

Biological Variation Values

Desirable Analytical Quality Specifications for Imprecision, Bias and Total Error Based Upon Biological Variation

The following values are provided as a service to Bio-Rad Customers and are based upon desirable performance. The values are derived from Ricos C, Alvarez V, Cava F, Garcia-Lario JV, Hernandez A, Jimenez CV, Mininchela J, Perich C, Simon M. "Current databases on biologic variation: pros, cons and progress" Scand J Clin Lab Invest 1999;59:491-500. These values are updated/modified with the most recent specifications made available in 2008.

S = serum; U = urine; P = plasma; B = blood; Plat = platelets; Ery = erythrocytes; Hb = hemoglobin; Leu = leukocytes; Pt = patient; Sa = saliva

CV_w = within-subject biological variation; CV_b = between-subject biological variation; Imp = imprecision; TE = total error

	ANALYTE	BIOLOGICAL VARIATION		DESIRABLE SPECIFICATIONS			
		CV _w	CV _b	Imp (%)	Bias (%)	TE _a (%) p<0.05	TE _a (%) p<0.01
S	11-Deoxycortisol	21.3	31.5	10.7	9.5	27.1	34.3
S	17-Hydroxyprogesterone	19.6	52.4	9.8	14.0	30.2	36.8
U	5-HIAA concentration, 24 h	20.3	33.2	10.2	9.7	26.5	33.4
S	5'Nucleotidase	23.2	19.9	11.6	7.6	26.8	34.7
S	a1-Acid glycoprotein	11.3	24.9	5.7	6.8	16.2	20.0
S	a1-Antitrypsin	5.9	16.3	3.0	4.3	9.2	11.2
S	a1-Globulin	11.4	22.6	5.7	6.3	15.7	19.6
S	a2-Globulins	10.3	12.7	5.2	4.1	12.6	16.1
S	a2-Macroglobulin	3.4	18.7	1.7	4.8	7.6	8.7
S	a-Amylase	8.7	28.3	4.4	7.4	14.6	17.5
U	a-Amylase	94	46	47.0	26.2	103.7	135.7
S	a-Amylase, pancreatic	11.7	29.9	5.9	8.0	17.7	21.7
S	Acid phosphatase (ACP)	8.9	8	4.5	3.0	10.3	13.4
P	Activated partial thromboplastin time	2.7	8.6	1.4	2.3	4.5	5.4
P	Adiponectin	18.8	51.2	9.4	13.6	29.1	35.5
S	AFP	12	46	6.0	11.9	21.8	25.9
S	Alanine aminotransferase	24.3	41.6	12.2	12.0	32.1	40.4
S	Albumin	3.1	4.2	1.6	1.3	3.9	4.9
U	Albumin	36	55	18.0	16.4	46.1	58.4
S	Aldosterone	29.4	40.1	14.7	12.4	36.7	46.7
U	Aldosterone concentration, 24 h	32.6	39	16.3	12.7	39.6	50.7
S	Alkaline phosphatase	6.4	24.8	3.2	6.4	11.7	13.9
U	Aminolevulinic Acid	16	27	8.0	7.8	21.0	26.5
U	Ammonia output, 24 h	24.7	27.3	12.4	9.2	29.6	38.0
S	Androstendione	11.5	51.1	5.8	13.1	22.6	26.5
S	Angiotensin converting enzyme	12.5	27.7	6.3	7.6	17.9	22.2
P	Antithrombin III	5.2	15.3	2.6	4.0	8.3	10.1
S	Apolipoprotein A1	6.5	13.4	3.3	3.7	9.1	11.3
S	Apolipoprotein B	6.9	22.8	3.5	6.0	11.6	14.0
S	Ascorbic Acid (Vitamin C)	26	31	13.0	10.1	31.6	40.4
S	Aspartate aminotransferase	11.9	17.9	6.0	5.4	15.2	19.2
S	a-Tocopherol	13.8	13.3	6.9	4.8	16.2	20.9
S	b2-Microglobulin	5.9	15.5	3.0	4.1	9.0	11.0
B	Basophils, count	28	54.8	14.0	15.4	38.5	48.0
B	Basophils, count	28	54.8	14.0	15.4	38.5	48.0
S	b-Globulins	10.1	9.1	5.1	3.4	11.7	15.2
S	Bilirubin, conjugated	36.8	43.2	18.4	14.2	44.5	57.1
S	Bilirubin, total	23.8	39	11.9	11.4	31.1	39.1
S	C Peptide	9.3	13.3	4.7	4.1	11.7	14.9

