



Supplementary Material

Table i. Orthopaedic and plastic surgeons present at first debridement definition.

Variable	Details
Period	Rolling year
Numerator	<ol style="list-style-type: none"> 1. Where Orthopaedics Consultant & Plastics <i>consultants</i> are both present at first debridement. 2. Where Orthopaedics & Plastic surgeons (<i>any grade</i>) are both present at first debridement.
Denominator	<ol style="list-style-type: none"> 1. All open fractures within cohort. 2. Lower limb long bone fractures only.
Trauma Audit & Research Network (TARN) data fields:	Operations; operation date and time, speciality and grade of surgeons.
Notes:	<ul style="list-style-type: none"> • Using all three surgeon fields in any order • Patients transferred for repatriation, transferred in directly from abroad, or where best available pre-hospital time are missing are excluded from this measure. • All submissions with one of the below operations recorded during stay. Operations include one of the below (TARN operation codes - 1009,812,813,814,844,885): <ul style="list-style-type: none"> ○ BOAST - POP & debridement ○ BOAST - Internal fixation: Nail & debridement ○ BOAST - Internal fixation: Other & debridement ○ BOAST - Internal fixation: Plate & debridement ○ BOAST - External fixation: Circular frame & debridement ○ BOAST - External fixation: Monolateral (Non-circular) frame ○ Skin Debridement • For each unique individual time to first debridement also reported (derived from operation time and best available incident time).

Table ii: Soft tissue coverage within 72 hours of incident definition

Variable	Details
Period	Rolling year
Numerator	Soft tissue coverage performed within 72 hours of incident.
Denominator	1. All open fractures within cohort. 2. Lower limb long bone fractures only.
Trauma Audit & Research Network (TARN) data fields:	Date and time of incident, or best available pre-hospital time if not recorded; Operation; Operation date and time
Notes:	<ul style="list-style-type: none"> • Patients transferred for repatriation, transferred in directly from abroad, or best available pre-hospital time are missing are excluded from this measure. Operations include one of the below (TARN codes 905, 911, 919, 958, 959, 961): BOAST - Direct closure BOAST - Free Tissue Transfer BOAST - Local Muscle / musculocutaneous flap BOAST - Local or perforator base skin/fascia flap BOAST - Other BOAST - Split Thickness Skin Graft • Produced with denominator for each eligible cohort, responses available: Y or N • For each row in dataset time to soft tissue cover also reported (derived from operation time and best available incident time)

Table iii. Risk ratios for debridement in 12 hours only in MTC hospitals by patient characteristics for those with open tibial fractures treated in England during 2008-2019, as recorded by the Trauma Audit and Research Network.

