LabCorp recognizes that pediatricians and pediatric endocrinologists have special needs and requirements for the laboratory testing of their patients. Age-specific reference intervals and specimen collection issues are particular concerns in pediatric patient care and evaluation.

Frequently, adult reference intervals are not appropriate for pediatric patients. To assist physicians in treating their pediatric patients, this document lists age-specific reference intervals for many of the endocrine tests offered by LabCorp. Where available, reference ranges are also provided by Tanner stage.

LabCorp realizes that pediatric specimen collection can be challenging and is a major concern for health care providers. It is frequently difficult to obtain substantial volumes of blood or urine from pediatric patients. For this reason, we have provided an appropriate specimen volume as well as an analytical minimum specimen volume for each test. The minimum volumes listed in this document represent the **analytical minimum** specimen required to perform the test once. This volume does not permit any repeat analysis. It is highly recommended that the preferred volume indicated below be submitted whenever possible.

Aldosterone (ng/dL) 004374

Volume: 0.8 mL (0.3 mL minimum) Serum

Age	Male/Female
< 1 yr	5.0-132.0
1-3 yr	5.0-60.0
4-7 yr	4.0-76.0
8-11 yr	3.0-28.0
12-16 yr	1.0-18.0

Aldosterone (µg/24 hours) 004291

Volume: 0.3 mL (0.1 mL minimum) Urine

Age	Male/Female
0-1 mo	1-11
2-11 mo	1-22
1-15 yr	2 -16

5a-Androstane-3a, .. 17b-Diol Glucuronide 140442

Volume: 0.3 mL (0.2 mL minimum) Serum

Age	Male	Female
0-3 yr	< 80	< 60
4-5 yr	< 70	< 155
6-7 yr	< 399	< 330
8-9 yr	< 220	< 140
10-11 yr	< 311	< 340
12-13 yr	< 737	78-441
14-15 yr	131-1395	73-760
16-20 yr	103-2603	113-732
Tanner Stage		
I (< 8yr)	<400	< 330
I (> 8yr)	<513	< 144
II	<707	66-174
III	94-568	96-441
IV	284-1205	79-854
V	103-2630	73-732

Note: Use plastic transport tubes for all frozen specimens. In addition, to avoid delays in turnaround time when requesting multiple tests on frozen samples, please submit separate specimens for each test requested.

Androstenedione (ng/dL) 004705

Volume: 0.3 mL (0.2 mL minimum) Serum

Age	Male	Female
0-5 mo	5-45	5-35
6-11 mo	5-30	5-25
1-5 yr	5-45	5-40
6-9 yr	5-55	5-45
10-11 yr	10-30	25-80
12-14 yr	20-85	15-175
15-17 yr	35-100	55-200
Tanner Stage		
I (<7 yr)	< 35	< 42
I (>7 yr)	< 49	< 83
II	< 89	<143
III	11-91	<152
IV	<219	28-252

Angiotensin-converting Enzyme (U/L) 010116

Volume: 0.5 mL (0.2 mL minimum) Serum

Age	Male/Female
0-2 yr	5-83
3-7 yr	8-76
8-14 yr	6-89
>14 yr	8-52

Antidiuretic Hormone, ADH (pg/mL) 046557

Volume: 2.0 mL (1.0 mL minimum) Frozen Plasma

Age	Range
0-1 mo	Less than 20.0
2-11 mo	Less than 11.2
1-18 yr	Less than 6.9

b_2-Microglobulin (mg/L) 010181

Volume: 0.5 mL (0.2 mL minimum) Serum/Plasma

Age	Male	Female
0-1 mo	1.6-4.8	1.7-4.5
1-6 mo	1.4-3.3	1.0-3.8
7-11 mo	0.9-3.1	1.0-2.3
1-3 yr	0.8-2.2	0.7-2.4
4-6 yr	0.6-2.3	0.5-2.2
7-9 yr	0.8-1.7	0.7-1.8
10-12 yr	0.7-1.8	0.7-2.0
13-15 yr	0.7-2.0	0.8-1.9
16-18 yr	0.7-1.9	0.6-1.9

Bone-Specific Alkaline Phosphatase (µg/L) 513002

Volume: 0.2 mL (0.1 mL minimum) Frozen Plasma

Age	Male	Female
< 1 yr	47-157	57-109
1-2 yr	26-99	26-129
3-4 yr	27-101	31-95
5-6 yr	34-116	33-105
7-8 yr	34-108	21-133
9-10 yr	39-139	29-157
11-12 yr	20-166	42-154
13-14 yr	11-195	< 113
15-16 yr	23-170	< 69

Catecholamines, Fractionated (pg/mL) 084152

Volume: 3.0 mL (1.5 mL minimum) Plasma, **Frozen**

Epinephrine

Age	Male/Female
2-9 days	36-401
10 days-2 mo	55-201
3 mo-11 mo	55-438
12-23 mo	36-639
24-35 mo	18-438
3-15 yr	18-456

Norepinephrine

Age	Male/Female
2-9 days	169-1184
10 days-2 mo	372-2081
3 mo-11 mo	271-1117
12-23 mo	68-1810
24-35 mo	186-1472
3-15 yr	85-1252

Catecholamines (µg/g creatinine) 316203

Volume: 10 mL (4.0 mL minimum) Urine

Epinephrine

Age	Male/Female
0-23 mo	< 75
2-4 yr	< 57
5-9 yr	< 35
10-19 yr	< 34

Note: Use plastic transport tubes for all frozen specimens. In addition, to avoid delays in turnaround time when requesting multiple tests on frozen samples, please submit separate specimens for each test requested.