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		CV _w	CV _b	Imp (%)	Bias (%)	TE _a (%) p<0.05	TE _a (%) p<0.01
S	C3 complement	5.2	15.6	2.6	4.1	8.4	10.2
S	C4 complement	8.9	33.4	4.5	8.6	16.0	19.0
S	CA 125	24.7	54.6	12.4	15.0	35.4	43.8
S	CA 15.3	5.7	42.9	2.9	10.8	15.5	17.5
S	CA 19.9	24.5	93	12.3	24.0	44.3	52.6
S	CA 549	9.1	33.4	4.6	8.7	16.2	19.3
S	Calcium	1.9	2.8	1.0	0.8	2.4	3.1
U	Calcium	27.5	36.6	13.8	11.4	34.1	43.5
U	Calcium, Ionized	1.7	2.2	0.9	0.7	2.1	2.7
S	Carbohydrate deficient transferrin	7.1	38.7	3.6	9.8	15.7	18.1
S	Carcinoembryonic antigen (CEA)	12.7	55.6	6.4	14.3	24.7	29.1
S	Carnitine, Free	7.6	15.2	3.8	4.2	10.5	13.1
S	Carnitine, Total	7.7	13.8	3.9	4.0	10.3	12.9
B	CD4	25		12.5			
S	Ceruloplasmin	5.7	11.1	2.9	3.1	7.8	9.8
S	Chloride	1.2	1.5	0.6	0.5	1.5	1.9
S	Cholesterol	5.4	15.2	2.7	4.0	8.5	10.3
S	Cholinesterase	7	10.4	3.5	3.1	8.9	11.3
S	CK MB, activity	19.7	24.3	9.9	7.8	24.1	30.8
S	CK MB, mass	18.4	61.2	9.2	16.0	31.2	37.4
P	Copper	8	19	4.0	5.2	11.8	14.5
S	Copper	4.9	13.6	2.5	3.6	7.7	9.3
S	Cortisol	20.9	45.6	10.5	12.5	29.8	36.9
S	C-Reactive protein	42.2	76.3	21.1	21.8	56.6	71.0
S	Creatine kinase	22.8	40	11.4	11.5	30.3	38.1
S	Creatinine	5.3	14.2	2.7	3.8	8.2	10.0
U	Creatinine	24	24.5	12.0	8.6	28.4	36.5
S	Cyfra 21.1	22.5	31.1	11.3	9.6	28.2	35.8
S	Cystatin C	4.6	13	2.3	3.4	7.2	8.8
P	Cysteine	5.9	12.3	3.0	3.4	8.3	10.3
S	Dehydroepiandrosterone sulfate	4.2	29.3	2.1	7.4	10.9	12.3
B	Eosinophils, count	21	76.4	10.5	19.8	37.1	44.3
B	Erythrocytes, count	3.2	6.1	1.6	1.7	4.4	5.5
S	Estradiol	18.1	19.7	9.1	6.7	21.6	27.8
P	Factor VII	6.8	19.4	3.4	5.1	10.7	13.1
P	Factor VIII	4.8	19.1	2.4	4.9	8.9	10.5
S	Ferritin	14.2	15	7.1	5.2	16.9	21.7
P	Fibrinogen	10.7	15.8	5.4	4.8	13.6	17.2
S	Folate	24	73	12.0	19.2	39.0	47.2
B	Folate	12	66	6.0	16.8	26.7	30.8
S	Follicle stimulating hormone	8.7	18	4.4	5.0	12.2	15.1
S	Free thyroxine (FT4)	7.6	12.2	3.8	3.6	9.9	12.4
S	Fructosamine	3.4	5.9	1.7	1.7	4.5	5.7
S	Globulins, total	5.5	12.9	2.8	3.5	8.0	9.9
S	Glucose	5.7	6.9	2.9	2.2	6.9	8.9
B	Glucose-6-Phosphate Dehydrogenase	32.8	31.8	16.4	11.4	38.5	49.6
B	Glutathione peroxidase	7.2	21.7	3.6	5.7	11.7	14.1
S	Glycated albumin	5.2	10.3	2.6	2.9	7.2	8.9
P	Haptoglobin	20.4	36.4	10.2	10.4	27.3	34.2
S	Haptoglobin	20.4	36.4	10.2	10.4	27.3	34.2
P	HDL cholesterol	7.1	19.7	3.6	5.2	11.1	13.5
S	HDL cholesterol	7.1	19.7	3.6	5.2	11.1	13.5
B	Hematocrit	2.8	6.4	1.4	1.7	4.1	5.0
B	Hemoglobin	2.8	6.6	1.4	1.8	4.1	5.1

