.	
	Dosage adjustment in obesity may be necessary i.e. Cefazolin 3g if weight >120 kg.	
	Vancomycin dosing: 15 to 20mg/kg (actual body weight).	
	A repeat intraoperative dose is required if the procedure is prolonged or the drug has a short half-life.	
	The interval between pre- and intra-operative doses should be equal to approximately two half-lives of the drug e.g., cefazolin should be administered every four hours	
Route	Parenteral, intravenous (IV) is the first line recommendation.	
	Topical antimicrobials for SAP are not recommended	
Timing	Timing of SAP should ensure adequate plasma and tissue concentrations are achieved at the time of surgical incision and for the duration of the procedure.	
	The optimal time for pre-operative IV SAP administration is within the 60 minutes before surgical incision.	
	Administration 15 to 30 minutes before surgical incision may be optimal.	
	Vancomycin infusions should ideally be started 30 to 120 minutes before surgical incision, due to its long infusion time.	
Duration	A single dose is sufficient for the significant majority of procedures.	
	Post-operative doses of IV antibiotics (up to 24 hours) are only required in defined circumstances (e.g. lower limb amputations*).	
	Prophylaxis (IV and oral) should not extend beyond 24 hours, regardless of surgical procedure.	
	Urinary or intravascular catheters or indwelling surgical drains are not a justification for the extension of SAP duration.	
* Although a single preoperative dose of surgical antibiotic prophylaxis is expected to be sufficient to prevent postoperative infection following total knee arthroplasty, there is insufficient evidence to show that a single dose of prophylaxis is as effective as 24 hours of prophylaxis. Studies are ongoing. Postoperative doses can be considered but prophylaxis (intravenous or oral) should not continue beyond 24 hours.		

Table S2 Surgical NAPS Terminology and Definitions

Procedural antimicrobial prophylaxis	All antimicrobials administered either immediately prior to or during the surgical procedure for the purpose of prophylaxis; each dose/prescription of the antimicrobial administered is recorded and reported individually.
Post-procedural antimicrobial prophylaxis	All antimicrobials prescribed following, but directly relating to, the procedure for the purposes of prophylaxis; each prescription course of the antimicrobial is recorded and reported, including any inpatient or discharge scripts.
Existing antimicrobial therapy	Any antimicrobial prescribed for treatment or prophylaxis in the 24 hours prior (72 hours if on dialysis) to the procedure; these are not analyzed individually but are able to be taken into account when assessing the appropriateness of whether procedural antimicrobials were given or not given.
Surgical episodes	Any individual procedure or set of multiple procedures performed together during the one session and the subsequent post-procedural care associated with the procedure(s).
Appropriateness	As per the Surgical NAPS Appropriate Assessment Guide (1, 2). Data assessed as ‘optimal’ and ‘adequate’.
Inappropriateness	As per the Surgical NAPS Appropriate Assessment Guide (1, 2). Data assessed as ‘suboptimal’ and ‘inadequate’.
Overall Appropriateness /Inappropriateness	Assessment per entire surgical episode as opposed to the individual antimicrobial doses/prescriptions. e.g. A surgical episode may be deemed to be overall inappropriate if any part of the prescription (procedural or post-procedural prophylaxis) was deemed inappropriate, including allergy or microbiology mismatch, timing, dose, route, frequency, duration, spectrum too broad, spectrum too narrow or if the procedure did not require any antimicrobials.

References:

1. Australian Commission on Safety and Quality in Health Care. Surgical national antimicrobial prescribing in australia: Results of the 2016 pilot. In: ACSQHC, editor. Sydney: Australian Commission for Safety and Quality in Health Care; 2017.
2. Ierano C, Thursky K, Marshall C, et al. Appropriateness of surgical antimicrobial prophylaxis practices in australia. JAMA Network Open. 2019;2(11):e1915003.

Figure S1 Surgical NAPS Appropriateness assessment guide

		Appropriate		Inappropriate		5 - Not assessable
		1 - Optimal	2 - Adequate	3 - Suboptimal	4 - Inadequate	
Allergy mismatch	Where antimicrobials are prescribed exactly according to Therapeutic Guidelines or local guidelines – antimicrobial choice, dose, route, timing and duration; or where there is an appropriate reason for deviation from guidelines		Mild or non-life threatening allergy mismatch	Life threatening allergy mismatch	Where there is insufficient information available or the case is too complex for assessment.	
Microbiology mismatch				Antimicrobial used is too narrow (where sensitivity results available) Dose or frequency too low		
Incorrect dose or frequency			Dose or frequency too high (with exception of gentamicin)	Gentamicin dose too high or too frequent		
Incorrect route			An intravenous antimicrobial has been prescribed when the patient is able to safely take it orally	The prescribed route does not reach the site of infection or surgery		
Incorrect timing			Repeat dose given too soon (including patients who were already on existing antimicrobial therapy) <i>taking into consideration patients with renal impairment</i>	Antimicrobial prophylaxis given less than 15 minutes before surgical incision (with exception of vancomycin) Vancomycin started less than 30 minutes before surgical incision		Antimicrobial prophylaxis given greater than 60 minutes before surgical incision (with exception of vancomycin) Vancomycin started greater than 120 minutes before surgical incision Repeat dose given too late (including patients already on existing antimicrobial therapy) <i>taking into account renal impairment</i>
Incorrect duration						Surgical prophylaxis greater than 24 hours (except where guidelines endorse this)
Spectrum too broad				Choice of antimicrobial is too broad Additional antimicrobial added unnecessarily		
Spectrum too narrow			<i>If any reason is selected for incorrect prescribing, the prescription will no longer be optimal.</i>			Choice of antimicrobial does not cover likely organisms
Procedure does not require any antimicrobials						Procedure does not require any antimicrobials, but antimicrobials were still prescribed
Procedure requires antimicrobials			Patient already on existing antimicrobials where last dose would have provided sufficient prophylaxis for the duration of the procedure			Procedure requires antimicrobials but no antimicrobials were prescribed AND there were no existing antimicrobials
Repeat dose required, but not given			This will automatically be selected for auditors			
No antimicrobial prescribed	No antimicrobial required		Procedure requires antimicrobials but no antimicrobials were prescribed and there were no pre-existing antimicrobials			

ROYAL AUSTRALASIAN COLLEGE OF SURGEONS

Morbidity Audit and Logbook Tool

Procedure list for SET and IMG - Orthopaedic Surgery



ELBOW SURGERY	
Procedure	Alternative search terms
Arthroplasty	elbow
Ligament	elbow

FOOT & ANKLE SURGERY	
Procedure	Alternative search terms
Major many digits	osteotomy foot
Minor	osteotomy foot

FRACTURES CLOSED REDUCTION	
Procedure	Alternative search terms
Lower limb	fractures closed reduction
Upper limb	fractures closed reduction

HAND SURGERY	
Procedure	Alternative search terms
Elective Major >1 Digit	hand
Elective Minor	hand
Traumatic Major >1 Digit	hand
Traumatic Minor	hand

KNEE SURGERY	
Procedure	Alternative search terms
Arthroscopy diagnostic	arthroscop knee arthroscopic
Arthroscopy therapeutic	arthroscop knee
Ligament acute	knee osteotomy
Ligament chronic	hip osteotomy knee
Osteotomy	knee

ORIF LOWER LIMB	
Procedure	Alternative search terms
Ankle	orif lower limb
Femur	orif lower limb
ORIF NOF	orif lower limb
Other	orif lower limb
Prosthesis NOF	orif lower limb
Tibia	orif lower limb





ORIF UPPER LIMB	
Procedure	Alternative search terms
Carpus	orif upper limb
Clavicle	orif upper limb
Humerus	orif upper limb
Other	orif upper limb
Radius	orif upper limb
Ulna	orif upper limb

OSTEOMYELITIS & JOINT WASHOUT	
Procedure	Alternative search terms
Removal of implants	osteomyelitis joint joints

PAEDIATRIC SURGERY	
Procedure	Alternative search terms
Feet Major	Paediatrics
Feet Minor	Paediatrics
Hips CDH	Paediatrics
Osteotomy	Paediatrics
Other Major	Paediatrics
Other Minor	Paediatrics
Spine	Paediatrics

SHOULDER SURGERY	
Procedure	Alternative search terms
Arthroplasty	shoulder
Arthroscopy & decompression	shoulder decompression
Other	shoulder
Rotator Cuff	shoulder
Stabilisation	shoulder

SOFT TISSUE SURGERY	
Procedure	Alternative search terms
Major wounds	soft tissue
Minor wounds	soft tissue
Tendons (exc hands)	soft tissue





SPINAL SURGERY	
Procedure	Alternative search terms
Adult scoliosis	spine spinal
Decompression laminectomy	spine spinal
Discectomy lumbar	spine spinal
Lumbar	spine spinal
Spinal Fusion Cervical	
Trauma	spine spinal

TOTAL JOINT REPLACEMENT	
Procedure	Alternative search terms
Hips Primary	total Joint Replacement
Hips Revision	total Joint Replacement
Knees Primary	total Joint Replacement
Knees Revision	total Joint Replacement

TUMOUR SURGERY	
Procedure	Alternative search terms
Amputations not digits	tumour
Biopsy & local resect	tumour
Major resection	tumour

ALL OTHER SURGERY	
Procedure	Alternative search terms
All other surgery	



Table S3 Appropriateness and Adjusted Appropriateness of assessable procedural doses