Norepinephrine

Age	Male/Female
0-23 mo	< 420
2-4 yr	< 120
5-9 yr	< 89
10-19 yr	< 82

Dopamine

Age	Male/Female
0-23 mo	< 3000
2-4 yr	< 1533
5-9 yr	< 1048
10-19 yr	< 545

Cortisol (µg/dL) 004051

Volume: 0.5 mL (0.3 mL minimum) Serum

Age	Male	Female
5th day	0.6-19.8	0.6-19.8
2 mo-13 yr	2.4-22.9	2.4-22.9
14-15 yr	2.5-22.9	2.5-28.6
16-18 yr	2.4-28.6	2.4-28.6
Tanner Stage		
II-III	2.7-13.4	1.4-16.2
IV-V	3.7-15.3	4.5-15.7

Cortisol, Urinary Free by HPLC (µg/24 hr) .. 004432

Volume: 15 mL (5.0 mL minimum) Urine

Age	Male/Female
2-11 yr	1-21
12-16 yr	2-38

C-Peptide (ng/mL) 010108

Volume: 1.0 mL (0.4 mL minimum) Serum, **Frozen**

Age	Male/Female
0-9 yr	0.0-3.3
10-16 yr	0.4-3.3

Dehydroepiandrosterone (DHEA) (ng/dL) 004101

Volume: 0.3 mL (0.1 mL minimum) Serum

Age	Male	Female
0-5 yr	26-72	19-42
6-7 yr	29-66	73-165
8-9 yr	53-135	74-180
10-11 yr	183-383	234-529
12-14 yr	240-520	224-611
Tanner Stage		
I	31-345	31-345
II	110-495	150-570
III	170-585	200-600
IV	160-640	200-780
V	250-900	215-850

Dehydroepiandrosterone (DHEA) Sulfate (µg/dL) 004697

Volume: 1.0 mL (0.4 mL minimum) Serum

Age	Male	Female
1-7 days	91-376	73-367
8-15 days	37-224	44-247
1-3 yr	< 30	< 79
4-6 yr	< 186	< 38
7-8 yr	< 94	< 68
9-10 yr	< 75	< 160
11 yr	< 152	< 98
12 yr	< 344	< 177
13 yr	< 242	< 167
14 yr	< 286	32-301
15 yr	59-310	39-288
16 yr	47-357	58-354
17 yr	102-341	97-399
18-19 yr	108-441	145-395
Tanner Stage		
I	< 87	< 65
II & III	< 151	< 175
IV	75-282	57-230
V	121-368	76-378

Note: Use plastic transport tubes for all frozen specimens. In addition, to avoid delays in turnaround time when requesting multiple tests on frozen samples, please submit separate specimens for each test requested.

Deoxypyridinoline (Dpd) Cross-Links (nmol Dpd/mmol creatinine) 511105

Volume: 10 mL (1.0 mL minimum) Urine

Age	Male	Female
8-11 yr	7.6-20.8	7.7-22.1
12-18 yr	1.4-24.2	0.0-20.6

Dihydrotestosterone (ng/dL) 140368*

Volume: 1.2 mL (0.5 mL minimum) Serum

Age	Male	Female
Newborn	5.0-60.0	<15.0
Prepubertal	<3.0	<3.0
Tanner Stage		
I	<3.0	<3.0
II	3.0-17.0	5.0-12.0
III	8.0-33.0	7.0-19.0
IV	22.0-52.0	4.0-13.0
V	24.0-65.0	3.0-18.0
Adult	30.0-85.0	4.0-22.0

Erythropoietin (mIU/mL) 140277

Volume: 0.8 mL (0.3 mL minimum) Serum

Age	Male	Female
1-3 yr	1.7-17.9	2.1-15.9
4-6 yr	3.5-21.9	2.9-8.5
7-9 yr	1.0-13.5	2.1-8.2
10-12 yr	1.0-14.0	1.1-9.1
13-15 yr	2.2-14.4	3.8-20.5

Estradiol (pg/mL) 140244

Volume: 0.8 mL (0.3 mL minimum) Serum

Age	Male	Female
1-6 yr	<15	<15
7-10 yr	<15	<70
11-12 yr	<40	10-300
13-15 yr	<45	10-300
16-17 yr	10-50	10-300
Tanner Stage		
I	3-15	5-10
II	3-10	5-115
III	5-15	5-180
IV	3-40	25-345
V	15-45	25-410

Estrogens, Total (pg/mL) 004549

Volume: 2.8 mL (1.1 mL minimum) Serum

Age	Male	Female
0-10 yr	0-25	0-25
Tanner Stage		
I	10-38	10-46
II	17-45	22-63
III	22-55	24-110
IV	27-80	40-180
V	25-80	60-280

Estrone (pg/mL) 004564

Volume: 0.4 mL (0.2 mL minimum) Serum

Age	Male	Female
0-5 yr	18-53	19-46
6-7 yr	17-48	17-44
8-9 yr	20-54	31-70
10-11 yr	21-49	28-68
12-14 yr	17-44	57-140
Tanner Stage		
I	5-17	4-29
II	10-25	10-33
III	15-25	15-43
IV	15-45	16-77
V	20-45	29-105

Follicle-stimulating Hormone (mIU/mL) 004309

Volume: 1.0 mL (0.4 mL minimum) Serum

Age	Male	Female
0-23 mo	0.4-2.1	0.4-7.1
2-5 yr	0.4-1.7	0.4-4.2
6-10 yr	0.4-1.6	0.4-3.0
11-20 yr	0.4-8.7	0.4-8.6
Tanner Stage		
I & II	0.3-4.6	0.7-6.7
III & IV	1.2-15.4	1.0-7.4
V	1.5-6.8	1.0-9.2

*This test may be considered by Medicare and other carriers as investigational and, therefore, may not be payable by the carrier as a covered benefit for patients.

Note: Use plastic transport tubes for all frozen specimens. In addition, to avoid delays in turnaround time when requesting multiple tests on frozen samples, please submit separate specimens for each test requested.