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		CV _w	CV _b	Imp (%)	Bias (%)	TE _a (%) p<0.05	TE _a (%) p<0.01
B	Hemoglobin	2.8	6.6	1.4	1.8	4.1	5.1
B	Hemoglobin A1C	1.9	4.0	1.0	1.1	2.7	3.3
S	High Sensitivity C-Reactive protein	42.2	76.3	21.1	21.8	56.6	71.0
P	Homocysteine	9	40.3	4.5	10.3	17.7	20.8
U	Hydroxyproline	36.1	38.8	18.1	13.2	43.0	55.3
S	Immunoglobulin A	5.4	35.9	2.7	9.1	13.5	15.4
S	Immunoglobulin G	4.5	16.5	2.3	4.3	8.0	9.5
S	Immunoglobulin M	5.9	47.3	3.0	11.9	16.8	18.8
S	Insulin	21.1	58.3	10.6	15.5	32.9	40.1
S	Iron	26.5	23.2	13.3	8.8	30.7	39.7
S	k-Chains	4.8	15.3	2.4	4.0	8.0	9.6
B	Lactate	27.2	16.7	13.6	8.0	30.4	39.7
S	Lactate dehydrogenase (LDH)	8.6	14.7	4.3	4.3	11.4	14.3
S	l-Chains	4.8	18	2.4	4.7	8.6	10.2
S	LD1	6.3	10.2	3.2	3.0	8.2	10.3
S	LD2	4.9	4.3	2.5	1.6	5.7	7.3
S	LD3	4.8	5.5	2.4	1.8	5.8	7.4
S	LD4	9.4	9	4.7	3.3	11.0	14.2
S	LD5	12.4	13.4	6.2	4.6	14.8	19.0
S	LDL cholesterol	8.3	25.7	4.2	6.8	13.6	16.4
B	Leukocytes, count	10.9	19.6	5.5	5.6	14.6	18.3
S	Lipase	23.1	33.1	11.6	10.1	29.1	37.0
S	Lipoprotein (a)	8.5	85.8	4.3	21.6	28.6	31.5
S	Luteinizing hormone	14.5	27.8	7.3	7.8	19.8	24.7
B	Lymphocytes, count	10.4	27.8	5.2	7.4	16.0	19.5
S	Magnesium	3.6	6.4	1.8	1.8	4.8	6.0
U	Magnesium	45.4	37.4	22.7	14.7	52.2	67.6
B	Mean corpuscular hemoglobin (MCH)	1.6	5.2	0.8	1.4	2.7	3.2
B	Mean corpuscular hemoglobin conc. (MCHC)	1.7	2.8	0.9	0.8	2.2	2.8
B	Mean corpuscular volume (MCV)	1.3	4.8	0.7	1.2	2.3	2.8
B	Mean platelet volume (MPV)	4.3	8.1	2.2	2.3	5.8	7.3
B	Monocytes, count	17.8	49.8	8.9	13.2	27.9	34.0
S	Mucinous carcinoma-associated antigen (MCA)	10.1	39.3	5.1	10.1	18.5	21.9
S	Myoglobin	13.9	29.6	7.0	8.2	19.6	24.4
S	NT-proBNP	17.2	28.8	8.6	8.4	22.6	28.4
S	Osmolality	1.3	1.2	0.7	0.4	1.5	2.0
S	Osteocalcin	6.3	23.1	3.2	6.0	11.2	13.3
B	pCO2	4.8	5.3	2.4	1.8	5.7	7.4
B	PH	3.5	2	1.8	1.0	3.9	5.1
S	Phenylacetate	6.6	25.2	3.3	6.5	12.0	14.2
S	Phosphate	8.5	9.4	4.3	3.2	10.2	13.1
S	Phospholipids	6.5	11.1	3.3	3.2	8.6	10.8
B	Platelets	9.1	21.9	4.6	5.9	13.4	16.5
U	Porphobilinogen	17	31	8.5	8.8	22.9	28.6
U	Porphyrins, Total	40		20.0			
S	Potassium	4.8	5.6	2.4	1.8	5.8	7.4
U	Potassium	27.1	23.2	13.6	8.9	31.3	40.5
S	Prealbumin	10.9	19.1	5.5	5.5	14.5	18.2
S	Prolactin (men)	6.9	61.2	3.5	15.4	21.1	23.4
S	Prostatic specific antigen (PSA)	18.1	72.4	9.1	18.7	33.6	39.7
U	Protein	39.6	17.8	19.8	10.9	43.5	57.0
P	Protein C	5.8	55.2	2.9	13.9	18.7	20.6
P	Protein S	5.8	63.4	2.9	15.9	20.7	22.7
S	Protein, total	2.7	4	1.4	1.2	3.4	4.4