PROCEDURAL FACTORS	Total doses	Appropriate (no.) (%)	Inappropriate (no.) (%)	Univariate Appropriateness		Multivariable Appropriateness [§]		Mixed Effects Model: Adjusted Appropriateness (%) [95% CI]	
				Odds Ratio [95% CI]	P-Value	Odds Ratio [95% CI]	P-Value		
TOTALS	3,978	2,574 (64.7)	1,404 (35.3)	-	-	-	-	-	
HOSPITAL FACTORS									
Funding	Public	1,828	1,192 (65.2)	636 (34.8)	Ref	Ref	Excluded (Exc) ^a	Exc ^a	Exc ^a
	Private	2,150	1,382 (64.3)	768 (35.7)	0.96 [0.84-1.09]	0.541	Exc ^a	Exc ^a	Exc ^a
Peer group	Principal referral	504	338 (67.1)	166 (32.9)	1.15 [0.92-1.43]	0.227	1.16 [0.48-2.84]	0.739	66.4 [55.8-76.9]
	Public acute group A	1,082	692 (64.0)	390 (36.0)	Ref	Ref	Ref	Ref	64.1 [55.8-72.4]
	Public acute group B	118	88 (74.6)	30 (25.4)	1.65 [1.07-2.55]	0.023	1.14 [0.33-3.91]	0.838	66.0 [49.4-82.6]
	Public acute group C	107	67 (62.6)	40 (37.4)	0.94 [0.63-1.42]	0.783	1.32 [0.42-4.09]	0.636	68.1 [53.8-82.5]
	Private acute group A	190	123 (64.7)	67 (35.3)	1.03 [0.75-1.43]	0.836	1.15 [0.38-3.44]	0.804	66.2 [52.0-80.3]
	Private acute group B	787	424 (53.9)	363 (46.1)	0.66 [0.55-0.79]	<0.005	0.76 [0.30-1.93]	0.561	59.7 [47.6-71.9]
	Private acute group C	269	191 (71.0)	78 (29.0)	1.38 [1.03-1.85]	0.030	3.43 [1.27-9.26]	0.015	80.2 [71.4-88.9]
	Private acute group D	777	525 (67.6)	252 (32.4)	1.17 [0.97-1.43]	0.106	2.08 [0.79-5.48]	0.139	74.3 [64.2-84.5]
	Mixed day procedure	2	1 (50.0)	1 (50.0)	Exc ^b	Exc ^b	Exc ^b	Exc ^b	Exc ^b
	Other acute specialised	125	118 (94.4)	7 (5.6)	Exc ^b	Exc ^b	Exc ^b	Exc ^b	Exc ^b
Childrens'	17	7 (41.2)	10 (58.8)	Exc ^b	Exc ^b	Exc ^b	Exc ^b	Exc ^b	
PATIENT FACTORS									
Gender	Male	1,959	1,293 (66.0)	666 (34.0)	Ref	Ref	Ref	Ref	68.3 [63.8-72.8]
	Female	1,968	1,247 (63.4)	721 (36.6)	0.89 [0.78-1.02]	0.084	0.89 [0.74-1.09]	0.262	66.7 [62.1-71.3]
	Unknown	51	34 (66.7)	17 (33.3)	Exc ^c	Exc ^c	Exc ^c	Exc ^c	Exc ^c
Age	0-19	175	106 (60.6)	69 (39.4)	0.83 [0.60-1.13]	0.234	0.91 [0.54-1.52]	0.720	65.1 [56.8-73.3]
	20-39	489	328 (67.1)	161 (32.9)	1.09 [0.89-1.35]	0.399	1.55 [1.08-2.23]	0.016	72.6 [67.2-78.0]
	40-59	807	526 (65.2)	281 (34.8)	1.01 [0.85-1.19]	0.951	1.16 [0.89-1.51]	0.263	68.6 [63.6-73.7]
	60-79	2,029	1,320 (65.1)	709 (34.9)	Ref	Ref	Ref	Ref	66.5 [61.8-71.2]
	<80	475	292 (61.5)	183 (38.5)	0.86 [0.70-1.05]	0.142	0.86 [0.62-1.18]	0.349	64.2 [57.9-70.4]
	Unknown	3	2 (66.7)	1 (33.3)	Exc ^c	Exc ^c	Exc ^c	Exc ^c	Exc ^c
Allergies	Nil Known	3,207	2,127 (66.3)	1,080 (33.7)	Ref	Ref	Ref	Ref	67.7 [63.3-72.2]
	Not Documented	82	57 (69.5)	25 (30.5)	1.16 [0.72-1.86]	0.546	1.26 [0.55-2.87]	0.584	71.0 [59.2-82.7]
	Present (beta-lactam antibiotic)	448	242 (54.0)	206 (56.0)	0.60 [0.49-0.73]	<0.005	0.81 [0.59-1.11]	0.184	64.6 [58.5-70.8]
	Present (non beta-lactam antibiotic)	140	86 (61.4)	54 (38.6)	0.81 [0.57-1.15]	0.232	1.01 [0.61-1.64]	0.983	67.8 [59.8-75.9]
	Present (non antibiotic)	101	62 (61.4)	39 (38.6)	0.81 [0.54-1.21]	0.303	1.12 [0.62-2.01]	0.707	69.3 [60.3-78.4]
ASA score	1	759	482 (63.5)	277 (36.5)	Ref	Ref	Ref	Ref	67.2 [61.8-72.5]
	2	1,510	969 (64.2)	541 (35.8)	1.03 [0.86-1.23]	0.755	0.94 [0.71-1.24]	0.651	66.2 [61.5-70.9]
	3	1,043	674 (64.6)	369 (35.4)	1.05 [0.86-1.28]	0.626	1.16 [0.84-1.62]	0.368	69.3 [64.5-74.2]
	4	78	48 (61.5)	30 (38.5)	0.92 [0.57-1.49]	0.732	1.37 [0.66-2.85]	0.393	71.6 [61.8-81.4]
	Unknown/ Not applicable	588	401 (68.2)	187 (31.8)	Exc ^c	Exc ^c	Exc ^c	Exc ^c	Exc ^c
PROCEDURAL FACTORS									

Surgery Number for Admission	Initial	3,813	2,483 (65.1)	1,330 (34.9)	Ref	Ref	Ref	Ref	67.7 [63.4-72.1]
	Subsequent	165	91 (55.2)	74 (44.9)	0.66 [0.48-0.90]	0.009	0.67 [0.41-1.11]	0.120	61.7 [52.8-70.7]
Elective or Emergency	Elective	3,380	2,185 (64.6)	1,195 (35.4)	Ref	Ref	Ref	Ref	67.7 [63.3-72.2]
	Emergency	556	363 (65.3)	193 (34.7)	1.03 [0.85-1.24]	0.769	0.91 [0.58-1.43]	0.674	66.3 [59.1-73.5]
	Not Assessable	42	26 (61.9)	16 (38.1)	Exc ^c	Exc ^c	Exc ^c	Exc ^c	Exc ^c
Trauma	No	3,469	2,230 (64.3)	1,239 (35.72)	Ref	Ref	Ref	Ref	67.0 [62.6-71.5]
	Yes	509	344 (67.6)	165 (32.4)	1.16 [0.95-1.41]	0.146	1.28 [0.81-2.00]	0.288	70.5 [63.7-77.3]
Removal or insertion of prosthetic material	No	1,198	702 (58.6)	496 (41.4)	Ref	Ref	Ref	Ref	59.9 [54.5-65.3]
	Yes	2,780	1,872 (67.3)	908 (32.7)	1.46 [1.27-1.67]	<0.005	2.09 [1.63-2.66]	<0.005	70.9 [66.6-75.3]
Wound category	Clean	3,624	2,336 (64.5)	1,288 (35.6)	Ref	Ref	Ref	Ref	67.6 [63.3-72.0]
	Clean-contaminated	57	28 (49.1)	29 (50.9)	0.53 [0.32-0.90]	0.018	0.53 [0.25-1.01]	0.098	57.9 [45.2-70.7]
	Contaminated /Dirty	57	38 (66.7)	19 (33.3)	1.10 [0.63-1.92]	0.730	1.26 [0.55-2.91]	0.584	70.9 [59.1-82.7]
	Unknown/Not Applicable	240	172 (71.7)	68 (28.3)	Exc ^c	Exc ^c	Exc ^c	Exc ^c	Exc ^c
Orthopaedic procedure	Total knee joint replacement	1344	915 (68.1)	429 (31.9)	Ref	Ref	Ref	Ref	74.1 [69.5-78.7]
	Total hip joint replacement	880	571 (64.9)	309 (35.1)	0.87 [0.72-1.04]	0.118	0.76 [0.58-1.01]	0.059	70.6 [65.5-75.7]
	Knee surgery ^d	375	207 (55.2)	168 (44.8)	0.58 [0.46-0.73]	<0.005	0.26 [0.17-0.41]	<0.005	54.1 [46.9-61.4]
	Open reduction internal fixation (ORIF)	485	345 (71.1)	140 (28.9)	1.16 [0.92-1.45]	0.213	0.66 [0.41-1.05]	0.082	68.4 [61.8-75.1]
	Shoulder surgery	324	205 (63.3)	119 (36.7)	0.81 [0.63-1.04]	0.098	0.49 [0.32-0.74]	0.001	64.0 [57.1-70.8]
	Other ^e	264	152 (57.6)	112 (42.4)	0.64 [0.49-0.83]	0.001	0.30 [0.19-0.47]	<0.005	56.2 [48.5-63.8]
	Foot and ankle surgery	175	104 (59.4)	71 (40.6)	0.69 [0.50-0.95]	0.023	0.30 [0.18-0.49]	<0.005	56.2 [47.8-64.6]
	Hand surgery	62	36 (58.1)	26 (41.9)	0.65 [0.39-1.09]	0.102	0.32 [0.15-0.69]	0.004	57.2 [44.5-70.0]
	Fractures closed reduction	29	20 (69.0)	9 (31.0)	1.04 [0.47-2.31]	0.919	0.64 [0.19-2.13]	0.471	68.2 [51.0-85.3]
Elbow surgery	40	19 (47.5)	21 (52.5)	0.42 [0.23-0.80]	0.008	0.73 [0.27-1.94]	0.525	69.9 [56.1-83.4]	
Antimicrobial	Cefazolin	3,435	2,442 (71.1)	993 (28.9)	Ref	Ref	Ref	Ref	73.6 [69.2-78.1]
	Gentamicin	207	18 (8.7)	189 (91.3)	0.04 [0.02-0.06]	<0.005	0.02 [0.01-0.04]	<0.005	12.4 [6.1-18.7]
	Vancomycin	177	44 (24.9)	133 (75.1)	0.13 [0.09-0.19]	<0.005	0.09 [0.05-0.14]	<0.005	31.4 [22.4-40.4]
	Cefalothin	34	27 (79.4)	7 (20.6)	1.57 [0.68-3.61]	0.291	0.34 [0.08-1.39]	0.133	55.6 [30.0-81.3]
	Clindamycin	36	7 (19.4)	29 (80.6)	0.10 [0.04-0.22]	<0.005	0.05 [0.02-0.13]	<0.005	22.8 [8.4-37.3]
	Other (6-18) ^f	89	36 (40.4)	53 (59.6)	Exc ^b	Exc ^b	Exc ^b	Exc ^b	Exc ^b

Ref= Reference group

Exc= Excluded

^a Excluded from multivariate analysis due to collinearity.

^b Excluded from analysis due to low number of prescriptions and/or proportions

^c Excluded from analysis due to unknown/ not applicable status

^d Knee surgery excluding total knee joint replacements.

^e Other surgical procedures included the following subcategories: 'Other', 'Soft tissue surgery', 'Sacrococcygeal tumour excision' and 'Osteomyelitis (removal of implants/joint washout)'.
^f Other antimicrobials= outside of the top five most frequently prescribed.

^g Model C Statistic= 0.8420

Table S4 Appropriateness and Adjusted Appropriateness of assessable post-procedural prescriptions