Gastrin (pg/mL) 004390

Volume: 0.5 mL (0.3 mL minimum) Serum, **Frozen**

Age	Male/Female
0-1 mo	69-190
2-22 mo	55-186
22 mo-16 yr (fasting 3-4 hr)	2-168
22 mo-16 yr (fasting 5-6 hr)	3-117
22 mo-16 yr (fasting >8 hr)	1-125

Glutamic Acid Decarboxylase Autoantibody (U/mL) 143008*

Volume: 0.2 mL (minimum) 0.02 mL Serum

Male & Female	< 1.5 U/mL

Growth Hormone (ng/mL) 004275

Volume: 0.8 mL (0.3 mL minimum) Serum

Age	Male/Female
1 day	5-53
1 wk	5-27
1-12 mo	2-10
1 yr to Adult	Less than 5.0

Homovanillic Acid (µg/mg creatinine) 120246

Volume: 10 mL (4.0 mL minimum) Urine

Age	Male/Female
0-2 mo	11.3-35.0
3-11 mo	8.4-44.9
12-23 mo	12.2-31.8
2-4 yr	3.4-32.0
5-9 yr	6.8-23.7
10-15 yr	3.2-13.6

5-Hydroxyindoleacetic Acid (mg/g creatinine) 316205

Volume: 1.0 mL (0.3 mL minimum) Urine

Age	Male/Female
3-8 yr	1.2-16.2
9-12 yr	2.4-8.7
13-17 yr	1.8-5.5

17-Hydroxypregnenolone (ng/dL) 140715

Volume: 2.5 mL (1.1 mL minimum) Serum/Plasma

Age	Male	Female
< 1 yr	14-77	62-287
1-5 yr	12-103	10-47
6-12 yr	31-186	11-141
Tanner Stage		
II-III	20-363	58-450
IV-V	32-297	53-542

17-Hydroxyprogesterone (ng/dL) 004713

Volume: 1.0 mL (0.5 mL minimum) Serum

Age	Male	Female
< 1mo	53-186	17-204
1-5 mo	35-157	25-110
6-11 mo	6-40	5-47
1-3 yr	2-19	3-51
4-6 yr	1-34	4-34
7-9 yr	1-45	4-44
10-12 yr	1-34	3-33
13-15 yr	23-82	2-72
16-18 yr	8-100	3-91

IA2 Autoantibodies (U/mL) 141531

Volume: 0.3 mL (0.1 mL minimum) Serum

Male & Female	less than 0.75

Insulin, Fasting (µIU/mL) 004333

Volume: 0.8 mL (0.3 mL minimum) Serum

Tanner Stage	Male/Female
I	2.6-15.5
II & III	8.3-22.0
IV & V	8.5-23.0

Insulin Autoantibodies (U/mL) 141598

Volume: 0.5 mL (0.2 mL minimum) Serum

Male & Female	less than 1.0

*This test may be considered by Medicare and other carriers as investigational and, therefore, may not be payable by the carrier as a covered benefit for patients.

Note: Use plastic transport tubes for all frozen specimens. In addition, to avoid delays in turnaround time when requesting multiple tests on frozen samples, please submit separate specimens for each test requested.

Insulin-like Growth Factor I (ng/mL) 010363

Volume: 0.5 mL (0.2 mL minimum) Serum

Age	Male	Female
2 mo-5 yr	17-248	17-248
6-8 yr	88-474	88-474
9-11 yr	110-565	117-771
12-15 yr	202-957	261-1096
16-24 yr	182-780	182-780
Tanner Stage		
I	109-485	128-470
II	174-512	186-695
III	230-818	292-883
IV	396-776	394-920
V	402-839	308-1138

Insulin-like Growth Factor II (ng/mL) 141770*

Volume: 0.4 mL (0.2 mL minimum) Serum

Age	Male/Female
Newborn	78 - 574
0-2 yr	206 - 674
3-4 yr	211 - 727
5-6 yr	281 - 1041
7-8 yr	380 - 1140
9-10 yr	455 - 1207
11-12 yr	386 - 1122
13-14 yr	342 - 1102
15-18 yr	398 - 1230

Insulin-like Growth Factor-binding Protein 3 (mg/L) 140152

Volume: 0.3 mL (0.1 mL minimum) Serum

Age	Male	Female
0-1 yr	0.9 - 1.8	0.7 - 2.5
2-3 yr	1.1 - 2.3	0.8 - 3.8
4-5 yr	1.2 - 3.1	1.3 - 3.6
6-7 yr	1.3 - 3.4	1.2 - 4.7
8-9 yr	1.4 - 3.9	1.6 - 4.0
10-11 yr	1.5 - 5.0	1.9 - 5.5
12-13 yr	1.7 - 5.1	1.8 - 6.1
14-15 yr	1.9 - 6.4	2.0 - 5.4
16-17 yr	1.7 - 6.0	1.9 - 5.3
18-20 yr	1.5 - 6.0	1.6 - 6.0

17-Ketogenic Steroids (mg/24 hr) 004010

Volume: 12 mL (10 mL minimum) Urine

Age	Male/Female
0-11 mo	<1.0
1-10 yr	<5.0
11-14 yr	<12.0

17-Ketosteroids (mg/24 hr) 004028

Volume: 25 mL (15 mL minimum) Urine

Age	Male	Female
0-4 yr	<2	<2
5-9 yr	<3	<3
10-11 yr	1-5	1-5
12-13 yr	1-6	1-6
14-16 yr	3-13	2-8

Luteinizing Hormone (mIU/mL) 004283

Volume: 0.8 mL (0.3 mL minimum) Serum

Age	Male	Female
0-23 mo	0.5-1.9	0.0-0.5
2-10 yr	0.0-0.5	0.0-0.5
11-20 yr	0.5-5.3	0.5-9.0
Tanner Stage		
I	0.0-3.6	0.0-3.0
II	0.3-4.8	0.1-4.1
III	0.6-6.3	0.2-9.1
IV & V	0.6-7.8	0.5-15.0

Metanephrines, Fractionated (µg/24 hr) 004234

Volume: 25 mL (10 mL minimum) Urine

Age	Metanephrine	Normetanephrine
3-8 yr	5-113	13-252
9-12 yr	21-154	32-346
13-17 yr	32-167	63-402

Neopterin (ng/mL) 140335*

Volume: 0.4 mL (0.2 mL minimum) Serum

Age	Male/Female
0-18 yr	0.9-3.4

*This test may be considered by Medicare and other carriers as investigational and, therefore, may not be payable by the carrier as a covered benefit for patients.