Variable	Detail	Number	%	Univariate models			Multivariable model		
				RR	95% CI	p-value	RR	95% CI	p-value
Total		3,422	100						
Day of presentation	Monday	461	13	1.00					
	Tuesday	486	14	0.99	0.85 to 1.14	0.845			
	Wednesday	457	13	1.08	0.93 to 1.24	0.309			
	Thursday	497	15	1.02	0.89 to 1.18	0.751			
	Friday	491	14	1.03	0.89 to 1.18	0.718			
	Saturday	512	15	1.09	0.95 to 1.25	0.214			
	Sunday	518	15	1.06	0.92 to 1.22	0.405			
Time of presentation	00:00-07:59	535	16	1.00			1.00		
	08:00-15:59	1,305	38	1.16	1.05 to 1.27	0.003	1.16	1.05 to 1.27	0.003
	16:00-23:59	1,582	46	0.65	0.58 to 0.72	<0.001	0.63	0.56 to 0.70	<0.001
Sex	Male	2,386	70	1.00			1.00		
	Female	1,036	30	0.84	0.77 to 0.91	<0.001	0.98	0.90 to 1.08	0.732
Age, yrs	0 to 9	83	2	1.03	0.84 to 1.26	0.792	1.20	0.98 to 1.47	0.077
	10 to 19	291	9	0.94	0.82 to 1.07	0.345	1.01	0.88 to 1.15	0.941
	20 to 29	626	18	1.00			1.00		
	30 to 39	518	15	0.82	0.73 to 0.93	0.001	0.80	0.71 to 0.90	<0.001
	40 to 49	492	14	0.89	0.79 to 1.00	0.051	0.84	0.75 to 0.94	0.003
	50 to 59	458	13	0.89	0.79 to 1.00	0.050	0.87	0.78 to 0.98	0.023
	60 to 69	347	10	0.70	0.60 to 0.82	<0.001	0.73	0.63 to 0.85	<0.001
	70 to 79	276	8	0.77	0.66 to 0.90	0.001	0.83	0.71 to 0.97	0.018
	80 to 89	227	7	0.67	0.56 to 0.81	<0.001	0.77	0.64 to 0.93	0.007
	90 and over	104	3	0.52	0.38 to 0.71	<0.001	0.61	0.45 to 0.84	0.002
Year of presentation	2012	352	10	1.00			1.00		
	2013	406	12	1.16	1.00 to 1.34	0.044	1.16	1.01 to 1.34	0.039
	2014	389	11	1.09	0.94 to 1.26	0.269	1.10	0.95 to 1.28	0.203
	2015	401	12	1.08	0.93 to 1.25	0.330	1.07	0.92 to 1.24	0.360
	2016	411	12	1.01	0.87 to 1.18	0.857	1.02	0.88 to 1.19	0.801
	2017	476	14	0.99	0.85 to 1.15	0.885	1.01	0.87 to 1.17	0.901
	2018	511	15	0.84	0.71 to 0.98	0.030	0.86	0.74 to 1.00	0.047
	2019	476	14	0.84	0.71-0.98	0.029	0.88	0.75-1.03	0.108
ISS (continuous)		3,422	100	1.01	1.00-1.01	<0.001	1.00	1.00-1.00	0.519
Injury mechanism	Vehicle incident /	1,992	58	1.00			1.00		

	collision								
	Fall less than 2m	838	24	0.66	0.60-0.74	<0.001	0.80	0.71-0.90	<0.001
	Fall more than 2m	318	9	0.94	0.83-1.06	0.332	0.96	0.85-1.08	0.509
	Other	274	8	0.98	0.86-1.11	0.711	0.99	0.87-1.12	0.846
Number of operations	1	971	28	1.00			1.00		
	2	1,190	35	1.01	0.92-1.12	0.788	1.01	0.91-1.11	0.880
	≥3	1,261	37	1.37	1.25-1.50	<0.001	1.28	1.16-1.40	<0.001

CI, confidence interval; RR, risk ratio.

Table iv. Risk ratios for soft-tissue coverage in 72 hours only in MTC hospitals by patient characteristics for those with open tibial fractures treated in England during 2008-2019, as recorded by the Trauma Audit and Research Network.

