

**Appendix D: Von Bertalanffy parameter estimates for all portions of all elements**

This appendix provides the von Bertalanffy parameter estimates for the remainder of the skeletal elements not covered in Chapters 2 or 3. Please refer to these chapters for a full description of the equations used.

Refer to Chapter 5 for details on how to use the von Bertalanffy parameter estimates to arrive at point-estimates for age-at-death for unknown samples.

Table D.1 Von Bertalanffy parameter estimates describing growth of the all other skeletal elements. Estimates are provided for each sex separately, as well as specimens whose sex cannot be determined. Parameter estimates for measurements of elements that are affected by the fusion of an epiphysis include only measurements of unfused specimens. Measurements in parentheses indicate dimensions beyond which elements can reliably be identified as males. See Appendix B for definitions of measurements.

element												
element and measurement	total (F, M)	R <sup>2</sup>	T1	T2	Y1	SE of Y1	Y2	SE of Y2	A	SE of A	B	SE of B
<b>male pelvis</b>												
ilium length	38	0.962	-0.31	7.00	19.838	3.152	77.248	2.163	-0.286	0.137	4.505	0.780
ilium height	38	0.943	-0.31	7.00	10.001	1.828	37.926	1.214	-0.513	0.207	6.104	1.308
ilium neck height (fused/unfused)	46	0.929	-0.31	14.00	10.126	0.417	34.069	1.940	1.020	0.839	-7.572	6.694
pubis length	38	0.963	-0.31	7.00	23.941	4.037	97.952	2.798	-0.221	0.130	3.976	0.700
pubis height	38	0.935	-0.31	7.00	12.510	1.845	38.504	1.235	-0.393	0.202	6.140	1.406
<b>pelvis, sex unknown</b>												
ilium length (< 65.0 mm)	55 (23, 32)	0.897	-0.31	5.29	22.522	2.546	58.922	2.073	0.332	0.296	2.080	1.400
ilium height (< 32.0 mm)	55 (23, 32)	0.871	-0.31	5.29	10.092	1.512	29.488	1.027	-0.303	0.253	5.567	1.368
ilium neck height (< 25.0 mm)	77 (39, 38)	0.934	-0.31	27.62	9.369	0.335	21.904	0.479	0.599	0.223	-2.422	2.062
pubis length (< 80.0 mm)	55 (24, 31)	0.903	-0.31	5.29	26.044	3.227	74.911	2.655	0.287	0.250	2.265	1.091
pubis height (< 32.0 mm)	55 (24, 31)	0.842	-0.31	5.29	12.772	1.469	29.907	1.118	-0.023	0.276	4.788	1.592
<b>male femur</b>												
midline length	47	0.951	-0.31	9.00	24.837	5.155	103.687	3.285	-0.155	0.114	3.717	0.798
total length	48	0.939	-0.31	9.00	24.925	5.989	106.283	3.745	-0.185	0.125	3.956	0.867
proximal width	48	0.956	-0.31	9.00	12.110	2.063	45.401	1.269	-0.122	0.102	3.922	0.741