Note: Use plastic transport tubes for all frozen specimens. In addition, to avoid delays in turnaround time when requesting multiple tests on frozen samples, please submit separate specimens for each test requested.

N-Telopeptide Cross-links (NTX) ..... 511097 (mM BCE/mmol creatinine)

Volume: 1.0 mL (0.3 mL minimum) Urine

Tanner Stage	Male	Female
I	55-508	6-662
II	21-423	193-514
III	27-462	13-632
IV	<609	<389
V	<240	<132

Osteocalcin (ng/mL) 010249

Volume: 1.0 mL (0.3 mL minimum) Serum, **Frozen**

Age	Male	Female
6 yr	< 28	< 52
7 yr	< 41	< 53
8 yr	< 54	< 54
9 yr	< 48	< 46
10 yr	< 47	< 61
11 yr	< 76	< 83
12 yr	< 126	< 94
13 yr	< 99	< 96
14 yr	< 116	< 75
15 yr	< 115	< 32
16 yr	< 70	< 32
17 yr	< 41	< 26
18 yr	< 38	< 17
19 yr	< 28	< 16

Parathyroid Hormone (PTH), Intact (pg/mL) . 015610

Volume: 1.0 mL (0.4 mL minimum) Serum, **Frozen**

Age	Male/Female
2-20 yr	9-52

Pregnenolone (ng/dL) 140707

Volume: 2.5 mL (1.1 mL minimum) Serum/Plasma

Age	Male	Female
< 1 yr	10-137	18-87
1-5 yr	10-43	19-48
6-12 yr	15-45	17-38
Tanner Stage		
II & III	15-84	10-45
IV-V	20-77	11-50

Progesterone (ng/mL) 004317

Volume: 0.5 mL (0.3 mL minimum) Serum

Age	Male	Female
1-10 yr	< 0.5	< 0.5
Tanner Stage		
I	< 0.3	< 0.3
II	< 0.3	< 0.5
III	< 0.5	< 4.5
IV	< 1.1	< 13.0
V	0.2-0.8	0.2-9.5

Prolactin (ng/mL) 004465

Volume: 0.5 mL (0.3 mL minimum) Serum

Age	Male	Female
<1 mo	3.7-81.2	0.3-95.0
1-11 mo	0.3-28.9	0.2-29.9
1-3 yr	2.3-13.2	1.0-17.0
4-6 yr	0.8-16.9	1.6-13.1
7-9 yr	1.9-11.6	0.3-12.9
10-12 yr	0.9-12.9	1.9-9.6
13-15 yr	1.6-16.6	3.0-14.4

Renin, Active (uU/mL) 142026

Volume: 1.0 mL (0.5 mL minimum) EDTA Plasma

Age	Range
1-6 yr	4-89
7-12 yr	3-66
13-17 yr	2-37

Renin Activity (ng/mL/hr) 002006

Volume: 2.5 mL (1.1 mL minimum) Plasma, **Frozen**

Age	Male/Female
0-1 mo	2.0-35.0
2-11 mo	2.4-37.0
1-3 yr	1.7-11.2
4-5 yr	1.0-6.5
6-10 yr	0.5-5.9
11-15 yr	0.5-3.3

Serotonin (ng/mL) 120089

Volume: 1.5 mL (minimum) 0.6 mL Blood, **Frozen**

Age	Male/Female
0-18 yr	113-431

Note: Use plastic transport tubes for all frozen specimens. In addition, to avoid delays in turnaround time when requesting multiple tests on frozen samples, please submit separate specimens for each test requested.

Serotonin, Platelet (ng/10^9 platelets) 120196

See *Directory of Services and Interpretive Guide* for specimen requirements

Age	Male/Female
0-19 mo	164-424
20 mo - 15 yr	537-903

Sex Hormone-binding Globulin (nmol/L) 082016

Volume: 0.3 mL (0.1 mL minimum) Serum

Age	Male	Female
0-1 mo	11-71	12-51
1-12 mo	60-209	50-181
1-3 yr	42-156	51-158
4-6 yr	39-146	48-142
7-9 yr	38-114	31-103
10-12 yr	32-93	20-100
13-15 yr	13-93	17 -77
16-18 yr	11-54	9-75

Testosterone, Total (ng/dL) 004226

Volume: 0.8 mL (0.3 mL minimum) Serum

Age	Male	Female
1-5 mo	1-177	1-5
6-11 mo	2-7	2-5
1-5 yr	0-10	0-10
6-7 yr	0-20	0-10
8-10 yr	0-25	0-30
11-12 yr	0-350	0-50
13-15 yr	15-500	0-50
Tanner Stage		
I	2-23	2-10
II	5-70	5-30
III	15-280	10-30
IV	105-545	15-40
V	265-800	10-40

Testosterone, Free by Ultrafiltration ..... 081786 with Total (ng/dL)

Volume: 1.8 mL (0.7 mL minimum) Serum

Free Testosterone (ng/dL)

Age	Male	Female
Cord Blood	0.50-2.20	0.40-1.60
1-15 days	0.15-3.10	0.05-0.25
1-2 mo	0.33-0.80	0.01-0.13
3-5 mo	0.07-1.40	0.03-0.11
6-7 mo	0.04-0.48	0.02-0.06
6-9 yr	0.01-0.32	0.01-0.09
10-11 yr	0.06-0.57	0.10-0.52
12-14 yr	0.14-15.60	0.10-0.52
15-17 yr	8.00-15.90	0.10-0.52