POST-PROCEDURAL FACTORS		Total doses	Appropriate (no.) (%)	Inappropriate (no.) (%)	Univariate Appropriateness		Multivariable Appropriateness ^a		Mixed Effects Model: Adjusted Appropriateness (%) [95% CI]
					Odds Ratio [95% CI]	P-Value	Odds Ratio [95% CI]	P-Value	
TOTALS		2,731	1,320 (48.3)	1,411 (51.7)					
HOSPITAL FACTORS									
Funding	Public	1,242	627 (50.5)	615 (49.5)	Ref	Ref	Excluded (Exc) ^a	Exc ^a	Exc ^a
	Private	1,489	693 (46.5)	796 (53.5)	0.85 [0.73-0.99]	0.040	Exc ^a	Exc ^a	Exc ^a
Peer group	Principal referral	326	145 (44.5)	181 (55.5)	0.66 [0.51-0.86]	0.002	0.65 [0.15-2.82]	0.565	43.5 [27.2-59.9]
	Public acute group A	783	429 (54.8)	354 (45.2)	Ref	Ref	Ref	Ref	49.6 [36.9-62.3]
	Public acute group B	62	28 (45.2)	34 (54.8)	0.68 [0.40-1.14]	0.145	1.17 [0.13-10.69]	0.889	51.8 [23.5-80.2]
	Public acute group C	66	23 (34.9)	43 (65.2)	0.44 [0.26-0.75]	0.002	0.17 [0.02-1.61]	0.122	26.3 [3.2-49.5]
	Private acute group A	123	52 (42.3)	71 (57.7)	0.60 [0.41-0.89]	0.010	0.37 [0.06-2.28]	0.285	35.9 [15.2-56.7]
	Private acute group B	625	162 (25.9)	463 (74.1)	0.29 [0.23-0.36]	<0.005	0.74 [0.16-3.49]	0.704	45.3 [27.6-63.1]
	Private acute group C	229	111 (48.5)	118 (51.5)	0.78 [0.58-1.04]	0.092	0.73 [0.15-3.746]	0.689	45.1 [27.2-63.0]
	Private acute group D	440	303 (68.9)	137 (31.1)	1.83 [1.43-2.33]	<0.005	14.49 [2.69-78.07]	0.002	81.6 [69.3-93.9]
	Other acute specialised	72	65 (90.3)	7 (9.7)	Exc ^b	Exc ^b	Exc ^b	Exc ^b	Exc ^b
Childrens ^c	5	2 (40.0)	3 (60.0)	Exc ^b	Exc ^b	Exc ^b	Exc ^b	Exc ^b	
PATIENT FACTORS									
Gender	Male	1,275	634 (49.7)	641 (50.3)	Ref	Ref	Ref	Ref	52.3 [45.5-59.1]
	Female	1,421	662 (46.6)	759 (53.4)	0.88 [0.76-1.03]	0.103	0.97 [0.76-1.25]	0.844	51.9 [45.2-58.7]
	Unknown	35	24 (68.6)	11 (31.4)	Exc ^c	Exc ^c	Exc ^c	Exc ^c	Exc ^c
Age	0-19	84	45 (53.6)	39 (46.4)	1.20 [0.77-1.86]	0.427	2.05 [0.94-4.46]	0.070	59.9 [48.8-71.0]
	20-39	242	110 (46.5)	132 (54.6)	0.86 [0.66-1.13]	0.290	1.41 [0.85-2.36]	0.187	55.1 [46.4-63.8]
	40-59	515	246 (47.8)	269 (52.2)	0.95 [0.78-1.16]	0.596	1.29 [0.92-1.80]	0.146	53.9 [46.5-61.2]
	60-79	1,529	751 (49.1)	778 (50.9)	Ref	Ref	Ref	Ref	50.6 [43.8-57.4]
	<80	359	167 (46.5)	192 (53.5)	0.90 [0.72-1.13]	0.375	1.12 [0.74-1.70]	0.587	52.1 [44.1-60.1]
	Unknown	2	1 (50.0)	1 (50.0)	Exc ^c	Exc ^c	Exc ^c	Exc ^c	Exc ^c
Allergies	Nil Known	2,187	1,071 (49.0)	1,116 (51.0)	Ref	Ref	Ref	Ref	52.5 [45.8-59.1]
	Not Documented	47	24 (51.1)	23 (48.9)	1.09 [0.61-1.94]	0.777	1.33 [0.43-4.15]	0.625	56.2 [40.2-72.1]
	Present (beta-lactam antibiotic)	317	147 (46.4)	170 (53.6)	0.90 [0.71-1.14]	0.387	0.81 [0.54-1.23]	0.331	49.8 [41.5-58.0]
	Present (other antibiotics)	107	42 (39.3)	65 (60.7)	0.67 [0.45-1.00]	0.051	0.63 [0.35-1.15]	0.134	46.5 [36.6-56.3]
	Present (non-antibiotic)	73	36 (49.3)	37 (50.7)	1.01 [0.64-1.62]	0.954	1.30 [0.59-2.87]	0.508	52.5 [45.8-59.1]
ASA score	1	428	197 (46.0)	231 (54.0)	Ref	Ref	Ref	Ref	49.9 [42.1-57.6]
	2	1,077	546 (50.7)	531 (49.3)	1.21 [0.96-1.51]	0.102	1.22 [0.83-1.80]	0.310	52.5 [45.7-59.3]
	3	774	359 (46.4)	415 (53.6)	1.01 [0.80-1.29]	0.906	1.20 [0.78-1.86]	0.407	52.3 [45.3-59.3]
	4	55	26 (47.3)	29 (52.7)	1.05 [0.60-1.84]	0.862	1.81 [0.69-4.75]	0.226	57.6 [44.7-70.5]
	Unknown/ Not applicable	397	192 (48.4)	205 (51.6)	Exc ^c	Exc ^c	Exc ^c	Exc ^c	Exc ^c
PROCEDURAL FACTORS									
Surgery number for admission	Initial	2,641	1,299 (49.2)	1,342 (50.8)	Ref	Ref	Ref	Ref	52.3 [45.7-58.8]
	Subsequent	90	21 (23.3)	69 (76.7)	0.31 [0.19-0.52]	<0.005	0.57 [0.26-1.25]	0.161	44.9 [32.9-56.8]

Elective or emergency	Elective	2,317	1,139 (49.2)	1,178 (50.8)	Ref	Ref	Ref	Ref	51.2 [44.6-57.9]
	Emergency	384	169 (44.0)	215 (56.0)	0.81 [0.65-1.01]	0.062	1.52 [0.82-2.82]	0.179	56.7 [47.4-66.0]
	Not Assessable	30	12 (40.0)	18 (60.0)	Exc ^c	Exc ^c	Exc ^c	Exc ^c	Exc ^c
Trauma	No	2,396	1,189 (49.6)	1,207 (50.4)	Ref	Ref	Ref	Ref	53.4 [46.8-60.1]
	Yes	335	131 (39.1)	204 (60.9)	0.65 [0.52-0.82]	<0.005	0.45 [0.24-0.83]	0.010	43.0 [33.6-52.4]
Removal or insertion of prosthetic material	No	684	341 (49.9)	343 (50.2)	Ref	Ref	Ref	Ref	50.3 [43.0-57.6]
	Yes				0.92 [0.78-1.10]	0.358	1.20 [0.86-1.68]	0.284	52.7 [46.0-59.4]
		2,047	979 (47.8)	1,068 (52.2)					
Wound category	Clean	2,490	1,195 (48.0)	1,295 (52.0)	Ref	Ref	Ref	Ref	51.9 [45.4-58.5]
	Clean-contaminated	30	17 (56.74)	13 (43.3)	1.42 [0.69-2.93]	0.3470.	1.57 [0.52-4.76]	0.429	57.8 [42.5-73.0]
	Contaminated/ Dirty	32	16 (50.0)	16 (50.0)	1.08 [0.54-2.18]	0.821	1.67 [0.40-6.93]	0.482	58.6 [39.6-77.5]
	Unknown/Not Applicable	179	92 (51.4)	87 (48.6)	Exc ^c	Exc ^c	Exc ^c	Exc ^c	Exc ^c
Surgical procedure group	Total knee joint replacement	1113	554 (49.8)	559 (50.2)	Ref	Ref	Ref	Ref	54.5 [47.4-61.6]
	Total hip joint replacement	710	378 (53.4)	332 (46.6)	1.15 [0.95-1.39]	0.149	0.77 [0.55-1.08]	0.125	51.0 [43.7-58.3]
	Knee surgery ^d	132	56 (42.4)	76 (57.6)	0.74 [0.52-1.07]	0.111	0.61 [0.31-1.21]	0.160	48.1 [38.1-58.1]
	Open reduction internal fixation	320	147 (45.9)	173 (54.1)	0.86 [0.67-1.10]	0.226	1.10 [0.60-2.03]	0.752	55.8 [46.9-64.7]
	Shoulder surgery	189	79 (41.8)	110 (58.2)	0.72 [0.53-0.99]	0.043	0.46 [0.26-0.81]	0.008	44.4 [35.3-53.4]
	Other ^e	119	50 (42.0)	69 (58.0)	0.73 [0.50-1.07]	0.109	0.47 [0.25-0.90]	0.024	44.7 [35.2-54.3]
	Foot and ankle surgery	91	39 (42.9)	52 (57.1)	0.76 [0.49-1.17]	0.206	0.58 [0.28-1.22]	0.153	47.4 [36.5-58.4]
	Hand surgery	26	7 (26.9)	19 (73.1)	0.37 [0.16-0.89]	0.027	0.34 [0.10-1.20]	0.095	40.7 [24.3-57.0]
	Fractures closed reduction	7	4 (57.1)	3 (42.9)	1.35 [0.30-6.04]	0.699	3.17 [0.23-43.78]	0.390	68.7 [38.9-95.6]
	Elbow surgery	24	6 (25.0)	18 (75.0)	0.34 [0.13-0.85]	0.022	0.95 [0.23-3.92]	0.947	53.9 [34.6-73.1]
Antimicrobials	1. Cefazolin	2,347	1,246 (53.1)	1,101 (46.9)	Ref	Ref	Ref	Ref	55.2 [48.4-61.9]
	2. Cefalexin	114	7 (6.1)	107 (93.9)	0.06 [0.03-0.12]	<0.005	0.04 [0.01-0.12]	<0.005	17.2 [6.6-27.8]
	3. Vancomycin	65	15 (23.1)	50 (76.9)	0.27 [0.15-0.47]	<0.005	0.19 [0.08-0.46]	<0.005	33.6 [21.6-45.65]
	4. Gentamicin	60	4 (6.7)	56 (93.3)	0.06 [0.02-0.17]	<0.005	0.10 [0.03-0.33]	<0.005	27.4 [13.0-41.7]
	5. Cefalothin	37	21 (56.8)	16 (43.2)	1.16 [0.60-2.23]	0.658	0.82 [0.17-3.87]	0.801	55.2 [33.7-76.6]
	Others (6-24) ^f	108	27 (25.0)	81 (75.0)	Exc ^b	Exc ^b	Exc ^b	Exc ^b	Exc ^b

Ref= Reference group

Exc= Excluded

^a Excluded from multivariate analysis due to collinearity.

^b Excluded from analysis due to low number of prescriptions and/or proportions

^c Excluded from analysis due to unknown/ not applicable status

^d Knee surgery excluding total knee joint replacements.

^e Other surgical procedures included the following subcategories: 'Other', 'Soft tissue surgery', 'Sacroccygeal tumour excision' and 'Osteomyelitis (removal of implants/joint washout)'.
^f Other antimicrobials= outside of the top five most frequently prescribed.

^g Model C Statistic= 0.8933

Table S5 Sub analysis 1: Appropriateness and adjusted appropriateness of assessable procedural doses for knee surgical procedures