min. proximal thickness	48	0.914	-0.31	9.00	5.553	0.338	12.255	0.438	0.472	0.356	-0.977	3.170
max. proximal thickness	47	0.930	-0.31	9.00	6.921	1.256	22.970	0.842	0.062	0.153	2.711	1.173
midshaft width (fused/unfused)	37	0.916	0.00	14.00	10.122	0.373	25.716	1.494	0.936	0.956	-9.259	10.095
midshaft thickness (fused/unfused)	37	0.912	0.00	14.00	6.542	0.252	16.207	0.953	0.750	0.695	-7.153	7.481
distal width	48	0.952	-0.31	9.00	11.551	2.446	48.094	1.301	0.053	0.094	3.395	0.542
distal thickness	47	0.845	-0.31	9.00	5.836	1.776	19.603	0.875	0.192	0.198	3.086	1.159
<b>unfused femur, sex unknown</b>												
midline length (< 80.0 mm)	62 (29, 33)	0.916	-0.31	5.62	24.345	3.792	77.026	2.369	-0.083	0.196	3.728	0.976
total length (< 85.0 mm)	65 (29, 36)	0.936	-0.31	5.62	24.193	3.629	80.419	1.886	-0.197	0.162	4.256	0.827
proximal width (< 35.0 mm)	63 (30, 33)	0.913	-0.31	5.62	11.849	1.511	33.166	0.929	0.009	0.185	3.924	0.964
min. proximal thickness (< 11.0 mm)	65 (30, 35)	0.855	-0.31	6.92	5.375	0.179	9.934	0.258	2.076	1.986	-9.249	10.586
max. proximal thickness (< 20.0 mm)	66 (30, 36)	0.914	-0.31	9.00	6.467	0.904	20.361	0.838	0.033	0.123	3.300	0.857
midshaft width (< 16.5 mm)	55 (32, 23)	0.832	-0.03	23.00	8.744	0.231	14.163	0.258	7.792	29.947	-32.341	126.559
midshaft thickness (< 12.5 mm)	61 (32, 29)	0.902	-0.03	23.00	5.755	0.193	11.359	0.446	0.402	0.200	0.197	2.130
distal width (< 33.0 mm)	55 (28, 27)	0.803	-0.31	4.20	11.720	2.034	32.478	1.252	0.767	0.385	2.148	1.110
distal thickness (< 15.0 mm)	56 (28, 28)	0.680	-0.31	4.20	5.465	1.074	13.543	0.586	0.764	0.521	3.034	1.602
<b>male tibia</b>												
midline length	35	0.909	-0.31	6.16	43.513	10.057	194.174	8.901	-0.556	0.252	5.204	1.263
total length	51	0.960	-0.31	9.00	46.229	9.417	209.245	5.950	-0.117	0.095	3.410	0.621
proximal width	51	0.954	-0.31	9.00	11.568	2.036	44.957	1.097	-0.057	0.087	4.385	0.574
min. proximal thickness	50	0.921	-0.31	9.00	7.425	1.495	26.450	0.844	-0.389	0.159	6.743	1.359
max. proximal thickness	51	0.932	-0.31	9.00	8.582	1.943	34.684	1.178	-0.289	0.137	4.896	1.003
min. midshaft (fused/unfused)	36	0.945	0.00	14.00	7.120	0.282	19.607	0.928	0.242	0.171	-0.863	1.970
max. midshaft (fused/unfused)	36	0.946	0.00	14.00	8.691	0.440	24.478	1.008	-0.156	0.116	4.617	1.693
distal width	51	0.845	-0.31	9.00	8.768	2.290	26.742	1.039	0.263	0.206	2.963	1.222
distal thickness	51	0.917	-0.31	9.00	7.679	2.012	31.787	1.067	-0.058	0.118	4.424	0.761