Percentage of Total Testosterone

Age	Male	Female
Cord Blood	2.0-4.4	2.0-3.9
1-15 days	0.9-1.7	0.8-1.5
1-2 mo	0.4-0.8	0.4-1.1
3-5 mo	0.4-1.1	0.5-1.0
6-7 mo	0.4-1.0	0.5-0.8
6-9 yr	0.9-1.7	0.9-1.4
10-11 yr	1.0-1.9	1.0-1.9
12-14 yr	1.3-3.0	1.0-1.9
15-17 yr	1.8-2.7	1.0-1.9

Thyroglobulin, Quantitative (ng/mL) 042846*

Volume: 0.8 mL (0.3 mL minimum) Serum

Term Infants	Male/Female
Cord Blood	5-65
1 day	6-93
10 day	9-148

Premature Infants (27 to 31 weeks)

1 day	107-395
3 day	49-163
30 day	17-63

*This test may be considered by Medicare and other carriers as investigational and, therefore, may not be payable by the carrier as a covered benefit for patients.

Note: Use plastic transport tubes for all frozen specimens. In addition, to avoid delays in turnaround time when requesting multiple tests on frozen samples, please submit separate specimens for each test requested.

Premature Infants (31 to 34 weeks)

1 day	147-277
10 day	32-112
30 day	19-51
7-12 yr	20-50
13-18 yr	9-27

Thyroid-stimulating Hormone (µIU/mL) 004259

Volume: 0.8 mL (0.3 mL minimum) Serum

Age	Male	Female
1-30 days	0.52-16.00	0.72-13.10
1 mo-5 yr	0.55-7.10	0.46-8.10
6-18 yr	0.37-6.00	0.36-5.80

Thyroxine (T_4) (µg/dL) 001149

Volume: 0.8 mL (0.3 mL minimum) Serum

Age	Male	Female
< 1 mo	5.9-21.5	6.3-21.5
1-11 mo	6.4-13.9	4.9-13.7
1-3 yr	7.0-13.1	7.1-14.1
4-6 yr	6.1-12.6	7.2-14.0
7-12 yr	6.7-13.4	6.1-12.1
13-15 yr	4.8-11.5	5.8-11.2

Thyroxine (T_4), Free by Equilibrium Dialysis (ng/dL) 141002

Volume: 0.5 mL (0.2 mL minimum) Serum

Age	Range
Birth-4 days	2.2-5.3
2 wk - 20 yr	0.8-2.0

Thyroxine (T_4), Free, Direct (ng/dL) 001974

Volume: 0.8 mL (0.3 mL minimum) Serum

Age	Male	Female
1-3 days	0.80-2.78	0.88-1.93
4-30 days	0.48-2.32	0.61-1.93
1-11 mo	0.76-2.00	0.88-1.84
1-5 yr	0.90-1.59	1.02-1.72
6-10 yr	0.81-1.68	0.82-1.58
11-15 yr	0.92-1.57	0.79-1.49
16-18 yr	0.92-1.53	0.83-1.44

Thyroxine-binding Globulin (µg/mL) 001735

Volume: 0.8 mL (0.3 mL minimum) Serum

Age	Male	Female
1-11 mo	16-33	18-32
1-3 yr	16-32	19-34
4-6 yr	17-30	18-31
7-12 yr	17-29	15-29
13-18 yr	13-26	14-29

Triiodothyronine (T_3), (ng/mL) 002188

Volume: 0.8 mL (0.3 mL minimum) Serum

Age	Male	Female
0-1 mo	15-210	15-200
2-11 mo	95-275	50-264
1-5 yr	80-253	126-258
6-10 yr	96-232	104-227
11-15 yr	73-199	96-211
16-18 yr	69-201	91-164

Triiodothyronine (T_3), Free (pg/mL) 010389

Volume: 0.5 mL (0.3 mL minimum) Serum

Age	Male	Female
1-3 days	1.4-4.8	1.4-5.4
4-30 days	1.4-5.5	1.5-5.0
1-11 mo	2.0-6.9	2.5-6.5
1-5 yr	2.4-6.7	3.0-6.0
6-10 yr	2.9-6.0	2.7-6.2
11-15 yr	3.1-5.9	2.6-5.7
16-18 yr	3.5-5.7	2.8-5.2

Triiodothyronine (T_3), Reverse (pg/mL) 002212

Volume: 0.3 mL (0.2 mL minimum) Serum

Age	Male/Female
1-4 yr	150-710
5-9 yr	170-790
10-15 yr	190-880

Note: Use plastic transport tubes for all frozen specimens. In addition, to avoid delays in turnaround time when requesting multiple tests on frozen samples, please submit separate specimens for each test requested.

Triiodothyronine (T_3), Uptake (%) 001156

Volume: 0.8 mL (0.3 mL minimum) Serum

Age	Male	Female
0-11 mo	23-34	23-36
1-3 yr	24-35	24-36
4-6 yr	24-34	24-35
7-12 yr	24-33	22-35
11-15 yr	25-37	23-37
16-18 yr	24-38	23-35

Vanillylmandelic Acid (VMA) ..... 123208 (mg/g creatinine)

Volume: 10 mL (4 mL minimum) Random Urine

Age	Male/Female
0-1 yr	0-18.8
2-4 yr	0-11.0
5-9 yr	0-8.3
10-19 yr	0-8.2

Vitamin D, 25-Hydroxy (ng/mL) 081950

Volume: 0.3 mL (0.2 mL minimum) Serum

Summer Ranges

Age	Male	Female
< 1 mo	11-44	11-41
1-11 mo	26-48	23-62
1-3 yr	12-60	18-62
4-12 yr	9-49	7-48
13-18 yr	9-41	7-38

Winter Ranges

Age	Male	Female
< 1 mo	8-38	6-42
1-11 mo	13-68	18-48
1-3 yr	16-51	17-53
4-12 yr	11-47	14-40
13-18 yr	6-39	6-28

Note: Use plastic transport tubes for all frozen specimens. In addition, to avoid delays in turnaround time when requesting multiple tests on frozen samples, please submit separate specimens for each test requested.