PROCEDURAL FACTORS		Total doses	Appropriate (no.) (%)	Inappropriate (no.) (%)	Univariate Appropriateness		Multivariable Appropriateness ^e		Mixed Effects Model: Adjusted Appropriateness (%) [95% CI]
					Odds Ratio [95% CI]	P-Value	Odds Ratio [95% CI]	P-Value	
TOTAL (n)		1719	1122 (65.3)	597 (34.7)	1292		1292		1292
HOSPITAL FACTORS									
Peer group	Principal referral	153	86 (56.2)	67 (43.8)	0.62 [0.42-0.91]	0.016	0.60 [0.20-1.83]	0.374	59.9 [46.8-72.9]
	Public acute group A	371	250 (67.4)	121 (32.6)	Ref	Ref	Ref	Ref	67.0 [57.9-76.2]
	Public acute group B	33	29 (87.9)	4 (12.1)	3.51 [1.21-10.21]	0.021	2.78 [0.36-21.20]	0.324	79.3 [59.7-98.9]
	Public acute group C	51	31 (60.8)	20 (39.2)	0.75 [0.41-1.37]	0.350	1.01 [0.25-4.08]	0.986	67.2 [50.5-83.9]
	Private acute group A	63	49 (77.8)	14 (22.2)	1.69 [0.90-3.19]	0.102	2.30 [0.49-10.85]	0.293	77.3 [62.0-92.5]
	Private acute group B	484	280 (57.9)	204 (42.1)	0.66 [0.51-0.88]	0.005	0.62 [0.21-1.80]	0.378	60.2 [47.9-72.4]
	Private acute group C	137	98 (71.5)	39 (28.5)	1.22 [0.79-1.87]	0.372	2.07 [0.62-6.89]	0.237	76.1 [65.0-87.2]
	Private acute group D	378	256 (67.7)	122 (32.3)	1.02 [0.75-1.38]	0.921	1.96 [0.64-5.96]	0.236	75.5 [65.4-85.6]
	Other acute specialised	45	43 (95.6)	2 (4.4)	Excluded (exc) ^a	Exc ^a	Exc ^a	Exc ^a	Exc ^a
Childrens'	4	0 (0.0)	4 (100.0)	Exc ^a	Exc ^a	Exc ^a	Exc ^a	Exc ^a	
PATIENT FACTORS									
Gender	Male	827	542 (65.5)	285 (34.5)	Ref	Ref	Ref	Ref	69.1 [63.7-74.4]
	Female	877	566 (64.5)	311 (35.5)	0.96 [0.78-1.17]	0.665	0.85 [0.62-1.16]	0.306	66.7 [61.4-72.4]
	Unknown	15	14 (93.3)	1 (6.7)	Exc ^b	Exc ^b	Exc ^b	Exc ^b	Exc ^b
Age	0-19	62	39 (62.9)	23 (37.1)	0.84 [0.50-1.44]	0.532	1.48 [0.52-4.23]	0.464	71.5 [58.9-84.2]
	20-39	163	109 (66.9)	54 (33.1)	1.00 [0.71-1.43]	0.978	2.42 [1.14-5.13]	0.021	77.2 [69.4-85.0]
	40-59	305	186 (61.0)	119 (39.0)	0.78 [0.60-1.01]	0.063	1.17 [0.75-1.83]	0.476	68.6 [62.1-75.1]
	60-79	1026	685 (66.8)	341 (33.2)	Ref	Ref	Ref	Ref	66.5 [60.9-72.1]
	<80	161	102(63.4)	59 (36.6)	0.86 [0.61-1.22]	0.395	0.77 [0.45-1.32]	0.340	62.9 [54.2-71.6]
	Unknown	2	1 (50.0)	1 (50.0)	Exc ^b	Exc ^b	Exc ^b	Exc ^b	Exc ^b
Allergies	Nil Known	1404	938 (66.8)	466 (33.2)	Ref	Ref	Ref	Ref	68.2 [63.1-73.3]
	Not Documented	35	27 (77.1)	8 (22.9)	1.68 [0.76-3.72]	0.204	3.72 [0.87-15.90]	0.076	82.7 [69.6-95.9]
	Present (beta-lactam antibiotic)	185	100 (54.1)	85 (45.9)	0.58 [0.43-0.80]	0.001	0.72 [0.44-1.17]	0.179	63.6 [55.6-71.7]
	Present (non beta-lactam antibiotic)	41	25 (61.0)	16 (39.0)	0.78 [0.41-1.47]	0.436	1.28 [0.50-3.29]	0.608	71.4 [59.2- 83.5]
	Present (non antibiotic)	54	32 (59.3)	22 (40.7)	0.72 [0.42-1.26]	0.250	0.86 [0.40-1.87]	0.711	66.2 [54.9-77.6]
ASA score	1	270	162 (23.0)	108 (76.0)	Ref	Ref	Ref	Ref	66.3 [58.6-73.9]
	2	688	460 (66.9)	228 (33.1)	1.35 [1.01-1.80]	0.046	1.15 [0.69-1.93]	0.591	68.2 [62.8-73.6]
	3	465	309 (66.5)	156 (33.5)	1.32 [0.97-1.80]	0.079	1.21 [0.69-2.14]	0.511	68.8 [62.9-74.7]
	4	16	10 (62.5)	6 (37.5)	1.11 [0.39-3.15]	0.843	0.80 [0.18-3.55]	0.769	63.2 [42.8-83.6]
	Unknown/ Not applicable	280	181 (64.6)	99 (35.4)	Exc ^b	Exc ^b	Exc ^b	Exc ^b	Exc ^b
PROCEDURAL FACTORS									
Surgery Number for Admission	Initial	1667	1092 (65.5)	575 (34.5)	Ref	Ref	Ref	Ref	67.9 [62.9-72.9]
	Subsequent	52	30 (57.7)	22 (42.3)	0.72 [0.41-1.26]	0.246	1.13 [0.40-3.22]	0.816	69.5 [55.5-83.5]
	Elective	1664	1094 (65.7)	570 (34.3)	Ref	Ref	Ref	Ref	67.9 [62.9-72.9]

Elective or Emergency	Emergency	35	19 (54.3)	16 (45.7)	0.62 [0.32-1.21]	0.162	1.39 [0.31-6.14]	0.665	72.1 [53.6-90.5]
	Not Assessable	20	9 (45.0)	11 (55.0)	Exc ^b	Exc ^b	Exc ^b	Exc ^b	Exc ^b
Trauma	No	1692	1109 (65.5)	583 (34.5)	Ref	Ref	Ref	Ref	68.1 [63.1-73.1]
	Yes	27	13 (48.1)	14 (51.9)	0.49 [0.23-1.05]	0.065	0.49 [0.13-1.88]	0.297	57.9 [37.0-78.8]
Removal or of insertion prosthetic material	No	479	261 (54.5)	218 (45.5)	Ref	Ref	Ref	Ref	61.5 [54.5-68.5]
	Yes	1240	861 (69.4)	379 (30.6)	1.90 [1.53-2.36]	<0.001	1.96 [1.26-3.06]	0.003	70.8 [65.5-76.0]
Wound category	Clean	1605	1041 (64.9)	564 (35.1)	Ref	Ref	Ref	Ref	68.1 [63.1-73.1]
	Clean-contaminated	12	5 (41.7)	7 (58.2)	0.39 [0.12-1.22]	0.106	0.30 [0.04-2.09]	0.222	50.3 [19.6-80.9]
	Contaminated /Dirty	8	3 (37.5)	5 (62.5)	0.33 [0.08-1.37]	0.125	0.64 [0.07-5.95]	0.698	62.0 [30.0-94.0]
	Unknown/Not Applicable	94	73 (77.7)	21 (22.3)	Exc ^b	Exc ^b	Exc ^b	Exc ^b	Exc ^b
Orthopaedic knee surgical procedure	Primary total knee joint replacement	1249	861 (68.9)	388 (31.1)	Ref	Ref	Ref	Ref	72.5 [67.3-77.8]
	Revision total knee joint replacement	95	54 (56.8)	41 (43.2)	0.59 [0.39-0.91]	0.016	0.92 [0.41-2.06]	0.832	71.4 [60.5-82.4]
	Knee arthroscopy - diagnostic	52	20 (38.5)	32 (61.5)	0.28 [0.16-0.50]	<0.001	0.10 [0.03-0.27]	<0.001	36.7 [21.1-52.3]
	Knee arthroscopy- therapeutic	191	83 (43.5)	108 (56.5)	0.35 [0.25-0.47]	<0.001	0.15 [0.07-0.30]	<0.001	43.6 [32.6-54.6]
	Knee - ligament	119	94 (79.0)	25 (21.0)	1.69 [1.07-2.68]	0.024	1.08 [0.42-2.78]	0.867	73.5 [62.5-84.6]
	Knee - osteotomy	13	10 (76.9)	3 (23.1)	1.50 [0.41-5.49]	0.538	0.75 [0.11-4.99]	0.767	68.8 [43.6-94.1]
Antimicrobial	Cefazolin	1449	1053 (72.7)	396 (26.3)	Ref	Ref	Ref	Ref	75.2 [70.0-80.4]
	Gentamicin	120	13 (10.8)	107 (89.2)	0.05 [0.03-0.08]	<0.001	0.02 [0.01-0.05]	<0.001	16.5 [7.4-25.5]
	Vancomycin	93	25 (26.9)	68 (74.1)	0.14 [0.09-0.22]	<0.001	0.09 [0.04-0.17]	<0.001	35.6 [23.3-47.9]
	Cefalothin	28	26 (92.9)	2 (7.1)	4.89 [1.16-20.69]	0.031	1.23 [0.10-15.25]	0.871	77.8 [Not estimable ^c]
	Clindamycin	11	1 (9.1)	10 (90.9)	0.04 [0.004-0.29]	0.002	0.02 [0.002-0.19]	0.001	15.7 [Not estimable ^c]
	Other (7) ^d	18	4 (22.2)	14 (77.8)	Exc ^a	Exc ^a	Exc ^a	Exc ^a	Exc ^a

Ref= Reference group

Exc= Excluded

^a Excluded from analysis due to low number of prescriptions and/or proportions

^b Excluded from analysis due to unknown/ not applicable status

^c Adjusted appropriateness 95% CI not estimable due to low number of prescriptions and/or proportions

^d Other antimicrobials= seven other antimicrobials prescribed (n=<5)

^e Model C Statistic= 0.8765

Table S6 Sub analysis 2: Appropriateness and adjusted appropriateness of assessable post-procedural prescriptions for knee surgical procedures

POST-PROCEDURAL FACTORS		Total doses	Appropriate (no.) (%)	Inappropriate (no.) (%)	Univariate Appropriateness		Multivariable Appropriateness ^f		Mixed Effects Model: Adjusted Appropriateness (%) [95% CI]
					Odds Ratio [95% CI]	P-Value	Odds Ratio [95% CI]	P-Value	
TOTALS		1245	610 (49.0)	635 (51.0)	877		877		877
HOSPITAL FACTORS									
Peer group	Principal referral	96	42 (43.8)	54 (56.2)	0.49 [0.31-0.79]	0.003	0.61 [0.09-4.16]	0.615	48.8 [27.9-69.7]
	Public acute group A	288	176 (61.1)	112 (38.9)	Ref	Ref	Ref	Ref	55.3 [40.8-69.8]
	Public acute group B	16	10 (62.5)	6 (37.5)	1.06 [0.38-3.00]	0.912	0.68 [0.03-16.90]	0.813	50.2 [10.0-90.3]
	Public acute group C	29	7 (24.1)	22 (75.9)	0.20 [0.08-0.49]	<0.001	0.10 [0.01-1.46]	0.093	27.0 [1.9-52.1]
	Private acute group A	42	21 (50.0)	21 (50.0)	0.63 [0.33-1.22]	0.173	0.50 [0.05-4.72]	0.548	46.2 [20.3-72.1]
	Private acute group B	405	95 (23.5)	310 (76.5)	0.20 [0.14-0.27]	<0.001	0.29 [0.05-1.83]	0.188	38.9 [20.2-57.7]
	Private acute group C	129	75 (58.1)	54 (41.9)	0.88 [0.58-1.35]	0.567	0.68 [0.10-4.67]	0.697	50.3 [29.5-71.0]
	Private acute group D	201	151 (75.1)	50 (24.9)	1.92 [1.29-2.86]	0.001	16.82 [2.04-139.05]	0.009	84.6 [71.9-97.3]
	Other acute specialised	37	33 (89.2)	4 (10.8)	Excluded (Exc) ^a	Exc ^a	Exc ^a	Exc ^a	Exc ^a
Childrens'	2	0 (0.0) (89.2)	2 (100.0)	Exc ^a	Exc ^a	Exc ^a	Exc ^a	Exc ^a	
PATIENT FACTORS									
Gender	Male	574	280 (48.8)	294 (51.2)	Ref	Ref	Ref	Ref	54.5 [46.0-62.9]
	Female	662	322 (48.6)	340 (51.4)	0.99 [0.80-1.24]	0.961	0.78 [0.52-1.19]	0.253	51.5 [43.3-59.8]
	Unknown	9	8 (88.9)	1 (11.1)	Exc ^b	Exc ^b	Exc ^b	Exc ^b	Exc ^b
Age	0-19	31	15 (48.4)	16 (51.6)	0.95 [0.46-1.94]	0.881	0.88 [0.17-4.56]	0.880	50.8 [30.5-71.1]
	20-39	71	30 (42.3)	41 (57.7)	0.74 [0.45-1.21]	0.226	0.81 [0.21-3.07]	0.758	49.8 [33.4-66.2]
	40-59	203	96 (47.3)	107 (52.7)	0.91 [0.67-1.23]	0.529	1.19 [0.68-2.07]	0.548	54.4 [44.8-64.0]
	60-79	824	410 (49.8)	414 (50.2)	Ref	Ref	Ref	Ref	52.3 [44.1-60.6]
	<80	115	58 (50.4)	57 (49.6)	1.03 [0.70-1.52]	0.892	1.36 [0.68-2.74]	0.383	56.1 [45.1-67.0]
	Unknown	1	1 (100.0)	0 (0.0)	Exc ^b	Exc ^b	Exc ^b	Exc ^b	Exc ^b
Allergies	Nil Known	1003	494 (49.3)	509 (50.7)	Ref	Ref	Ref	Ref	52.7 [44.6-60.7]
	Not Documented	24	13 (54.2)	11 (45.8)	1.22 [0.54-2.74]	0.635	1.07 [0.19-6.00]	0.935	53.5 [31.5-75.6]
	Present (beta-lactam antibiotic)	142	71 (50.0)	71 (50.0)	1.03 [0.73-1.46]	0.868	1.00 [0.52-1.93]	0.995	52.7 [42.2-63.2]
	Present (non beta-lactam antibiotic)	34	14 (41.2)	20 (58.8)	0.72 [0.36-1.44]	0.356	1.03 [0.37-2.89]	0.958	53.0 [38.7-67.3]
	Present (non antibiotic)	42	18 (42.9)	24 (57.1)	0.77 [0.41-1.44]	0.418	1.37 [0.51-3.72]	0.536	56.5 [42.4-70.5]
ASA score	1	152	63 (41.4)	89 (58.6)	Ref	Ref	Ref	Ref	44.9 [34.0-55.8]
	2	521	273 (52.4)	248 (47.6)	1.56 [1.08-2.24]	0.018	2.38 [1.10-5.16]	0.027	55.3 [47.0-63.7]
	3	357	170 (47.6)	187 (52.4)	1.28 [0.87-1.89]	0.201	1.78 [0.78-4.07]	0.173	51.8 [43.1-60.5]
	4	12	9 (75.0)	3 (25.0)	4.24 [1.1-16.28]	0.035	7.22 [0.78-67.03]	0.082	68.0 [44.6-91.4]
	Unknown/ Not applicable	203	95 (46.8)	108 (53.2)	Exc ^b	Exc ^b	Exc ^b	Exc ^b	Exc ^b
PROCEDURAL FACTORS									
Surgery Number for Admission	Initial	1203	605 (50.3)	598 (49.7)	Ref	Ref	Ref	Ref	53.4 [45.4-61.4]
	Subsequent	42	5 (11.9)	37 (88.1)	0.13 [0.05-0.34]	<0.001	0.16 [0.03-0.85]	0.032	32.5 [4.1-50.9]