Variable	Detail	Number	%	Univariate models			Multivariable model		
				RR	95% CI	p-value	RR	95% CI	p-value
Total		2,963	100						
Day of presentation	Monday	406	14	1.00			1.00		
	Tuesday	420	14	0.95	0.86 to 1.05	0.296	0.97	0.88 to 1.06	0.466
	Wednesday	404	14	0.95	0.86 to 1.05	0.347	0.98	0.89 to 1.07	0.612
	Thursday	422	14	0.88	0.79 to 0.97	0.014	0.88	0.80 to 1.07	0.008
	Friday	421	14	0.88	0.79 to 0.97	0.013	0.90	0.81 to 0.99	0.028
	Saturday	449	15	0.96	0.87 to 1.05	0.366	0.98	0.90 to 1.08	0.688
	Sunday	441	15	1.03	0.94 to 1.13	0.556	1.03	0.94 to 1.12	0.545
	Time of presentation	00:00 to 07:59	469	16	1.00				
08:00 to 15:59		1,122	38	1.02	0.94 to 1.11	0.578			
16:00 to 23:59		1,372	46	1.04	0.96 to 1.12	0.386			
Sex	Male	2,069	70	1.00			1.00		
	Female	894	30	1.08	1.03 to 1.15	0.004	0.99	0.93 to 1.06	0.877
Age, yrs	0 to 9	71	2	1.34	1.19 to 1.51	<0.001	1.19	1.06 to 1.33	0.003
	10 to 19	259	9	1.05	0.94 to 1.17	0.361	1.00	0.91 to 1.11	0.971
	20 to 29	540	18	1.00			1.00		
	30 to 39	450	15	1.00	0.91 to 1.10	0.990	1.00	0.91 to 1.10	0.996
	40 to 49	428	14	0.98	0.89 to 1.08	0.641	0.96	0.87 to 1.06	0.409
	50 to 59	386	13	0.95	0.86 to 1.06	0.351	0.93	0.84 to 1.03	0.170
	60 to 69	296	10	0.91	0.81 to 1.02	0.113	0.89	0.79 to 1.00	0.048
	70 to 79	241	8	1.10	0.99 to 1.22	0.086	1.02	0.91 to 1.15	0.701
	80 to 89	203	7	1.12	1.00 to 1.25	0.051	0.98	0.87 to 1.11	0.801
	90 and over	89	3	1.28	1.14 to 1.44	<0.001	1.02	0.89 to 1.17	0.766
Year of presentation	2012	196	7	1.00			1.00		
	2013	328	11	1.32	1.12 to 1.57	0.001	1.31	1.12 to 1.54	0.001
	2014	372	13	1.33	1.13 to 1.57	0.001	1.32	1.13 to 1.53	<0.001
	2015	368	12	1.50	1.28 to 1.76	<0.001	1.51	1.30 to 1.75	<0.001
	2016	373	13	1.37	1.16 to 1.62	<0.001	1.34	1.54 to 1.56	<0.001
	2017	435	15	1.36	1.16 to 1.60	<0.001	1.33	1.14 to 1.54	<0.001
	2018	460	16	1.38	1.17 to 1.62	<0.001	1.35	1.16 to 1.56	<0.001
	2019	431	15	1.39	1.18-1.63	<0.001	1.36	1.17-1.58	<0.001
ISS (continuous)		2,963	100	0.99	0.99-0.99	<0.001	1.00	0.99-1.00	0.118
Injury mechanism	Vehicle incident /	1,726	58	1.00			1.00		

	collision								
	Fall less than 2m	712	24	1.14	1.07-1.21	<0.001	0.98	0.91-1.06	0.605
	Fall more than 2m	278	9	1.00	0.90-1.10	0.957	1.00	0.91-1.10	0.994
	Other	247	8	0.97	0.87-1.08	0.538	0.94	0.85-1.04	0.240
Number of operations	1	739	25	1.00			1.00		
	2	1,061	36	0.79	0.75-0.83	<0.001	0.78	0.74-0.82	<0.001
	≥3	1,163	39	0.54	0.51-0.58	<0.001	0.55	0.51-0.59	<0.001

CI, confidence interval; RR, risk ratio.

Table v. Descriptive characteristics of patients excluded from analyses due to missing data who had severe open tibial fractures treated in England during 2008-2019, as recorded by the Trauma Audit and Research Network.