References

Aldosterone, Serum

Meites S, Buffone GJ, Cheng MH, et al, eds. *Pediatric Clinical Chemistry, Reference (Normal) Values.* 3rd ed. Washington, DC: AACC Press; 1989:45.

Stark P, Beckerhoff R, Leumann EP, et al. Control of plasma aldosterone in infancy and childhood. *Helv Paediatr Acta.* 1976; 30:349-356.

Aldosterone, Urine

Meites S, Buffone GJ, Cheng MH, et al, eds. *Pediatric Clinical Chemistry, Reference (Normal) Values.* 3rd ed. Washington, DC: AACC Press; 1989:45-46.

Loeuile GA, Racadot A, Vasseur P, Vandewalle B. Blood and urinary aldosterone levels in normal neonates, infants and children. *Pediatrie.* 1981; 36:335-344.

5α-Androstane-3α,17ß-Diol Glucuronide

Rittner HL, Lee PDK, Blum WF, et al. Developmental patterns of serum 3 alpha-androstanediol glucuronide. *J Edocrinol Invest.* 1997; 20:245-250.

Androstenedione

Soldin SJ, Hicks JM, eds. *Pediatric Reference Ranges.* Washington, DC: AACC Press; 1995: 30.

Meites S, Buffone GJ, Cheng MH, et al, eds. *Pediatric Clinical Chemistry, Reference (Normal) Values.* 3rd ed. Washington, DC: AACC Press; 1989:56.

Angiotensin-converting Enzyme

Tietz NW, ed. *Clinical Guide to Laboratory Tests.* 3rd ed. Philadelphia: W.B. Saunders Company; 1995:54.

Lieberman J. Elevation of serum angiotensin-converting enzyme (ACE) level in sarcoidosis. *Am J Med.* 1975; 59:365.

Antidiuretic Hormone

Rascher W, Rauh W, Brandeis WE, Huber K-H, Schärer K. Determinants of plasma arginine-vasopressin in children. *Acta Paediatr Scand.* 1986;75:111-117.

β_2-Microglobulin

Soldin SJ, Hicks JM, Bailey J, Beatey J, Watson P. Pediatric reference ranges for B2-microglobulin and ceruloplasmin. *Clin Chem.* 1997; 43:S199.

Bone-Specific Alkaline Phoshphatase

Tobiume H, Kanzaki S, Hida S, et al. Serum bone alkaline phosphatase isoenzyme levels in normal children and children with growth hormone (GH) deficiency: A potential marker for bone formation and response to GH therapy. *J Clin Endocrinol Metab.* 1997;82(7):2056-2061.

Cathecholamines, Serum

Candito M, Albertini M, Politano S, et al. Plasma catecholamine levels in children. *J Chromatogr B Biomed Sci Appl.* 1993; 617:304-307.

Cathecholamines, Urine

Soldin SJ, Lam G, Pollard A, et al. High performance liquid chromatographic analysis of urinary catecholamines employing amperometric detection: Reference values and use in laboratory diagnosis of neural crest tumors. *Clin Biochem.* 1980; 13:285-291.

Cortisol, Serum

Jonetz-Mentzel L, Wiedmann G. Establishment of reference ranges for cortisol in neonates, infants, children and adolescents. *Eur J Clin Chem Biochem.* 1993; 31:525-529.

Lashansky G, Saenger P, Fishman K, et al. Normative data for adrenal steroidogenesis in a healthy pediatric population: Age- and sex-related changes after adrenocorticotropin stimulation. *J Clin Endocrinol Metab.* 1991; 73:674-686.

Cortisol, Urine

Tietz NW, ed. *Clinical Guide to Laboratory Tests.* 3rd ed. Philadelphia: W.B. Saunders Company; 1995:174.

C-Peptide, Serum

Ratzmann KP, Strese J Kohnert DK, et al. Age-dependent relationship of fasting C-peptide concentration and insulin secretion in non-obese subjects with normal glucose tolerance. *Exp Clin Endocrinol.* 1986; 88:57-63.

Dehydroepiandrosterone (DHEA)

Ducharme JR, Forest MG, De Peretti E, et al. Plasma adrenal and gonadal sex steroids in human pubertal development. *J Clin Endicrinol Metab.* 1976; 42:468-476.

Tietz NW, ed. *Clinical Guide to Laboratory Tests.* 3rd ed. Philadelphia: W.B. Saunders Company; 1995:195-196.

Dehydroepiandrosterone Sulfate (DHEA-S)

Kühnel W. Immulite and Immulite 2000 Reference Range Compendium. Los Angeles, Calif: Diagnostic Products Corporation; 2000. [DPC Technical Report]

Deoxypyridinoline (Dpd) Cross-links

Bjorgaas M, Haug E, Johnsen HJ. The urinary excretion of deoxypyridinium cross-links is higher in diabetic than in nondiabetic adolescents. *Calcif Tissue Int.* 1999;65:121-124.

Dihydrotestosterone

Tietz NW, ed. *Clinical Guide to Laboratory Tests.* 3rd ed. Philadelphia: W.B. Saunders Company; 1995:202-203.

Erythropoietin

Krafte-Jacobs B, Williams J, Soldin SJ. Plasma erythropoetin reference ranges in children. *J Pediatrics.* 1995; 126:601-603.

Estradiol

Soldin SJ, Brugnara C, Gunter KC, Hicks JM, eds. *Pediatric Reference Ranges.* 2nd ed. Washington, DC: AACC Press; 1997:68.