Elective or Emergency	Elective	1207	597 (49.5)	610 (50.5)	Ref	Ref	Ref	Ref	52.9 [44.9-60.8]
	Emergency	24	11 (45.8)	13 (54.2)	0.86 [0.38-1.95]	0.725	0.90 [0.11-7.33]	0.923	51.6 [25.5-77.8]
	Not Assessable	14	2 (14.3)	12 (85.7)	Exc ^b	Exc ^b	Exc ^b	Exc ^b	Exc ^b
Trauma	No	1227	605 (49.3)	622 (50.7)	Ref	Ref	Ref	Ref	53.1 [45.1-61.1]
	Yes	18	5 (27.8)	13 (72.2)	0.40 [0.14-1.12]	0.080	0.22 [0.03-1.63]	0.140	35.6 [13.4-57.9]
Removal or insertion of prosthetic material	No	264	130 (49.2)	134 (50.8)	Ref	Ref	Ref	Ref	51.6 [41.9-61.3]
	Yes	981	480 (48.9)	501 (51.1)	0.99 [0.75-1.30]	0.928	1.15 [0.62-2.11]	0.662	53.2 [45.1-61.4]
Wound category	Clean	1157	567 (49.0)	590 (51.0)	Ref	Ref	Ref	Ref	52.8 [44.8-60.8]
	Clean-contaminated	6	4 (66.7)	2 (33.3)	2.08 [0.38-11.41]	0.398	1.76 [0.07-43.95]	0.731	59.5 [21.7-97.3]
	Contaminated /Dirty	2	1 (50.0)	1 (50.0)	1.04 [0.06-16.68]	0.978	Exc ^c	Exc ^c	Exc ^c
	Unknown/Not Applicable	80	38 (47.5)	42 (52.5)	Exc ^b	Exc ^b	Exc ^b	Exc ^b	Exc ^b
Orthopaedic knee surgical procedure	Primary total knee joint replacement	1045	529 (50.6)	516 (49.4)	Ref	Ref	Ref	Ref	51.8 [43.6-60.0]
	Revision total knee joint replacement	68	25 (36.8)	43 (63.2)	0.57 [0.34-0.94]	0.029	2.58 [0.75-8.84]	0.133	63.0 [47.6-78.4]
	Knee arthroscopy- diagnostic	5	1 (20.0)	4 (80.0)	0.24 [0.03-2.19]	0.208	0.14 [<0.01-4.37]	0.261	29.5 [Not estimable ^d]
	Knee arthroscopy- therapeutic	48	19 (39.6)	29 (60.4)	0.64 [0.35-1.15]	0.138	1.00 [0.25-4.02]	0.997	51.8 [34.6-69.1]
	Knee- ligament	69	29 (42.0)	40 (58.0)	0.71 [0.43-1.16]	0.169	2.55 [0.55-11.78]	0.231	62.9 [45.5-80.2]
	Knee - osteotomy	10	7 (70.0)	3 (30.0)	2.28 [0.59-8.85]	0.235	0.90 [0.11-7.14]	0.922	50.6 [25.5-75.6]
Antimicrobial	Cefazolin	1090	578 (57.3)	512 (42.6)	Ref	Ref	Ref	Ref	55.5 [47.4-63.7]
	Cefalexin	25	0 (0.0)	25 (100.0)	0.07 [0.02-0.28]	<0.001	0.02 [<0.01-0.27]	0.004	13.6 [Not estimable ^d]
	Vancomycin	34	5 (14.7)	29 (85.3)	0.15 [0.06-0.40]	<0.001	0.06 [0.01-0.30]	0.001	23.9 [7.6-40.2]
	Gentamicin	29	2 (6.9)	27 (93.1)	1.59 [0.73-3.49]	0.242	1.16 [0.14-9.56]	0.889	57.3 [31.0-83.7]
	Cefalothin	28	18 (64.3)	10 (35.7)	0.09 [0.01-0.69]	0.021	0.05 [<0.01-0.66]	0.023	22.3 [Not estimable ^d]
	Other (12) ^e	39	7 (17.9)	32 (82.1)	Exc ^a	Exc ^a	Exc ^a	Exc ^a	Exc ^a

Ref= Reference group

Exc= Excluded

^a Excluded from analysis due to low number of prescriptions and/or proportions

^b Excluded from analysis due to unknown/ not applicable status

^c Removed from model due to successful predictions for perfect or failure

^d Adjusted appropriateness 95% CI not estimable due to low number of prescriptions and/or proportions

^e Other antimicrobials= twelve other antimicrobials prescribed (n=<11)

^f Model C Statistic= 0.9181

Table S7 Sub analysis 3: Appropriateness and adjusted appropriateness of assessable procedural doses for hip surgical procedures

PROCEDURAL FACTORS		Total doses	Appropriate (no.) (%)	Inappropriate (no.) (%)	Univariate Appropriateness		Multivariable Appropriateness ^f		Mixed Effects Model: Adjusted Appropriateness (%) [95% CI]
					Odds Ratio [95% CI]	P-Value	Odds Ratio [95% CI]	P-Value	
TOTALS		880	571 (64.9)	309 (35.1)	673		673		673
HOSPITAL FACTORS									
Peer group	Principal referral	91	70 (76.9)	21 (23.1)	1.73 [1.00-2.99]	0.049	2.69 [0.62-11.6]	0.186	61.6 [49.8-73.3]
	Public acute group A	278	183 (65.8)	95 (34.2)	Ref	Ref	Ref	Ref	73.8 [60.9-86.7]
	Public acute group B	21	16 (76.2)	5 (23.8)	1.66 [0.59-4.67]	0.336	1.02 [0.13-8.05]	0.986	61.8 [35.6-88.0]
	Public acute group C	36	27 (75.0)	9 (25.0)	1.56 [0.70-3.45]	0.274	2.48 [0.28-21.76]	0.413	72.9 [51.0-94.8]
	Private acute group A	56	33 (58.9)	23 (41.1)	0.75 [0.41-1.34]	0.325	2.32 [0.36-14.84]	0.375	72.2 [53.4-90.9]
	Private acute group B	168	85 (50.6)	83 (49.4)	0.53 [0.36-0.79]	0.002	0.78 [0.19-3.30]	0.737	58.1 [41.1-75.0]
	Private acute group C	40	25 (62.5)	15 (37.5)	0.87 [0.44-1.72]	0.679	2.25 [0.37-13.50]	0.376	71.8 [54.2-89.4]
	Private acute group D	182	124 (68.1)	58 (31.9)	1.11 [0.75-1.65]	0.608	3.48 [0.71-16.92]	0.123	76.4 [63.6-89.3]
	Other acute specialised	8	8 (100.0)	0 (0.0)	Excluded (Exc) ^a	Exc ^a	Exc ^a	Exc ^a	Exc ^a
PATIENT FACTORS									
Gender	Male	356	248 (69.7)	108 (30.7)	Ref	Ref	Ref	Ref	69.7 [63.0-76.3]
	Female	494	307 (62.1)	187 (37.9)	0.71 [0.53-0.96]	0.023	0.70 [0.44-1.12]	0.142	65.4 [58.8-71.9]
	Unknown	30	16 (53.3)	14 (46.7)	Exc ^b	Exc ^b	Exc ^b	Exc ^b	Exc ^b
Age	0-19	6	5 (83.3)	1 (16.7)	2.73 [0.32-23.56]	0.360	2.96 [0.18-49.18]	0.449	78.5 [Not estimable ^d]
	20-39	11	9 (81.8)	2 (18.2)	2.46 [0.53-11.50]	0.252	4.23 [0.31-57.18]	0.277	81.6 [Not estimable ^d]
	40-59	133	94 (70.7)	39 (29.3)	1.32 [0.87-1.99]	0.189	1.35 [0.69-2.64]	0.374	70.4 [61.6-79.3]
	60-79	563	364 (64.7)	199 (35.3)	Ref	Ref	Ref	Ref	66.8 [60.4-73.1]
	<80	167	99 (59.3)	68 (40.7)	0.80 [0.56-1.13]	0.206	0.82 [0.45-1.50]	0.511	64.2 [55.3-73.0]
Allergies	Nil Known	678	458 (67.6)	220 (32.4)	Ref	Ref	Ref	Ref	68.1 [62.0-74.3]
	Not Documented	14	9 (64.3)	5 (35.7)	0.86 [0.29-2.61]	0.796	0.74 [0.08-6.59]	0.793	64.4 [36.0-92.9]
	Present (beta-lactam antibiotic)	112	59 (52.7)	53 (46.3)	0.53 [0.36-0.80]	0.002	0.69 [0.33-1.45]	0.330	63.4 [53.0-73.9]
	Present (non beta-lactam antibiotic)	52	31 (59.6)	21 (40.4)	0.71 [0.40-1.26]	0.243	0.72 [0.31-1.69]	0.449	63.9 [51.8-76.1]
	Present (non antibiotic)	24	14 (58.3)	10 (41.7)	0.67 [0.29-1.54]	0.347	0.84 [0.24-2.98]	0.792	66.0 [49.4-82.6]
ASA score	1	71	47 (66.2)	24 (33.8)	Ref	Ref	Ref	Ref	67.9 [56.6-79.1]
	2	355	228 (64.2)	127 (35.8)	0.92 [0.54-1.57]	0.751	0.82 [0.34-1.96]	0.652	65.4 [58.6-72.2]
	3	305	197 (64.6)	108 (35.4)	0.93 [0.54-1.61]	0.798	1.07 [0.43-2.65]	0.892	68.6 [61.9-75.4]
	4	24	15 (62.5)	9 (37.5)	0.85 [0.33-2.23]	0.742	1.49 [0.26-8.37]	0.653	72.5 [55.6-89.3]
	Unknown/ Not applicable	125	84 (67.2)	41 (32.8)	Exc ^b	Exc ^b	Exc ^b	Exc ^b	Exc ^b
PROCEDURAL FACTORS									
Surgery Number for Admission	Initial	844	552 (65.4)	292 (34.6)	Ref	Ref	Ref	Ref	67.2 [61.3-73.2]
	Subsequent	36	19 (52.8)	17 (47.2)	0.59 [0.30-1.15]	0.124	0.80 [0.18-3.59]	0.766	64.3 [44.3-84.4]
	Elective	791	509 (64.3)	282 (35.7)	Ref	Ref	Ref	Ref	67.6 [61.5-73.8]
	Emergency	82	56 (68.3)	26 (31.7)	1.19 [0.73-1.94]	0.477	0.69 [0.19-2.49]	0.575	62.9 [46.5-79.3]