Table D.1, continued.

element												
element and measurement	total (F, M)	R <sup>2</sup>	T1	T2	Y1	SE of Y1	Y2	SE of Y2	A	SE of A	B	SE of B
<b>unfused tibia, sex unknown</b>												
midline length (< 150.0 mm)	66 (32, 34)	0.926	-0.31	9.00	45.065	6.399	150.098	5.547	0.349	0.139	2.264	0.627
total length (< 155.0 mm)	69 (34, 35)	0.939	-0.31	9.00	45.502	6.252	153.351	3.945	0.277	0.097	2.520	0.522
proximal width (< 34.0 mm)	68 (33, 35)	0.867	-0.31	9.00	12.338	1.812	31.953	0.784	0.724	0.249	2.269	0.971
min. proximal thickness (< 20.0 mm)	69 (33, 36)	0.762	-0.31	9.00	7.647	1.280	18.295	0.746	0.150	0.179	5.214	1.297
max. proximal thickness (< 25.0 mm)	69 (33, 36)	0.851	-0.31	9.00	8.570	1.323	22.807	0.809	0.189	0.140	4.003	0.900
min. midshaft (< 15.0 mm)	59 (31, 28)	0.873	0.00	27.62	6.546	0.253	12.702	0.383	0.669	0.363	-1.456	2.996
max. midshaft (< 19.0 mm)	63 (31, 32)	0.861	0.00	27.62	8.575	0.356	16.404	0.536	0.517	0.288	-0.171	2.732
distal width (< 27.0 mm)	82 (35, 47)	0.797	-0.31	9.00	9.30809	1.949265	24.27172	0.88895	0.32022	0.22754	2.64939	1.54955
distal thickness (< 25.0 mm)	69 (35, 34)	0.838	-0.31	9.00	7.6328	1.39704	22.05051	0.471198	0.8238	0.26728	2.77773	0.83823
<b>male fibula</b>												
total length	49	0.958	-0.31	9.00	40.314	8.813	191.389	5.663	-0.134	0.091	3.610	0.570
proximal width	48	0.894	-0.31	9.00	4.533	1.339	18.360	0.797	-0.061	0.141	4.001	0.897
proximal thickness	48	0.903	-0.31	9.00	2.794	0.798	11.856	0.484	-0.304	0.157	5.487	1.156
distal width	34	0.851	-0.31	9.00	8.125	0.553	17.122	1.074	0.212	0.420	1.596	4.103
distal thickness	34	0.941	-0.31	9.00	7.215	0.332	16.856	0.719	0.088	0.254	1.933	2.455
diagonal distal width	15	0.930	-0.31	7.98	5.351	1.381	22.329	1.327	0.175	0.220	2.910	0.979
<b>unfused fibula, sex unknown</b>												
total length (< 167.0 mm)	78 (36, 42)	0.930	-0.31	9.00	45.963	6.478	149.116	4.348	0.299	0.127	1.983	0.747
proximal width (< 15.5 mm)	74 (36, 38)	0.804	-0.31	9.00	4.625	1.109	13.567	0.505	0.392	0.219	2.934	1.069
proximal thickness (< 10.0 mm)	76 (36, 40)	0.678	-0.31	9.00	2.765	0.906	8.166	0.434	0.252	0.253	3.896	1.370
distal width (< 18.0 mm)	63 (30, 33)	0.746	-0.03	9.00	8.186	0.419	15.046	0.660	0.644	0.622	-2.151	5.910
distal thickness (< 18.0 mm)	64 (30, 34)	0.840	-0.03	9.00	6.857	0.368	14.688	0.618	0.330	0.323	0.437	3.050
diagonal distal width (< 20.0 mm)	22 (9, 13)	0.858	-0.31	5.29	5.548	1.179	16.522	0.760	1.194	0.671	1.055	1.570
<b>male astragalus</b>												
length	30	0.962	0.00	14.00	20.447	0.849	46.759	1.568	0.262	0.147	2.384	1.461
width	30	0.976	0.00	14.00	14.391	0.621	44.074	1.519	0.238	0.100	0.828	0.882
height	30	0.965	0.00	14.00	9.334	0.271	26.673	0.000	4.608	0.014	-24.583	0.135
<b>female astragalus</b>												
length	24	0.984	-0.03	23.00	18.4484	0.625218	37.33307	0.679001	0.28391	0.08436	4.18635	0.80592
width	24	0.984	-0.03	23.00	12.112	0.687779	33.42496	0.85164	0.08473	0.0358	4.68253	0.4795
height	24	0.970	-0.03	23.00	7.6992	0.569874	21.97197	0.814614	0.15252	0.06182	3.25919	0.67406
<b>astragalus, sex unknown</b>												
length (< 40.0 mm)	42 (24, 18)	0.958	-0.03	23.00	19.660	0.521	36.313	0.523	0.999	0.434	0.200	2.104
width (< 35.0 mm)	41 (24, 17)	0.967	-0.03	23.00	12.577	0.594	32.817	1.078	0.129	0.054	4.478	0.599
height (< 24.0 mm)	42 (24, 18)	0.965	-0.03	23.00	8.101	0.325	21.483	0.733	0.230	0.076	2.553	0.675
<b>male 1st metatarsal</b>												
total length	26	0.971	0.00	10.00	31.911	1.582	101.891	3.814	0.157	0.215	0.261	1.759
proximal width	26	0.918	0.00	10.00	10.356	0.822	28.660	1.639	0.064	0.285	2.169	2.634
proximal height	26	0.947	0.00	10.00	6.879	0.566	19.610	0.712	-0.489	0.256	8.425	2.903
<b>unfused 1st metatarsal, sex unknown</b>												
total length (< 75.5 mm)	37 (21, 16)	0.958	-0.03	9.00	29.549	1.037	66.802	1.769	0.302	0.150	2.285	1.104
proximal width (< 23.0 mm)	38 (21, 17)	0.904	-0.03	9.00	9.636	0.465	19.705	0.716	0.450	0.299	2.001	2.038
proximal height (< 15.0 mm)	38 (21, 17)	0.865	-0.03	9.00	6.628	0.474	12.897	0.513	0.269	0.290	5.009	2.443

Table D.1, continued.