Abraham GE, Odell WD, Swerdloff RS, Hopper K. Simultaneous radioimmunoassay of plasma FSH, LH, progesterone, 17-hydroxyprogesterone, and estradiol-17beta during the menstrual cycle. *J Clin Endocrinol Metab.* 1972; 34:312-318.

Tietz NW, ed. *Clinical Guide to Laboratory Tests.* 3rd ed. Philadelphia: W.B. Saunders Company; 1995:216.

Estrogens, Total

Tietz NW, ed. *Clinical Guide to Laboratory Tests.* 3rd ed. Philadelphia: W.B. Saunders Company; 1995:220.

Estrone

Meites S, Buffone GJ, Cheng MH, et al, eds. *Pediatric Clinical Chemistry, Reference (Normal) Values.* 3rd ed. Washington, DC: AACC Press; 1989:123.

Ducharme JR, Forest MG, De Peretti E, et al. Plasma adrenal and gonadal sex steroids in human pubertal development. *J Clin Endicrinol Metab.* 1976; 42:468-476.

Tietz NW, ed. *Clinical Guide to Laboratory Tests.* 3rd ed. Philadelphia: W.B. Saunders Company; 1995:222.

Follicle-stimulating Hormone (FSH)

Murthy JN, Hicks JM, Soldin SJ. Evaluation of the Technicon Immuno I Random Access Immunoassay Analyzer and calculation of pediatric reference ranges for endocrine tests, T-uptake and ferritin. *Clin Biochem.* 1995; 28:181-185.

Tietz NW, ed. *Clinical Guide to Laboratory Tests.* 3rd ed. Philadelphia: W.B. Saunders Company; 1995:248.

Gastrin

Meites S, Buffone GJ, Cheng MH, et al, eds. *Pediatric Clinical Chemistry, Reference (Normal) Values.* 3rd ed. Washington, DC: AACC Press; 1989:131.

Sann L, Chayvialle JAP, Bremond A, Lambert R, Serum gastrin level in early childhood. *Arch Disease Childhood.* 1975; 50:782-785.

Janik JS, Akbar AM, Burrington JD, Burke G. Serum gastrin levels in infants and children. *Pediatrics.* 1977; 60:60-64.

Glutamic Acid Decarboxylase

Kronus (kit manufacturer) Directional Insert.

Growth Hormone

Tietz NW, ed. *Clinical Guide to Laboratory Tests.* 3rd ed. Philadelphia: W.B. Saunders Company; 1995:300.

Baumann G. Growth hormone binding protiens and various forms of growth hormone: Implications for measurements. *Acta Paediatr Scand Suppl.* 1990; 370:72-80.

Homovanillic Acid (HVA)

Tuchman M, Morris CL, Ramnaraine ML, et al. Value of random urinary homovanillic acid and vanillylmandelic acid levels in the diagnosis of and management of patients with neuroblastoma: Comparison with 24-hour urine collections. *Pediatrics.* 1985; 75:324-328.

5-Hydroxyindoleacetic Acid

Soldin SJ, et al, eds. *Pediatric Reference Ranges.* 2nd ed. Washington, DC: AACC Press; 1997:89.

17-Hydroxypregnenolone

Lashanski G, Saenger P, Fishman K, et al. Normative data for adrenal steroidogenesis in a healthy pediatric population: Age- and sex-related changes after adrenocorticotropin stimulation. *J Clin Endocinol Metab.* 1991;73(3):674-686.

17-Hydroxyprogesterone

Soldin SJ, Bailey J, Beatey J, et al. Pediatric Reference ranges for 17 alpha-hydroxy progesterone. *Clin Chem.* 1995; 41:S92.

Insulin, Fasting

Smith P, Dunger DB, Williams AJK, et al. Relationship between insulin, insulin-like growth factor I, and dehydroepiandrosterone sulfate concentrations during childhood, puberty and adult life. *J Clin Endocrinol Metab.* 1989; 68:932-937.

Insulin-like Growth Factor I (IGF-I)

Nichols Institute Diagnostics (kit manufacturer) Directional Insert.

Insulin-like Growth Factor II (IGF-II)

Diagnostic Systems Laboratory Technical Communication.

Insulin-like Growth Factor-binding Protein 3

Nichols Institute Diagnostics (kit manufacturer) Directional Insert.

17-Ketogenic Steroids

Tietz NW, ed. *Clinical Guide to Laboratory Tests.* 3rd ed. Philadelphia: W.B. Saunders Company; 1995:380.

17-Ketosteroids

Tietz NW, ed. *Clinical Guide to Laboratory Tests.* 3rd ed. Philadelphia: W.B. Saunders Company; 1995:380.

Luteinizing Hormone (LH)

Soldin SJ, Morales A, Albalos, et al. Pediatric reference ranges on the Abbott Imx for FSH, LH, prolactin, TSH, T_4, T_3, free T_4, free T_3, T-uptake, IgE and ferritin. *Clin Biochem.* 1995; 28:603-606.

Tietz NW, ed. *Clinical Guide to Laboratory Tests.* 3rd ed. Philadelphia: W.B. Saunders Company; 1995:410.

Metanephrines

Soldin SJ, Hicks JM, eds. *Pediatric Reference Ranges.* Washington, DC: AACC Press; 1995.

N-Telopeptide Cross-links (NTX)

Mora S, Prinster C, Proverbio MC, et al. Urinary markers of bone turnover in healthy children and adolescents: Age-related changes and effect of puberty. *Calcif Tissue Int.* 1998; 63:369-374.

Neopterin

Werner ER, Bichler A, Daxenbichler G, et al. Determination of neopterin in serum and urine. *Clin Chem.* 1987; 33:62-66.

Osteocalcin

Johansen JS, Giwercman A, Hartwell D, et al. Serum bone Gla-protein as a marker of bone growth in children and adolescents: Correlation with age, height, serum insulin-like growth factor I, and serum testosterone. *J Clin Endocrinol Metab.* 1988;67(2):273-278.

