

Appendix

Derivation of MDT Equations

MDR (microbial deposition rate) and MDT (microbial deposition total) are both expressions of microbe-carrying-particle contamination. Equations 1, 2, and 3 below are used to convert sampling observations into an MDR or MDT value. The risk of periprosthetic joint infection due to airborne microbe-carrying-particle contamination in the setting of total joint replacement is assumed to be similar for cases with the same total contamination load, or MDT, so MDT is the outcome variable used in the present report.

Equation 1:

$$\text{MDR (colonies/m}^2\text{/hr)} = (\text{Colony count}) / (\text{A} \times \text{t})$$

where A = plate area (m²) and t = the plate exposure time (hr)

Equation 2:

$$\text{MDT (colonies/m}^2\text{)} = (\text{Colony count}) / \text{A}$$

Equation 3:

$$\text{MDT} = \text{t} \times \text{MDR}$$

Active sampling observation values can be converted to MDT with use of the formula described by Whyte and Eaton⁵¹: microbial deposition rate (colonies/m²/sec) = 0.0161x^{0.6571} where x = microbe-carrying-particle concentration/m³. The rate can be adjusted to an hourly basis by multiplying by 3,600 sec/hr, resulting in MDR = 58x^{0.6571}. Then, using Equation 3, it is possible to derive Equation 4:

Equation 4:

$$\text{MDT (colonies/m}^2\text{)} = 58 \text{tx}^{0.6571}$$

where t = case duration (hr) and x = airborne volumetric value (colonies/m³).

As seen in Equations 3 and 4, the conversion of MDR to MDT requires one to assume a standard exposure time. This report assumes t = 1.4 hours, or 84 minutes, which was the average case duration as reported by Charnley¹⁴.

TABLE E-1 Pilot Study Raw Data (Plate Exposure Times and Colony Counts) and Calculated MDT Values

Case	Date of Procedure	Plate Type	Exposure Time (<i>hr</i>)		Back-Table-Zone Colony Counts						Back-Table-Zone MDT	Wound-Zone Colony Counts				Wound-Zone MDT	Negative Control
			Wound	Back Tables	Plate B1	Plate B2	Plate B3	Plate B4	Plate B5	Average		Plate W1	Plate W2	Plate W3	Average		
1	9/12/2014	221236	0.58	0.58	0	2	0	0		0.50	83	0	2	2	1.3	222	0
2	9/12/2014	221236	0.72	0.72	2	4	2	0		2.00	333	0	0	2	0.7	111	0
3	9/30/2014	221236	1.15	1.15	5	2	3			3.33	555	1	0	1	0.7	111	0
4	12/30/2014	221236	1.30	1.30	1	2	0	0		0.75	125	0	0	0	0.3	42	0
5	12/30/2014	221236	1.40	1.40	0	0	1	1		0.50	83	0	0	0	0.0	0	0
6	1/20/2015	221236	0.97	0.97	2	0	1	0	3	1.20	200	1	0	1	1.0	166	Null
7	1/26/2015	221236	1.02	1.02	1	4	0	1		1.50	250	1	1	1	1.0	166	0
8	2/2/2015	221236	0.98	0.98	0	0	0	0		0.00	0	0	0	0	0.0	0	0
9	2/3/2015	221236	1.22	1.22	0	0	2	1		0.75	125	0	0	1	0.3	42	0
10	9/21/2015	221236	0.63	1.25	3	Null	2	Null		2.50	416	Null	6	1	3.5	582	0
11	9/21/2015	221236	0.62	1.13	5	6	1	1		3.25	541	0	0	0	0.0	0	0
12	9/21/2015	221236	2.08	2.70	3	0	6	3		3.00	499	4	0	4	2.7	443	0
13	9/22/2015	221236	1.55	2.15	2	1	1	3		1.75	291	1	1	2	1.3	222	0
14	9/29/2015	TS146001	1.10	1.42	2	2	0	2		1.50	250	0	1	2	1.0	166	0
15	11/16/2015	221236	0.68	1.13	0	0	0	3		0.75	125	2	2	1	1.7	277	0
16	11/16/2015	221236	0.63	0.65	0	0	0	2		0.50	83	0	11	1	4.0	665	0
17	11/30/2015	TS146001	0.68	1.45	1	0	0	1		0.50	83	0	0	2	0.7	111	0
18	11/30/2015	TS146001	1.38	1.43	Null	Null	Null	Null		Null	Null	0	3	2	1.7	277	0
19	11/30/2015	TS146001	0.72	1.30	2	1	0	0		0.75	125	0	1	1	0.7	111	0
20	12/21/2015	TS146001	0.70	1.23	4	5	1	0		2.50	416	1	3	1	1.7	277	0
21	12/21/2015	TS146001	0.80	1.32	0	4	3	0		1.75	291	0	2	0	0.7	111	0
22	12/22/2015	TS146001	1.45	1.98	0	2	1	1		1.00	166	1	0	0	0.3	55	0
Average and standard deviation			1.02 ± 0.39	1.29 ± 0.48							240 ± 166					189 ± 179	

TABLE E-2 Pilot Study Excluded Cases Raw Data (Plate Exposure Times and Colony Counts) and Calculated MDT

Case	Date of Procedure	Exclusion Reason	Plate Type	Exposure Time (hr)		Back-Table-Zone Colony Counts						Back-Table-Zone MDT	Wound-Zone Colony Counts					Wound Zone MDT	Negative Control
				Wound	Back Tables	Plate B1	Plate B2	Plate B3	Plate B4	Plate B5	Average		Plate W1	Plate W2	Plate W3	Plate W4	Average		
E-1	1/26/15	Negative control growth	221236	1.33	1.33	1	0	0	0	0	0.20	33	0	0	2	0	0.5	83	1
E-2	2/2/15	Negative control growth	221236	1.12	1.12	0	0	0	0		0.00	0	1	0	1	0	0.5	83	1
E-3	2/9/15	Negative control growth	221236	1.07	1.07	2	1	1	4		2.00	333	1	1	4	2	2.0	333	1
E-4	2/14/15	Robotic unicondylar knee	221236	1.13	1.13	1	0	3	0		1.00	166	1	0	0	2	0.8	125	0
E-5	2/14/15	Robotic unicondylar knee	221236	0.82	0.82	2	1	1	1		1.25	208	2	4	1	2	2.3	374	0
E-6	10/1/15	Robotic unicondylar knee	221236	0.97	1.77	0	1	0	0		0.25	42	1	0	0		0.3	55	0
E-7	10/16/15	Robotic unicondylar knee	221236	1.20	2.45	4	5	0	0		2.25	374	2	2	0		1.3	222	0
E-8	10/16/15	Robotic unicondylar knee	221236	1.05	1.58	1	3	2	4		2.50	416	0	0	1		0.3	55	0
E-9	12/10/15	Robotic unicondylar knee	TS146001	1.25	1.97	1	2	3	5		2.75	458	2	1	4		2.3	388	0
E-10	12/10/15	Robotic unicondylar knee	TS146001	1.03	1.77	2	1	0	1		1.00	166	0	1	3		1.3	222	0
E-11	12/24/15	Negative control growth	TS146001	1.23	1.93	1	0	0	1		0.50	83	0	0	0		0.0	0	1
Average and standard deviation				1.11 ± 0.14	1.54 ± 0.49							207 ± 164						176 ± 139	