element												
element and measurement	total (F, M)	R <sup>2</sup>	T1	T2	Y1	SE of Y1	Y2	SE of Y2	A	SE of A	B	SE of B
<b>male 1st phalanx, 1st digit (foot)</b>												
total length	24	0.976	0.00	9.00	31.259	1.210	88.826	2.301	3.400	0.421	-19.949	2.531
proximal width	24	0.960	0.00	9.00	8.511	0.451	20.582	0.725	0.225	0.239	2.501	1.956
proximal height	24	0.959	0.00	9.00	5.383	0.275	11.897	0.377	0.093	0.207	4.812	2.050
<b>unfused 1st phalanx, 1st digit (foot), sex unknown</b>												
total length (< 75.0 mm)	34 (19, 15)	0.946	-0.03	8.19	27.705	1.265	67.678	2.463	0.331	0.197	1.894	1.203
proximal width (< 20.0 mm)	39 (20, 19)	0.889	-0.03	9.00	7.976	0.572	17.982	0.680	0.199	0.225	3.560	1.873
proximal height (< 12.5 mm)	40 (20, 20)	0.855	-0.03	9.00	5.189	0.398	10.799	0.430	0.096	0.248	4.880	2.537
<b>male scapula</b>												
width (in the absence of data on glenoid)	51	0.973	-0.31	14.00	46.287	7.785	285.326	9.626	-0.022	0.052	2.225	0.458
width (glenoid not ossified)	45	0.960	-0.31	7.00	42.491	10.138	205.415	4.876	-0.088	0.135	2.636	0.735
height	45	0.946	-0.31	7.00	36.155	10.889	182.108	4.805	-0.558	0.220	4.828	1.222
neck width	45	0.949	-0.31	7.00	11.572	1.990	39.308	0.901	-0.154	0.150	3.807	0.996
glenoid width	45	0.955	-0.31	7.00	11.251	1.998	41.256	0.862	-0.237	0.130	4.513	0.824
glenoid height	45	0.970	-0.31	7.00	7.365	1.419	33.547	0.625	-0.265	0.109	3.912	0.613
<b>scapula, sex unknown</b>												
width (< 186.0 mm)	81 (42, 39)	0.954	-0.31	27.62	50.897	4.023	171.242	4.220	0.538	0.131	0.184	0.729
width (glenoid not ossified: < 150.0 mm)	62 (30, 32)	0.930	-0.31	5.29	48.057	4.580	148.011	4.907	0.614	0.303	0.479	1.154
height (< 120.0 mm)	62 (30, 32)	0.940	-0.31	5.29	38.557	4.252	120.536	3.230	0.245	0.191	2.150	0.822
neck width (< 28.0 mm)	58 (30, 28)	0.771	-0.31	5.29	14.660	0.322	25.050	0.000	11.739	1.126	-43.389	1.032
glenoid width (< 31.0 mm)	61 (30, 31)	0.848	-0.31	5.29	15.468	0.616	28.614	0.770	2.323	2.105	-7.576	9.026
glenoid height (< 25.0 mm)	62 (30, 32)	0.879	-0.31	5.29	10.312	0.458	22.293	0.572	2.673	2.436	-7.171	8.113
<b>male radius</b>												
total length	48	0.956	-0.31	7.98	35.841	8.209	165.011	4.094	-0.520	0.173	5.749	1.148
proximal height	49	0.953	-0.31	7.98	8.358	1.746	35.032	0.859	-0.144	0.110	3.998	0.679
proximal width	49	0.962	-0.31	7.98	7.159	1.136	26.896	0.537	-0.153	0.096	4.697	0.642
distal height	50	0.940	-0.31	9.00	7.174	1.860	33.619	1.074	-0.228	0.114	4.694	0.765
distal width	50	0.946	-0.31	9.00	12.646	2.460	49.777	1.412	-0.196	0.106	4.903	0.767
<b>unfused radius, sex unknown</b>												
total length (< 110.0 mm)	64 (31, 33)	0.908	-0.31	4.20	36.250	4.554	102.762	2.340	0.169	0.210	3.424	0.829
proximal height (< 23.5 mm)	62 (31, 31)	0.797	-0.31	4.20	8.668	1.404	21.793	0.730	1.062	0.482	1.197	1.483
proximal width (< 19.0 mm)	61 (31, 30)	0.754	-0.31	4.20	7.434	1.205	17.955	0.667	0.743	0.421	2.411	1.432
distal height (< 23.0 mm)	74 (38, 36)	0.850	-0.31	9.00	7.892	1.398	21.287	0.542	0.740	0.284	1.852	1.135
distal width (< 36.0 mm)	73 (38, 35)	0.862	-0.31	9.00	12.786	1.930	33.391	0.900	0.441	0.178	3.366	0.870
<b>male ulna</b>												
total length	49	0.973	-0.31	7.98	40.616	8.126	206.489	3.944	-0.499	0.121	5.578	0.784
proximal height	49	0.959	-0.31	7.98	10.959	3.224	63.769	1.610	-0.311	0.115	4.251	0.656
proximal width	49	0.968	-0.31	7.98	6.084	0.733	28.468	0.862	0.095	0.181	1.088	1.017
midshaft thickness (fused/unfused)	47	0.914	-0.31	14.00	5.047	0.241	17.371	1.019	1.422	2.015	-9.999	14.771
midshaft height (fused/unfused)	47	0.939	-0.31	14.00	9.280	0.359	34.303	2.924	1.954	5.840	-14.165	42.705
distal height	49	0.946	-0.31	7.98	5.941	1.658	29.012	0.828	-0.091	0.117	3.330	0.651
distal width	49	0.923	-0.31	7.98	4.651	1.491	22.064	0.743	-0.190	0.147	3.963	0.869

