

Supplementary Table 1. Suggested analytical performance specification for various measurands in the field of clinical chemistry based on the EFLM biological variation database (Milan model 2) (last accessed on May 12 2023)

Measurand	Matrix	EFLM BV DB											
		CV _i	CV ₆	II (CV _i /CV ₆)		Imprecision (%)			Allowable bias (%)			TEa (%)	
				Minimum	Desirable	Optimal	Minimum	Desirable	Optimal	Minimum	Desirable	Optimal	
17- α -hydroxyprogesterone	Serum/plasma	28.3	38.6	0.73	21.2	14.2	7.1	17.9	12.0	6.0	53.0	35.3	17.7
25-hydroxy vitamin D3	Serum/plasma	6.9	26.1	0.26	5.2	3.5	1.7	10.1	6.7	3.4	18.7	12.4	6.2
Adiponectin	Serum/plasma	18.8	51.2	0.37	14.1	9.4	4.7	20.5	13.6	6.8	43.7	29.1	14.6
Adrenaline	Urine	135.0	54.0	2.50	101.3	67.5	33.8	54.5	36.3	18.2	221.6	147.7	73.9
Alanine transaminase (ALT)	Serum/plasma	10.1	29.3	0.34	7.6	5.0	2.5	11.6	7.7	3.9	24.1	16.1	8.0
Albumin	Serum/plasma	2.5	4.9	0.51	1.9	1.3	0.6	2.1	1.4	0.7	5.2	3.4	1.7
Aldosterone	Serum/plasma	36.6	34.7	1.05	27.5	18.3	9.2	18.9	12.6	6.3	64.2	42.8	21.4
Alkaline phosphatase (ALP) bone isoenzyme	Serum/plasma	6.6	35.6	0.19	4.9	3.3	1.6	13.6	9.1	4.5	21.7	14.5	7.2
Alkaline phosphatase (ALP), liver type	Serum/plasma	5.3	24.1	0.22	4.0	2.6	1.3	9.3	6.2	3.1	15.8	10.5	5.3
Alpha-1 antitrypsin	Serum/plasma	4.1	10.5	0.39	3.1	2.0	1.0	4.2	2.8	1.4	9.3	6.2	3.1
Alpha fetoprotein (AFP)	Serum/plasma	4.6	55.2	0.08	3.4	2.3	1.1	20.8	13.8	6.9	26.5	17.6	8.8
Amylase	Serum/plasma	6.6	30.2	0.22	4.9	3.3	1.6	11.6	7.7	3.9	19.8	13.2	6.6
Anti-Müllerian hormone (AMH)*	Serum/plasma	19.2	-	-	14.4	9.6	4.8	-	-	-	-	-	-
Apolipoprotein A1	Serum/plasma	5.4	11.2	0.48	4.1	2.7	1.4	4.7	3.1	1.6	11.3	7.6	3.8
Apolipoprotein B	Serum/plasma	7.4	20.2	0.37	5.6	3.7	1.9	8.1	5.4	2.7	17.2	11.5	5.7
Aspartate transaminase (AST)	Serum/plasma	9.6	20.8	0.46	7.2	4.8	2.4	8.6	5.7	2.9	20.5	13.6	6.8
Beta-2-microglobulin	Serum/plasma	4.1	11.5	0.36	3.1	2.0	1.0	4.6	3.1	1.5	9.7	6.4	3.2
Bicarbonate	Whole blood	4.0	4.8	0.83	3.0	2.0	1.0	2.3	1.6	0.8	7.3	4.9	2.4
Bicarbonate	Serum/plasma	4.2	4.4	0.95	3.2	2.1	1.1	2.3	1.5	0.8	7.5	5.0	2.5
Bilirubin, total	Serum/plasma	20.0	26.7	0.75	15.0	10.0	5.0	12.5	8.3	4.2	37.3	24.8	12.4
Calcitonin	Serum/plasma	13.0	65.8	0.20	9.8	6.5	3.3	25.2	16.8	8.4	41.2	27.5	13.7
Calcium	Serum/plasma	1.8	2.7	0.67	1.4	0.9	0.5	1.2	0.8	0.4	3.4	2.3	1.1
Cancer antigen 125 (CA 125)	Serum/plasma	8.7	25.5	0.34	6.5	4.3	2.2	10.1	6.7	3.4	20.9	13.9	7.0
Cancer antigen 19-9 (CA 19-9)	Serum/plasma	4.3	57.4	0.07	3.2	2.1	1.1	21.6	14.4	7.2	26.9	17.9	9.0
Cancer antigen 72-4 (CA 72-4)	Serum/plasma	50.3	103.4	0.49	37.7	25.1	12.6	43.1	28.7	14.4	105.4	70.2	35.1
Carbon dioxide, total (tCO2)	Whole blood	4.0	4.8	0.83	3.0	2.0	1.0	2.3	1.6	0.8	7.3	4.9	2.4
Carcinoembryonic antigen (CEA)	Serum/plasma	6.8	59.3	0.11	5.1	3.4	1.7	22.4	14.9	7.5	30.8	20.5	10.3
Ceruloplasmin	Serum/plasma	4.9	15.2	0.32	3.7	2.5	1.2	6.0	4.0	2.0	12.1	8.0	4.0
Chloride	Serum/plasma	1.1	1.3	0.85	0.8	0.6	0.3	0.6	0.4	0.2	2.0	1.3	0.7
Cholesterol	Serum/plasma	5.3	16.7	0.32	4.0	2.6	1.3	6.6	4.4	2.2	13.1	8.8	4.4
Chromogranin A	Serum/plasma	14.8	30.7	0.48	11.1	7.4	3.7	12.8	8.5	4.3	31.1	20.7	10.4
Complement 3 (C3)	Serum/plasma	4.6	15.2	0.30	3.4	2.3	1.1	6.0	4.0	2.0	11.6	7.8	3.9
Complement 4 (C4)	Serum/plasma	6.9	24.5	0.28	5.2	3.5	1.7	9.5	6.4	3.2	18.1	12.1	6.0
Copper	Serum/plasma	7.5	13.2	0.57	5.6	3.8	1.9	5.7	3.8	1.9	15.0	10.0	5.0