		Debridement surgery within 12 hours						Soft tissue coverage within 72 hours					
		Total		Treated at a MTC		Treated at another hospital		Total		Treated at a MTC		Treated at another hospital	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Total number of patients in whole dataset		8,258	100	4,867	100	3,391	100	8,258	100	4,867	100	3,391	100
Excluded due to time of arrival not recorded		98	1	33	1	65	2	98	1	33	1	65	2
Excluded due to time of surgery not recorded		3,655	44	1,411	29	2,244	66	4,211	51	1,855	38	2,356	69
Excluded due to number of operations not recorded		1	<1	1	<1	0	0	476	6	16	<1	460	14
Total patients excluded		3,754	100	1,445	100	2,309	100	4,785	100	1,904	100	2,881	100
Sex	Male	2,228	59	939	65	1,289	56	2,845	59	1,256	66	1,589	55
	Female	1,526	41	506	35	1,020	44	1,940	41	648	34	1,292	45
Age, yrs	0 to 9	78	2	36	2	42	2	104	2	48	3	56	2
	10 to 19	305	8	128	9	177	8	378	8	160	8	218	8
	20 to 29	530	14	228	16	302	13	694	15	314	16	380	13
	30 to 39	432	12	183	13	249	11	558	12	251	13	307	11
	40 to 49	487	13	200	14	287	12	630	13	264	14	366	13
	50 to 59	534	14	208	14	326	14	687	14	280	15	407	14
	60 to 69	445	12	158	11	287	12	576	12	209	11	367	13

	70 to 79	393	10	127	9	266	12	485	10	162	9	323	11
	80 to 89	369	10	116	8	253	11	452	9	140	7	312	11
	90 and over	181	5	61	4	120	5	221	5	76	4	145	5
Year of arrival at hospital	2012	753	20	311	22	442	19	1,277	27	467	25	810	28
	2013	390	10	147	10	243	11	596	12	225	12	371	13
	2014	314	8	117	8	197	9	369	8	134	7	235	8
	2015	340	9	129	9	211	9	407	9	162	9	245	9
	2016	362	10	130	9	232	10	395	8	168	9	227	8
	2017	498	13	194	13	304	13	547	11	235	12	312	11
	2018	586	16	232	16	354	15	630	13	283	15	347	12
	2019	511	14	185	13	326	14	564	12	230	12	334	12
Transfer type	No transfer	2,090	56	886	61	1,204	52	2,993	63	1,200	63	1,793	62
	Transfer in	440	12	309	21	131	6	435	9	304	16	131	5
	Transfer in and out	90	2	70	5	20	1	102	2	81	4	21	1
	Transfer out	1,134	30	180	12	954	41	1,255	26	319	17	936	32
Day and time of presentation at hospital	Monday 00:00 to 07:59	65	2	29	2	36	2	86	2	39	2	47	2
	Monday 08:00 to 15:59	210	6	64	4	146	6	261	5	82	4	179	6
	Monday 16:00 to 23:59	225	6	90	6	135	6	280	6	117	6	163	6
	Tuesday 00:00 to 07:59	77	2	31	2	46	2	90	2	38	2	52	2

	Tuesday 08:00 to 15:59	204	5	66	5	138	6	260	5	87	5	173	6
	Tuesday 16:00 to 23:59	197	5	73	5	124	5	285	6	111	6	174	6
	Wednesday 00:00 to 07:59	64	2	25	2	39	2	74	2	29	2	45	2
	Wednesday 08:00 to 15:59	188	5	81	6	107	5	246	5	107	6	139	5
	Wednesday 16:00 to 23:59	235	6	100	7	135	6	290	6	123	6	167	6
	Thursday 00:00 to 07:59	93	2	37	3	56	2	107	2	44	2	63	2
	Thursday 08:00 to 15:59	198	5	71	5	127	6	266	6	102	5	164	6
	Thursday 16:00 to 23:59	241	6	103	7	138	6	314	7	140	7	174	6
	Friday 00:00 to 07:59	90	2	50	3	40	2	105	2	58	3	47	2
	Friday 08:00 to 15:59	190	5	74	5	116	5	257	5	103	5	154	5
	Friday 16:00 to 23:59	261	7	113	8	148	6	328	7	146	8	182	6
	Saturday 00:00 to 07:59	124	3	50	3	74	3	165	3	66	3	99	3
	Saturday 08:00 to 15:59	205	5	73	5	132	6	267	6	97	5	170	6
	Saturday 16:00 to 23:59	260	7	88	6	172	7	321	7	111	6	210	7