Table D.1, continued.

element												
element and measurement	total (F, M)	R <sup>2</sup>	T1	T2	Y1	SE of Y1	Y2	SE of Y2	A	SE of A	B	SE of B
<b>unfused ulna, sex unknown</b>												
total length (< 150.0 mm)	69 (35, 34)	0.946	-0.31	9.00	43.647	5.744	150.866	3.738	0.156	0.077	3.156	0.438
proximal height (< 50.0 mm)	70 (35, 35)	0.900	-0.31	9.00	12.419	2.542	12.419	2.542	0.294	0.133	2.347	0.659
proximal width (< 21.0 mm)	70 (35, 35)	0.936	-0.31	9.00	6.087	0.366	18.600	0.562	0.888	0.305	-1.392	1.301
midshaft thickness (< 13.0 mm)	71 (37, 34)	0.873	-0.31	23.00	3.847	0.447	10.175	0.418	0.414	0.185	0.940	1.447
midshaft height (< 22.0 mm)	71 (37, 34)	0.933	-0.31	23.00	6.494	0.643	19.570	0.621	0.382	0.118	1.014	0.880
distal height (< 21.0 mm)	68 (37, 31)	0.833	-0.31	9.00	6.017	1.218	17.275	0.399	1.271	0.466	0.891	1.266
distal width (< 16.0 mm)	70 (37, 33)	0.852	-0.31	9.00	5.241	0.887	13.930	0.338	0.990	0.409	0.915	1.456
<b>male 1st metacarpal</b>												
total length	28	0.965	0.00	10.00	32.629	1.540	96.198	3.669	0.097	0.236	0.676	2.138
proximal width	28	0.927	0.00	10.00	12.633	0.905	36.699	1.869	-0.200	0.360	3.620	3.671
proximal height	28	0.925	0.00	10.00	6.938	0.855	24.414	1.115	-0.710	0.482	8.304	4.624
<b>unfused 1st metacarpal, sex unknown</b>												
total length (< 75.0 mm)	42 (23, 20)	0.951	-0.03	9.00	31.127	1.010	68.977	2.009	0.233	0.159	1.846	1.398
proximal width (< 25.5 mm)	41 (23, 19)	0.909	-0.03	9.00	11.722	0.423	21.719	0.596	0.815	0.513	-0.082	2.943
proximal height (< 17.0 mm)	41 (23, 19)	0.914	-0.03	9.00	6.798	0.304	13.921	0.445	0.562	0.332	1.489	1.998
<b>male 1st phalanx, 1st digit (hand)</b>												
total length	24	0.964	0.00	9.00	30.594	1.434	82.043	3.781	0.678	0.486	-3.347	3.438
proximal width	24	0.941	0.00	9.00	12.153	1.400	25.572	0.282	4.060	0.000	-30.504	0.451
proximal height	24	0.930	0.00	9.00	6.613	0.183	15.566	3.897	3.974	0.000	-26.567	0.286
<b>unfused 1st phalanx, 1st digit (hand), sex unknown</b>												
total length (< 74.0 mm)	40 (22, 18)	0.961	-0.03	9.00	27.927	1.161	73.790	2.106	-0.006	0.128	3.339	1.130
proximal width (< 22.0 mm)	37 (22, 15)	0.839	-0.03	9.00	10.564	0.570	18.781	0.715	0.763	0.769	1.838	4.389
proximal height (< 13.5 mm)	37 (22, 15)	0.891	-0.03	9.00	5.515	0.353	11.033	0.381	0.619	0.474	3.046	2.541
<b>baculum</b>												
length	480	0.947	0.10	16.00	35.614	1.319	126.465	0.554	0.978	0.147	-4.434	0.930
proximal height	315	0.654	0.10	16.00	3.755	0.536	12.873	0.201	0.876	0.601	-3.628	3.342
proximal width	313	0.814	0.10	16.00	4.298	0.411	14.334	0.226	0.540	0.150	-2.590	1.441
distal height	315	0.901	0.10	16.00	2.423	0.294	14.947	0.000	3.116	0.514	-12.087	0.351
distal width	315	0.745	0.10	16.00	1.586	0.000	5.988	0.018	3.037	0.645	-17.748	0.169