Elective or Emergency	Not Assessable	7	6 (85.7)	1 (14.3)	Exc ^b	Exc ^b	Exc ^b	Exc ^b	Exc ^b
Trauma	No	821	529 (64.4)	292 (35.6)	Ref	Ref	Ref	Ref	66.7 [60.6-72.9]
	Yes	59	42 (71.2)	17 (28.8)	1.36 [0.76-2.44]	0.296	1.51 [0.38-6.04]	0.563	71.6 [56.2-86.9]
Removal or insertion of prosthetic material	No	158	116 (73.4)	43 (26.4)	ref	Ref	Ref	Ref	69.8 [61.0-78.6]
	Yes	722	456 (63.2)	266 (36.8)	0.64 [0.44-0.94]	0.022	0.77 [0.38-1.53]	0.449	66.6 [60.4-72.8]
Wound category	Clean	828	532 (64.3)	296 (35.7)	Ref	Ref	Ref	Ref	67.1 [61.2-73.1]
	Clean-contaminated	3	3 (100.0)	0 (0.0)	Exc ^c	Exc ^c	Exc ^c	Exc ^c	Exc ^c
	Contaminated /Dirty	1	0 (0.0)	1 (100.0)	Exc ^c	Exc ^c	Exc ^c	Exc ^c	Exc ^c
	Unknown/Not Applicable	48	36 (75.0)	12 (25.0)	Exc ^b	Exc ^b	Exc ^b	Exc ^b	Exc ^b
Orthopaedic hip surgical procedure	Primary total hip joint replacement	793	517 (65.2)	276 (34.8)	Ref	Ref	Ref	Ref	66.5 [60.4-72.6]
	Revision total hip joint replacement	87	54 (62.1)	33 (37.9)	0.87 [0.55-1.38]	0.562	1.76 [0.61-5.08]	0.298	73.0 [61.6-84.5]
Antimicrobial	Cefazolin	727	550 (75.7)	177 (24.3)	Ref	Ref	Ref	Ref	76.3 [69.9-82.8]
	Gentamicin	75	3 (4.0)	72 (96.0)	0.13 [$<0.01-0.04$]	<0.001	0.01 [$<0.01-0.03$]	<0.001	8.5 [Not estimable ^d]
	Vancomycin	51	9 (17.6)	42 (82.4)	0.07 [0.03-0.14]	<0.001	0.05 [0.01-0.14]	<0.001	27.7 [10.5-44.9]
	Cefalothin	1	0 (0.0)	1 (100.0)	Exc ^c	Exc ^c	Exc ^c	Exc ^c	Exc ^c
	Clindamycin	7	4 (57.1)	3 (42.9)	0.43 [0.10-1.93]	0.271	0.39 [0.04-4.21]	0.434	62.3 [Not estimable ^d]
	Other (6) ^e	19	5 (26.3)	14 (74.7)	Exc ^a	Exc ^a	Exc ^a	Exc ^a	Exc ^a

Ref= Reference group

Exc= Excluded

^a Excluded from analysis due to low number of prescriptions and/or proportions

^b Excluded from analysis due to unknown/ not applicable status

^c Removed from model due to successful predictions for perfect or failure

^d Adjusted appropriateness 95% CI not estimable due to low number of prescriptions and/or proportions

^e Other antimicrobials= six other antimicrobials prescribed (n=<9).

^f Model C Statistic= 0.8999

Table S8 Sub analysis 4: Appropriateness and adjusted appropriateness of assessable post-procedural prescriptions for hip surgical procedures

POST -PROCEDURAL FACTORS		Total doses	Appropriate (no.) (%)	Inappropriate (no.) (%)	Univariate Appropriateness		Multivariable Appropriateness		Mixed Effects Model: Adjusted Appropriateness (%) [95% CI]
					Odds Ratio [95% CI]	P-Value	Odds Ratio [95% CI]	P-Value	
TOTALS		710	378 (53.2)	332 (46.8)	528		528		528
HOSPITAL FACTORS									
Peer group	Principal referral	73	34 (46.6)	39 (55.4)	0.43 [0.25-0.74]	0.002	1.05 [0.16-7.01]	0.957	57.5 [42.0-73.0]
	Public acute group A	224	150 (67.0)	74 (33.0)	Ref	Ref	Ref	Ref	58.2 [37.1-79.3]
	Public acute group B	17	10 (58.8)	7 (41.2)	0.70 [0.26-1.93]	0.495	0.74 [0.05-11.81]	0.832	53.3 [17.4-89.2]
	Public acute group C	35	16 (45.7)	19 (54.3)	0.42 [0.20-0.85]	0.017	0.13 [0.01-2.01]	0.144	29.6 [Not estimable ^d]
	Private acute group A	40	15 (37.5)	25 (62.5)	0.30 [0.15-0.59]	0.001	0.01 [<0.001 -0.36]	0.010	9.3 [Not estimable ^d]
	Private acute group B	131	39 (29.8)	92 (70.2)	0.21 [0.13-0.33]	<0.001	0.28 [0.04-1.90]	0.192	39.5 [18.0-60.9]
	Private acute group C	42	21 (50.0)	21 (50.0)	0.49 [0.25-0.96]	0.038	0.22 [0.02-2.21]	0.198	36.3 [10.0-62.6]
	Private acute group D	141	86 (61.0)	55 (39.0)	0.77 [0.50-1.20]	0.246	3.26 [0.42-25.32]	0.258	72.6 [53.5-91.6]
	Other acute specialised	7	7 (100.0)	0 (0.0)	Excluded (Exc ^a)	Exc ^a	Exc ^a	Exc ^a	Exc ^a
PATIENT FACTORS									
Gender	Male	285	172 (60.4)	113 (39.6)	Ref	Ref	Ref	Ref	51.8 [42.5-61.1]
	Female	402	191 (47.5)	211 (52.5)	0.59 [0.44-0.81]	0.001	1.11 [0.64-1.92]	0.722	53.1 [44.4-61.8]
	Unknown	23	15 (65.2)	8 (34.8)	Exc ^b	Exc ^b	Exc ^b	Exc ^b	Exc ^b
Age	0-19	7	7 (100.0)	0 (0.0)	Exc ^c	Exc ^c	Exc ^c	Exc ^c	Exc ^c
	20-39	8	4 (50.0)	4 (50.0)	0.94 [0.23-3.80]	0.930	0.56 [0.06-5.21]	0.610	44.7 [15.0-74.4]
	40-59	112	65 (58.0)	47 (42.0)	1.30 [0.85-1.98]	0.221	1.25 [0.60-2.62]	0.548	55.2 [43.7-66.6]
	60-79	446	230 (51.6)	216 (48.4)	Ref	Ref	Ref	Ref	52.2 [43.6-60.9]
	<80	137	72 (52.6)	65 (47.4)	1.04 [0.71-1.53]	0.840	0.97 [0.47-2.02]	0.938	51.9 [40.8-63.0]
Allergies	Nil Known	545	293 (53.8)	252 (46.4)	Ref	Ref	Ref	Ref	51.7 [43.3-60.2]
	Not Documented	11	5 (45.5)	6 (54.5)	0.72 [0.22-2.38]	0.586	1.27 [0.09-18.6]	0.861	54.9 [19.6-90.2]
	Present (beta-lactam antibiotic)	96	51 (53.1)	45 (46.9)	0.97 [0.63-1.51]	0.908	1.75 [0.72-4.25]	0.215	59.0 [46.5-71.4]
	Present (non beta-lactam antibiotic)	43	18 (41.9)	25 (58.1)	0.62 [0.33-1.16]	0.135	0.58 [0.21-1.60]	0.289	44.5 [29.7-59.3]
	Present (non antibiotic)	15	11 (73.3)	4 (26.7)	2.37 [0.74-7.52]	0.145	3.47 [0.41-28.97]	0.251	67.2 [42.6-91.9]
ASA score	1	58	33 (56.9)	25 (43.1)	Ref	Ref	Ref	Ref	52.3 [0.38-66.6]
	2	290	157 (54.1)	133 (45.9)	0.89 [0.51-1.58]	0.700	0.92 [0.33-2.54]	0.867	51.1 [42.1-60.1]
	3	245	126 (51.4)	119 (48.6)	0.80 [0.45-1.43]	0.454	1.13 [0.39-3.29]	0.829	53.8 [44.4-63.2]
	4	18	9 (50.0)	9 (50.0)	0.76 [0.26-2.19]	0.608	2.09 [0.25-17.66]	0.498	61.7 [37.3-86.1]
		Unknown/ Not applicable	99	53 (53.5)	46 (46.5)	Exc ^b	Exc ^b	Exc ^b	Exc ^b
PROCEDURAL FACTORS									
Surgery Number for Admission	Initial	691	371 (53.7)	320 (46.3)	Ref	Ref	Ref	Ref	52.4 [44.2-60.7]
	Subsequent	19	7 (36.8)	12 (63.2)	0.50 [0.20-1.29]	0.154	1.72 [0.18-16.42]	0.637	59.4 [30.4-88.5]
Elective or Emergency	Elective	644	343 (53.3)	301 (46.7)	Ref	Ref	Ref	Ref	52.7 [44.2-61.3]
	Emergency	59	30 (50.8)	29 (49.2)	0.91 [0.53-1.55]	0.722	0.89 [0.15-5.32]	0.902	51.3 [28.8-73.7]
	Not Assessable	7	5 (71.4)	2 (28.6)	Exc ^b	Exc ^b	Exc ^b	Exc ^b	Exc ^b