	Sunday 00:00 to 07:59	136	4	52	4	84	4	178	4	66	3	112	4
	Sunday 08:00 to 15:59	178	5	57	4	121	5	245	5	91	5	154	5
	Sunday 16:00 to 23:59	215	6	85	6	130	6	262	5	114	6	148	5
Most severely injured body region	Abdomen	9	<1	4	<1	5	<1	8	<1	4	<1	4	<1
	Chest	104	3	63	4	41	2	131	3	84	4	47	2
	Head	131	3	95	7	36	2	172	4	135	7	37	1
	Limbs	3,239	86	1,118	77	2,121	92	4,140	87	1,461	77	2,679	93
	Multiple	258	7	157	11	101	4	319	7	210	11	109	4
	Other	2	<1	1	<1	1	<1	2	<1	1	<1	1	<1
	Spine	11	<1	7	<1	4	<1	13	<1	9	<1	4	<1
AIS Limb	3	3,750	99	1,441	99	2,309	100	4,781	99	1,900	99	2,881	99
	4	4	<1	4	<1	0	0	4	<1	4	<1	0	0
ISS (continuous)		Median 9 (IQR 9 to 10); Mean 12.86 (SD 9.78)		Median 9 (IQR 9 to 17); Mean 15.40 (SD 12.29)		Median 9 (IQR 9 to 9); Mean 11.27 (SD 7.37)		Median 9 (IQR 9 to 10); Mean 12.80 (SD 9.59)		Median 9 (IQR 9 to 18); Mean 15.64 (SD 12.24)		Median 9 (IQR 9 to 9); Mean 10.92 (SD 6.71)	
ISS (categorical)	1-8 (minor)	0	0	0	0	0	0	0	0	0	0	0	0
	9-15 (moderate)	3,143	84	1,069	74	2,074	90	4,015	84	1,385	73	2,630	91
	16-24 (severe)	208	6	116	8	92	4	256	5	156	8	100	3
	>24 (very severe)	403	11	260	18	143	6	514	11	363	19	151	5

Injury type	Blunt	3,621	96	1,405	97	2,216	96	4,606	96	1,859	98	2,747	95
	Penetrating	133	4	40	3	93	4	179	4	45	2	134	5
Injury mechanism	Vehicle incident / collision	1,612	43	791	55	821	36	2,041	43	1,057	56	984	34
	Fall less than 2m	1,428	38	372	26	1,056	46	1,870	39	498	26	1,372	48
	Fall more than 2m	362	10	151	10	211	9	434	9	191	10	243	8
	Other	352	9	131	9	221	10	440	9	158	8	282	10
Pre-existing condition	Yes	1,957	52	649	45	1,308	57	2,426	51	858	45	1,568	54
	No	1,797	48	796	55	1,001	43	2,359	49	1,046	55	1,313	46
Pre-existing conditions	Hypertension	693	18	200	14	493	21	857	18	260	14	597	21
	Asthma	281	7	83	6	198	9	366	8	119	6	247	9
	Depression	252	7	77	5	175	8	313	7	97	5	216	8
	Diabetes mellitus (Type 2)	252	7	79	5	173	7	295	6	101	5	194	7
	Alcohol abuse	184	5	53	4	131	6	234	5	76	4	158	5
	Other - heart disease	179	5	56	4	123	5	230	5	78	4	152	5
	COPD	191	5	61	4	130	6	220	5	72	4	148	5
	Thyroid disease	126	3	34	2	92	4	158	3	44	2	114	4

	Hypercholesterolaemia	132	4	45	3	87	4	161	3	57	3	104	4
	Osteoporosis	97	3	28	2	69	3	106	2	31	2	75	3
Number of operations	1	1,539	41	542	38	997	43	2,154	45	774	41	1,380	48
	2	662	18	376	26	286	12	930	19	505	27	425	15
	≥3	498	13	363	25	135	6	646	14	461	24	185	6

AIS, Abbreviated Injury Scale. CI, confidence interval; COPD, chronic obstructive pulmonary disorder; IQR, interquartile range; ISS, Injury Severity Score; RR, risk ratio; SD, standard deviation.