Parathyroid Hormone, Intact

Soldin SJ et al, eds. *Pediatric Reference Ranges.* 2nd ed. Washington, DC: AACC Press; 1997:119.

Pregnenolone

Lashanski G, Saenger P, Dimartino-Nardi J, et al. Normative data for the steroidogenic response of mineralocorticoids and their precursors to adrenocorticotropin in a healthy pediatric population. *J Clin Endocinol Metab*. 1992;75(6):1491-1496.

Progesterone

Tietz NW, ed. *Clinical Guide to Laboratory Tests.* 3rd ed. Philadelphia: W.B. Saunders Company; 1995:508.

Prolactin

Cook JF, Hicks JM, Godwin ID, et al. Pediatric reference ranges for prolactin. *Clin Chem.* 1992; 38:959.

Renin Active

Coates JE, Chapelsky LJ, Yatscoff RW. Pediatric reference intervals for plasma renin. *Clin Biochem.* 1994;27(4):316-317.

Renin Activity

Tietz NW, ed. *Clinical Guide to Laboratory Tests.* 3rd ed. Philadelphia: W.B. Saunders Company; 1995:538.

Serotonin, Whole Blood

Goldsmith BM, Feinstein C, Munson S, et al. Determination of a reference range for whole blood serotonin in a pediatric population using high pressure liquid chromatography with electrochemical detection. *Clin Biochem.* 1986; 19:359-363.

Serotonin, Platelet

Flachaire E, Beney C, Berthier A, et al. Determination of reference values for serotonin concentration in platelets of healthy newborns, children, adults and elderly subjects by HPLC with electrochemical detection. *Clin Chem.* 1990; 36:2117-2120.

Sex Hormone-binding Globulin

Hicks SJ, Bailey JM, Beatey J, Watson P. Pediatric reference ranges for sex hormone binding globulin. *Clin Chem.* 1997; 43:S200.

Testosterone, Total

Soldin SJ, Hicks JM, eds. *Pediatric Reference Ranges.* Washington, DC: AACC Press; 1995:124.

Meites S, Buffone GJ, Cheng MH, et al, eds. *Pediatric Clinical Chemistry, Reference (Normal) Values.* 3rd ed. Washington, DC: AACC Press; 1989:247.

Tietz NW, ed. *Clinical Guide to Laboratory Tests.* 3rd ed. Philadelphia: W.B. Saunders Company; 1995:578.

Testosterone, Free by Ultrafiltration

Tietz NW, ed. *Clinical Guide to Laboratory Tests.* 3rd ed. Philadelphia: W.B. Saunders Company; 1995:578.

Thyroglobulin

Meites S, Buffone GJ, Cheng MH, et al, eds. *Pediatric Clinical Chemistry, Reference (Normal) Values.* 3rd ed. Washington, DC: AACC Press; 1989:249.

Thyroid-stimulating Hormone (TSH)

Soldin SJ, Morales A, Albalos, et al. Pediatric reference ranges on the Abbott Imx for FSH, LH, prolactin, TSH, T_4, T_3, free T_4, free T_3, T-Uptake, IgE and ferritin. *Clin Biochem.* 1995; 28:603-606.

Thyroxine (T_4)

Soldin SJ, Hicks JM, eds. *Pediatric Reference Ranges.* Washington, DC: AACC Press; 1995:141.

Soldin SJ, Cook J, Beaty et al. Pediatric reference ranges for thyroxine and triiodothyronine uptake. *Clin Chem.* 1992; 38:960.

Thyroxine (T_4), Free by Ultrafiltration

Tietz NW, ed. *Clinical Guide to Laboratory Tests.* 3rd ed. Philadelphia: W.B. Saunders Company; 1995:596.

Thyroxine (T_4), Free, Direct

Soldin SJ, Morales A, Albalos, et al. Pediatric reference ranges on the Abbott Imx for FSH, LH, prolactin, TSH, T_4, T_3, free T_4, free T_3, T-Uptake, IgE and ferritin. *Clin Biochem.* 1995; 28:603-606.

Thyroxine-binding Globulin (TBG)

Hicks JM, Godwin ID, Beatey J, et al. Pediatric reference ranges for thyroid binding globulin. *Clin Chem.* 1993; 39:1172.

Triiodothyronine (T_3)

Soldin SJ, Morales A, Albalos, et al. Pediatric reference ranges on the Abbott Imx for FSH, LH, Prolactin, TSH, T_4, T_3, free T_4, free T_3, T-Uptake, IgE and ferritin. *Clin Biochem.* 1995; 28:603-606.

Triiodothyronine (T_3), Free

Soldin SJ, Morales A, Albalos, et al. Pediatric reference ranges on the Abbott Imx for FSH, LH, Prolactin, TSH, T_4, T_3, free T_4, free T_3, T-Uptake, IgE and ferritin. *Clin Biochem,* 1995; 28:603-606.

Triiodothyronine (T_3), Reverse

Soldin SJ, Hicks JM, eds. *Pediatric Reference Ranges.* Washington, DC: AACC Press; 1995:132.

Triiodothyronine Uptake (T_3U)

Soldin SJ, Cook J, Beaty, et al. Pediatric reference ranges for thyroxine and triiodothyronine uptake. *Clin Chem.* 1992; 38:960.

Vanillylmandelic Acid (VMA)

Soldin SJ, Hill JG. Liquid chromatographic analysis for urinary 4-hydrozy-3-methoxy-mandelic acid and 4-hydroxy-3-mehoozyphenyl acetic acid and ist use in investigation of neural crest tumors. *Clin* Chem. 1981; 27:502-503.

Vitamin D, 25-Hydroxy

Soldin SJ, Murthy JN, Lauber B, MacFarlane G. Pediatric reference ranges for 25-hydroxy vitamin D using the DiaSorin Kit. *Clin Chem.* 1998; 44:A14.