Trauma	No	668	358 (53.6)	310 (46.4)	Ref	Ref	Ref	Ref	53.1 [44.8-61.4]
	Yes	42	20 (47.6)	22 (52.4)	0.79 [0.42-1.47]	0.453	0.57 [0.08-3.90]	0.568	45.8 [20.8-70.8]
Removal or of insertion of prosthetic material	No	132	92 (69.7)	40 (30.0)	Ref	Ref	Ref	Ref	60.1 [49.0-71.3]
	Yes	578	286 (49.5)	292 (50.5)	0.43 [0.28-0.64]	<0.001	0.48 [0.23-1.04]	0.063	50.8 [42.2-59.3]
Wound category	Clean	661	348 (52.6)	313 (47.4)	Ref	Ref	Ref	Ref	52.6 [44.4-60.8]
	Clean-contaminated	1	1 (100.0)	0 (0.0)	Exc ^c	Exc ^c	Exc ^c	Exc ^c	Exc ^c
	Contaminated /Dirty	1	1 (100.0)	0 (0.0)	Exc ^c	Exc ^c	Exc ^c	Exc ^c	Exc ^c
	Unknown/Not Applicable	47	28 (59.6)	19 (40.4)	Exc ^b	Exc ^b	Exc ^b	Exc ^b	Exc ^b
Orthopaedic hip surgical procedure	Primary total hip joint replacement	660	356 (53.9)	304 (46.1)	Ref	Ref	Ref	Ref	52.6 [44.3-60.9]
	Revision total hip joint replacement	50	22 (44.0)	28 (56.0)	0.67 [0.38-1.20]	0.177	0.94 [0.24-3.63]	0.932	51.9 [33.4-70.3]
Antimicrobial	Cefazolin	634	364 (57.4)	270 (42.6)	Ref	Ref	Ref	Ref	55.4 [47.1-63.7]
	Cefalexin	3	1 (33.3)	2 (66.7)	0.05 [0.01-0.22]	<0.001	0.10 [0.02-0.52]	0.006	26.4 [6.6-46.2]
	Vancomycin	17	3 (17.6)	14 (82.4)	0.16 [0.05-0.56]	0.004	0.06 [0.01-0.45]	0.006	21.2 [1.1-41.4]
	Gentamicin	30	2 (6.7)	28 (93.3)	0.49 [0.08-2.98]	0.442	1.12 [0.05-25.72]	0.944	56.9 [15.7-98.1]
	Cefalothin	5	2 (40.0)	3 (60.0)	0.19 [0.02-1.67]	0.21	0.03 [<0.01-0.55]	0.019	13.9 [Not estimable ^d]
	Other (8) ^e	21	6 (28.6)	15 (71.4)	Exc ^a	Exc ^a	Exc ^a	Exc ^a	Exc ^a

Ref= Reference group

Exc= Excluded

^a Excluded from analysis due to low number of prescriptions and/or proportions

^b Excluded from analysis due to unknown/ not applicable status.

^c Removed from model due to successful predictions for perfect or failure

^d Adjusted appropriateness 95% CI not estimable due to low number of prescriptions and/or proportions

^e Other antimicrobials= eight other antimicrobials prescribed (n=<5)

^f Model C Statistic= 0.9252

Table S9 Sub analysis 5: Appropriateness and adjusted appropriateness of assessable procedural doses for open reduction internal fixation (ORIF) surgical procedures

PROCEDURAL FACTORS		Total doses	Appropriate (no.) (%)	Inappropriate (no.) (%)	Univariate Appropriateness		Multivariable Appropriateness ^h		Mixed Effects Model: Adjusted Appropriateness (%) [95% CI]
					Odds Ratio [95% CI]	P-Value	Odds Ratio [95% CI]	P-Value	
TOTAL (n)		485	345 (71.1)	140 (28.9)	351		351		351
HOSPITAL FACTORS									
Peer group	Principal referral	146	110 (75.3)	36 (24.7)	1.46 [0.91-2.33]	0.116	1.91 [0.69-5.30]	0.216	69.0 [58.4-79.6]
	Public acute group A	223	151 (67.7)	72 (32.3)	Ref	Ref	Ref	Ref	78.2 [68.6-87.9]
	Public acute group B	31	20 (64.5)	11 (35.5)	0.87 [0.39-1.91]	0.722	0.50 [0.10-4.47]	0.395	57.0 [30.9-83.0]
	Public acute group C	1	0	1 (100.0)	Exc ^c	Exc ^c	Exc ^c	Exc ^c	Exc ^c
	Private acute group A	16	13 (81.3)	3 (18.8)	2.07 [0.57-7.48]	0.269	2.94 [0.21-40.41]	0.420	83.2 [Not estimable ^d]
	Private acute group B	11	2 (18.2)	9 (81.8)	0.11 [0.02-0.50]	0.005	0.06 [0.01-0.59]	0.016	20.5 [Not estimable ^d]
	Private acute group C	10	8 (80.0)	2 (20.0)	1.91 [0.39-9.21]	0.422	1.64 [0.15-17.70]	0.683	76.3 [Not estimable ^d]
	Private acute group D	27	23 (85.2)	4 (14.8)	2.74 [0.91-8.22]	0.072	8.3 [0.77-90.42]	0.082	94.3 [Not estimable ^d]
	Other acute specialised	16	15 (93.8)	1 (6.2)	Excluded (Exc ^a)	Exc ^a	Exc ^a	Exc ^a	Exc ^a
Childrens'	4	3 (75.0)	1 (25.0)	Exc ^a	Exc ^a	Exc ^a	Exc ^a	Exc ^a	
PATIENT FACTORS									
Gender	Male	260	192 (73.8)	68 (26.2)	Ref	Ref	Ref	Ref	73.6 [66.7-80.5]
	Female	220	149 (67.7)	71 (32.3)	0.74 [0.50-1.10]	0.141	0.79 [0.42-1.48]	0.466	70.2 [62.1-78.4]
	Unknown	5	4 (80.0)	1 (20.0)	exc ^c	exc ^c	exc ^c	exc ^c	exc ^c
Age	0-19	46	30 (65.2)	16 (34.8)	0.80 [0.39-1.65]	0.541	0.69 [0.20-2.40]	0.555	65.8 [50.1-81.5]
	20-39	137	99 (72.3)	38 (27.7)	1.11 [0.64-1.92]	0.716	0.83 [0.30-2.29]	0.726	68.8 [58.4-79.2]
	40-59	98	79 (80.6)	19 (19.4)	1.77 [0.93-3.36]	0.082	1.45 [0.50-4.21]	0.494	76.5 [66.0-86.9]
	60-79	114	80 (70.2)	34 (29.8)	Ref	Ref	Ref	Ref	71.5 [60.6-82.3]
	<80	89	56 (62.9)	33 (37.1)	0.72 [0.40-1.30]	0.276	1.49 [0.45-4.94]	0.516	76.8 [63.5-90.1]
	Unknown	1	1 (100.0)	0	Exc ^b	Exc ^b	Exc ^b	Exc ^b	Exc ^b
Allergies	Nil Known	391	284 (72.6)	107 (27.4)	Ref	Ref	Ref	Ref	70.8 [64.3-77.4]
	Not Documented	18	13 (72.2)	5 (27.8)	0.98 [0.34-2.81]	0.969	1.33 [0.18-10.02]	0.784	74.8 [Not estimable ^d]
	Present (beta-lactam antibiotic)	58	37 (63.8)	21 (36.2)	0.66 [0.37-1.19]	0.166	1.73 [0.61-4.94]	0.305	78.1 [65.9-90.3]
	Present (non beta-lactam antibiotic)	14	9 (64.3)	5 (35.7)	0.68 [0.22-2.07]	0.495	1.68 [0.22-12.95]	0.619	77.7 [Not estimable ^d]
	Present (non antibiotic)	4	2 (50.0)	2 (50.0)	0.38 [0.05-2.71]	0.332	Exc ^c	Exc ^c	Exc ^c
ASA score	1	142	102 (71.8)	40 (28.2)	Ref	Ref	Ref	Ref	69.7 [59.7-79.6]
	2	158	113 (71.5)	45 (28.5)	0.98 [0.60-1.63]	0.952	1.06 [0.50-2.23]	0.885	70.5 [61.8-79.1]
	3	87	55 (63.2)	32 (36.8)	0.67 [0.38-1.19]	0.174	1.33 [0.41-4.24]	0.634	73.6 [62.1-85.2]
	4	26	16 (61.5)	10 (38.5)	0.63 [0.26-1.50]	0.294	5.63 [0.71-44.58]	0.102	88.4 [Not estimable ^d]
	Unknown/ Not applicable	72	59 (81.9)	13 (18.1)	Exc ^b	Exc ^b	Exc ^b	Exc ^b	Exc ^b
PROCEDURAL FACTORS									
Surgery Number for Admission	Initial	460	326 (70.9)	134 (29.1)	Ref	Ref	Ref	Ref	72.1 [66.0-78.2]
	Subsequent	25	19 (76.0)	6 (24.0)	1.30 [0.51-3.33]	0.582	1.04 [0.24-4.52]	0.956	72.7 [52.4-93.0]
	Elective	151	114 (75.5)	37 (24.5)	Ref	Ref	Ref	Ref	75.6 [64.7-86.5]

Elective or Emergency	Emergency	327	226 (69.1)	101 (30.9)	0.73 [0.47-1.13]	0.153	0.71 [0.27-1.85]	0.482	70.9 [63.8-77.9]
	Not Assessable	7	5 (71.4)	2 (28.6)	Exc ^b	Exc ^b	Exc ^b	Exc ^b	Exc ^b
Trauma	No	167	118 (70.7)	49 (29.3)	Ref	Ref	Ref	Ref	66.0 [54.6-77.5]
	Yes	318	227 (71.4)	91 (28.6)	1.04 [0.69-1.56]	0.867	1.75 [0.75-4.09]	0.196	74.2 [67.6-80.9]
Removal or of insertion prosthetic material	No	110	88 (80.0)	22 (20.0)	Ref	Ref	Ref	Ref	77.8 [67.8-87.9]
	Yes	375	257 (68.5)	118 (31.5)	0.54 [0.33-0.91]	0.021	0.58 [0.24-1.44]	0.242	70.6 [63.7-77.4]
Wound category	Clean	399	292 (73.2)	107 (26.8)	Ref	Ref	Ref	Ref	72.8 [66.7-78.9]
	Clean-contaminated	21	12 (57.1)	9 (42.9)	0.49 [0.20-1.19]	0.116	0.47 [0.13-1.70]	0.250	61.0 [39.4-82.6]
	Contaminated /Dirty	19	14 (73.7)	5 (26.3)	1.03 [0.36-2.92]	0.962	0.91 [0.21-3.95]	0.898	71.4 [50.3-92.6]
	Unknown/Not Applicable	46	27 (58.7)	19 (41.3)	Exc ^b	Exc ^b	Exc ^b	Exc ^b	Exc ^b
Orthopaedic ORIF surgical procedure	Neck of femur (NOF)	79	50 (63.3)	29 (36.7)	Ref	Ref	Ref	Ref	51.1 [33.2-69.0]
	Prosthetic NOF	21	9 (42.9)	12 (57.1)	0.43 [0.16-1.16]	0.095	0.42 [0.07-2.54]	0.341	35.5 [5.6-65.4]
	Upper limb ^e	211	156 (73.9)	55 (26.1)	1.65 [0.95-2.85]	0.077	4.43 [1.37-14.36]	0.013	75.3 [67.8-82.7]
	Lower limb ^f	174	130 (74.7)	44 (25.3)	1.71 [0.97-3.03]	0.065	5.39 [1.67-17.41]	0.005	77.8 [70.5-85.1]
Antimicrobial	Cefazolin	447	333 (74.5)	114 (25.6)	Ref	Ref	Ref	Ref	74.9 [68.8-81.1]
	Gentamicin	4	1 (25.0)	3 (75.0)	0.11 [0.01-1.11]	0.061	0.36 [0.01-9.99]	0.550	58.4 [Not estimable ^d]
	Vancomycin	13	4 (30.8)	9 (69.2)	0.15 [0.05-0.50]	0.002	0.02 [<0.01-0.19]	0.001	11.7 [Not estimable ^d]
	Cefalothin	1	0	1 (100.0)	Exc ^c	Exc ^c	Exc ^c	Exc ^c	Exc ^c
	Clindamycin	8	1 (12.5)	7 (87.5)	0.05 [0.01-0.40]	0.005	0.01 [<0.01-0.23]	0.004	7.9 [Not estimable ^d]
	Other (4) ^g	12	6 (50.0)	6 (50.0)	Exc ^a	Exc ^a	Exc ^a	Exc ^a	Exc ^a

Ref= Reference group

Exc= Excluded

^a Excluded from analysis due to low number of prescriptions and/or proportions

^b Excluded from analysis due to unknown/ not applicable status.

^c Removed from model due to successful predictions for perfect or failure

^d Adjusted appropriateness 95% CI not estimable due to low number of prescriptions and/or proportions

^e Upper limb includes: carpus, clavicle, humerus, metacarpal, phalanx, olecranon, radius, scaphoid, ulna

^f Lower limb includes: ankle, calcaneus, femur, patella, talus, tibia

^g Other antimicrobials= four other antimicrobials prescribed (n=<5).

^h Model C Statistic= 0.8544

Table S10 Sub analysis 6: Appropriateness and adjusted appropriateness of assessable post procedural prescriptions for open reduction internal fixation (ORIF) surgical procedures

POST-PROCEDURAL FACTORS		Total doses	Appropriate (no.) (%)	Inappropriate (no.) (%)	Univariate Appropriateness		Multivariable Appropriateness ^b		Mixed Effects Model: Adjusted Appropriateness (%) [95% CI]
					Odds Ratio [95% CI]	P-Value	Odds Ratio [95% CI]	P-Value	
TOTALS (n)		320	147 (45.9)	173 (54.1)	239	-	239	-	239
HOSPITAL FACTORS									
Peer group	Principal referral	100	53 (53.0)	47 (47.0)	1.24 [0.75-2.04]	0.402	1.04 [0.31-3.51]	0.950	43.4 [28.0-58.7]
	Public acute group A	163	95 (58.3)	68 (41.7)	Ref	Ref	Ref	Ref	42.7 [29.8-55.6]
	Public acute group B	16	9 (56.3)	7 (43.7)	1.09 [0.39-3.06]	0.875	1.80 [0.13-24.51]	0.657	52.6 [11.8-93.4]
	Private acute group A	9	4 (44.4)	5 (55.6)	1.75 [0.45-6.74]	0.419	5.77 [0.23-143.48]	0.285	70.5 [Not estimable ^d]
	Private acute group B	7	2 (28.6)	5 (71.4)	3.49 [0.66-18.54]	0.142	2.65 [0.16-45.25]	0.501	58.9 [Not estimable ^d]
	Private acute group C	8	6 (75.0)	2 (25.0)	0.47 [0.09-2.38]	0.358	0.14 [0.01-2.69]	0.190	15.1 [Not estimable ^d]
	Private acute group D	11	4 (14.3)	7 (85.7)	2.44 [0.69-8.68]	0.167	6.89 [0.46-102.15]	0.161	72.8 [Not estimable ^d]
	Other acute specialised Childrens'	5 1	5 (100.0) 1 (100.0)	0 (0.0) 0	Excluded (exc) ^a Exc ^a	Exc ^a Exc ^a	Exc ^a Exc ^a	Exc ^a Exc ^a	Exc ^a Exc ^a
PATIENT FACTORS									
Gender	Male	167	79 (47.3)	88 (52.7)	Ref	Ref	Ref	Ref	46.5 [36.3-56.7]
	Female	150	67 (44.7)	83 (55.3)	0.90 [0.58-1.40]	0.638	0.78 [0.37-1.65]	0.517	42.4 [31.5-53.3]
	Unknown	3	1 (33.3)	2 (66.7)	Exc ^b	Exc ^b	Exc ^b	Exc ^b	Exc ^b
Age	0-19	27	13 (48.1)	14 (51.9)	0.85 [0.35-2.07]	0.723	1.18 [0.23-6.00]	0.844	50.7 [27.2-74.2]
	20-39	88	44 (50.0)	44 (50.0)	0.92 [0.49-1.72]	0.787	0.87 [0.28-2.69]	0.807	45.7 [31.6-59.7]
	40-59	66	33 (50.0)	33 (50.0)	0.92 [0.47-1.80]	0.801	1.25 [0.39-3.98]	0.707	51.7 [37.0-66.4]
	60-79	69	36 (52.2)	33 (47.8)	Ref	Ref	Ref	Ref	48.0 [33.0-63.1]
	<80	69	21 (30.4)	48 (69.6)	0.40 [0.20-0.81]	0.010	0.34 [0.08-1.41]	0.138	30.7 [12.8-48.6]
	Unknown	1	0	1 (100.0)	Exc ^b	Exc ^b	Exc ^b	Exc ^b	Exc ^b
Allergies	Nil Known	265	125 (47.2)	140 (52.8)	Ref	Ref	Ref	Ref	45.3 [36.3-54.3]
	Not Documented	6	3 (50.0)	3 (50.0)	1.12 [0.22-5.65]	0.891	1.59 [0.09-26.84]	0.748	53.0 [7.1-98.8]
	Present (beta-lactam antibiotic)	39	13 (33.3)	26 (66.7)	0.56 [0.28-1.14]	0.109	0.61 [0.18-2.07]	0.428	37.3 [18.1-56.5]
	Present (non beta-lactam antibiotic)	8	4 (50.0)	4 (50.0)	1.12 [0.27-4.57]	0.875	1.02 [0.09-11.39]	0.988	45.6 [5.6-85.6]
	Present (non antibiotic)	2	2 (100.0)	0	Exc ^d	Exc ^d	Exc ^d	Exc ^d	Exc ^d
ASA score	1	86	44 (51.2)	42 (48.8)	Ref	Ref	Ref	Ref	41.1 [28.6-53.6]
	2	100	45 (45.0)	55 (55.0)	0.78 [0.44-1.39]	0.402	0.92 [0.37-2.24]	0.845	39.7 [28.3-51.0]
	3	72	32 (44.4)	40 (55.6)	0.76 [0.41-1.43]	0.400	2.38 [0.69-8.25]	0.171	55.0 [40.2-69.7]
	4	18	3 (16.7)	15 (83.3)	0.19 [0.05-0.71]	0.013	1.71 [0.22-13.17]	0.609	49.6 [20.2-79.0]
	Unknown/ Not applicable	44	23 (52.3)	21 (47.7)	Exc ^b	Exc ^b	Exc ^b	Exc ^b	Exc ^b
	PROCEDURAL FACTORS								
Surgery Number for Admission	Initial	310	143 (46.1)	167 (53.9)	Ref	Ref	Ref	Ref	45.1 [36.3-53.8]
	Subsequent	10	4 (40.0)	6 (60.0)	0.78 [0.22-2.81]	0.703	0.43 [0.06-3.05]	0.402	31.9 [3.1-60.6]
	Elective	76	36 (47.4)	40 (52.6)	Ref	Ref	Ref	Ref	33.3 [18.1-48.8]
	Emergency	236	107 (45.4)	129 (54.6)	0.92 [0.55-1.55]	0.757	2.46 [0.81-7.49]	0.113	47.8 [38.3-57.3]

Elective or Emergency	Not Assessable	8	4 (50.0)	4 (50.0)	Exc ^b	Exc ^b	Exc ^b	Exc ^b	Exc ^b
Trauma	No	107	58 (54.2)	49 (45.8)	Ref	Ref	Ref	Ref	49.0 [34.9-63.1]
	Yes	213	89 (41.8)	124 (58.2)	0.61 [0.38-0.97]	0.036	0.68 [0.25-1.80]	0.435	42.6 [32.6-52.6]
Removal or of insertion of prosthetic material	No	72	48 (66.7)	24 (33.3)	Ref	Ref	Ref	Ref	59.6 [44.8-74.4]
	Yes	248	99 (39.9)	149 (60.1)	0.33 [0.19-0.58]	<0.001	0.32 [0.12-0.87]	0.025	40.7 [31.2-50.2]
Wound category	Clean	260	117 (45.0)	143 (55.0)	Ref	Ref	Ref	Ref	44.4 [35.6-53.3]
	Clean-contaminated	15	9 (60.0)	6 (40.0)	1.83 [0.63-5.30]	0.263	0.88 [0.19-3.99]	0.869	42.4 [18.0-66.7]
	Contaminated /Dirty	14	7 (50.0)	7 (50.0)	1.22 [0.42-3.59]	0.715	1.61 [0.21-12.23]	0.647	52.2 [19.2-85.2]
	Unknown/Not Applicable	31	14 (45.2)	17 (54.8)	Exc ^b	Exc ^b	Exc ^b	Exc ^b	Exc ^b
Orthopaedic ORIF procedure	Neck of femur (NOF)	55	21 (38.2)	34 (61.8)	Ref	Ref	Ref	Ref	44.6 [25.6-63.7]
	Prosthetic NOF	18	5 (27.8)	13 (72.2)	0.62 [0.19-2.00]	0.426	0.70 [0.07-6.72]	0.759	38.9 [4.5-73.3]
	Upper limb ^e	122	65 (53.3)	57 (46.7)	1.85 [0.96-3.54]	0.064	1.36 [0.35-5.31]	0.656	49.8 [37.6-62.0]
	Lower limb ^f	125	56 (44.8)	69 (55.2)	1.31 [0.69-2.51]	0.409	0.76 [0.20-2.85]	0.680	40.1 [28.9-51.3]
Antimicrobial	Cefazolin	271	139 (51.3)	132 (48.7)	Ref	Ref	Ref	Ref	49.5 [40.0-58.9]
	Cefalexin	30	2 (6.7)	28 (93.3)	0.07 [0.02-0.29]	<0.001	0.03 [0.01-0.19]	<0.001	7.1 [Not estimable ^d]
	Vancomycin	8	4 (50.0)	4 (50.0)	0.95 [0.23-3.88]	0.943	0.94 [0.11-8.50]	0.960	48.5 [9.4-87.6]
	Other (5) ^g	11	9 (81.8)	2 (18.2)	Exc ^a	Exc ^a	Exc ^a	Exc ^a	Exc ^a

Ref= Reference group

Exc= Excluded

^a Excluded from analysis due to low number of prescriptions and/or proportions

^b Excluded from analysis due to unknown/ not applicable status.

^c Removed from model due to successful predictions for perfect or failure

^d Adjusted appropriateness 95% CI not estimable due to low number of prescriptions and/or proportions

^e Upper limb includes: carpus, clavicle, humerus, metacarpal, phalanx, olecranon, radius, scaphoid, ulna

^f Lower limb includes: ankle, calcaneus, femur, patella, talus, tibia

^g Other antimicrobials= five other antimicrobials prescribed (n=<4).

^h Model C Statistic= 0.8762

Table S11: Subgroup analysis: Appropriateness of orthopaedic knee procedures per presence, insertion or removal of prosthetic material

Orthopaedic Knee Procedures (n=507)	No presence, insertion or removal of prosthetic material n=342 (67.5%)		Presence, insertion or removal of prosthetic material n=165 (32.5%)	
	Appropriate n=146 (42.7)	Inappropriate n=196 (57.3)	Appropriate n=117 (70.9)	Inappropriate n=48 (29.1)
Diagnostic Arthroscopy (n=57)	19 (37.3)	32 (62.8)	2 (33.3)	4 (66.7)
Therapeutic arthroscopy (n=239)	61 (33.7)	120 (66.3)	41 (70.7)	17 (29.3)
Ligament (n=188)	59 (59.6)	40 (40.4)	64 (71.9)	25 (28.1)
Osteotomy (n=23)	7 (63.6)	4 (36.4)	10 (83.3)	2 (16.7)