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Supplementary Table 1. Continued

Measurand	Matrix	EFLM BV/DB											
		CV	CV ₆	II (CV/CV ₆)		Imprecision (%)			Allowable bias (%)			TEa (%)	
				CV	CV ₆	Minimum	Desirable	Optimal	Minimum	Desirable	Optimal	Minimum	Desirable
Cortisol	Serum/plasma	16.3	48.7	0.33	12.2	8.2	4.1	19.3	12.8	6.4	39.4	26.3	13.1
C-reactive protein (CRP)	Serum/plasma	34.1	83.6	0.41	25.6	17.1	8.5	33.9	22.6	11.3	76.1	50.7	25.4
C-reactive protein (CRP) - high-sensitive	Serum/plasma	58.9	77.4	0.76	44.2	29.4	14.7	36.5	24.3	12.2	109.4	72.9	36.5
Creatine kinase (CK)	Serum/plasma	15.0	37.9	0.40	11.3	7.5	3.8	15.3	10.2	5.1	33.8	22.6	11.3
Creatinine	Serum/plasma	4.5	14.1	0.32	3.4	2.3	1.1	5.6	3.7	1.9	11.1	7.4	3.7
C-terminal cross-linked telopeptide of type I collagen (CTX)	Serum/plasma	15.1	45.9	0.33	11.3	7.5	3.8	18.1	12.1	6.0	36.8	24.5	12.3
Cystatin C	Serum/plasma	4.0	12.1	0.33	3.0	2.0	1.0	4.8	3.2	1.6	9.7	6.5	3.2
Dehydroepiandrosterone sulphate (DHEAS)	Serum/plasma	6.0	21.0	0.29	4.5	3.0	1.5	8.2	5.5	2.7	15.6	10.4	5.2
Dihydrotestosterone (DHT)	Serum/plasma	11.6	37.2	0.31	8.7	5.8	2.9	14.6	9.7	4.9	29.0	19.3	9.7
Estradiol	Serum/plasma	15.0	13.0	1.15	11.3	7.5	3.8	7.4	5.0	2.5	26.0	17.3	8.7
Ferritin*	Serum/plasma	12.8	-	-	9.6	6.4	3.2	-	-	-	-	-	-
Fibroblast growth factor-23	Serum/plasma	14.0	21.5	0.65	10.5	7.0	3.5	9.6	6.4	3.2	26.9	18.0	9.0
Folate	Serum/plasma	11.8	37.9	0.31	8.9	5.9	3.0	14.9	9.9	5.0	29.5	19.7	9.8
Follicle stimulating hormone (FSH)	Serum/plasma	12.4	42.1	0.29	9.3	6.2	3.1	16.5	11.0	5.5	31.8	21.2	10.6
Free kappa light chain	Serum/plasma	4.8	15.3	0.31	3.6	2.4	1.2	6.0	4.0	2.0	12.0	8.0	4.0
Free lambda light chain	Serum/plasma	4.8	17.3	0.28	3.6	2.4	1.2	6.7	4.5	2.2	12.7	8.4	4.2
Fructosamine	Serum/plasma	2.2	6.3	0.35	1.7	1.1	0.6	2.5	1.7	0.8	5.4	3.6	1.8
Gamma-glutamyl transferase (GGT) activity	Serum/plasma	9.1	44.5	0.20	6.8	4.5	2.3	17.0	11.4	5.7	28.3	18.9	9.4
Glucose	Serum/plasma	5.0	8.1	0.62	3.8	2.5	1.3	3.6	2.4	1.2	9.8	6.5	3.3
Glycated albumin	Serum/plasma	1.4	5.7	0.25	1.0	0.7	0.3	2.2	1.5	0.7	3.9	2.6	1.3
Hemoglobin A1c (IFCC) (mmol/mol)	Whole blood	1.6	7.1	0.23	1.2	0.8	0.4	2.7	1.8	0.9	4.7	3.1	1.6
Hemoglobin A1c (NGSP) (%)	Whole blood	1.2	4.8	0.25	0.9	0.6	0.3	1.9	1.2	0.6	3.3	2.2	1.1
Haptoglobin	Serum/plasma	8.6	39.0	0.22	6.4	4.3	2.1	15.0	10.0	5.0	25.6	17.1	8.5
HDL cholesterol	Serum/plasma	5.7	24.3	0.23	4.3	2.9	1.4	9.4	6.2	3.1	16.4	10.9	5.5
Human epididymis protein 4 (HE4)	Serum/plasma	7.1	17.9	0.40	5.3	3.5	1.8	7.2	4.8	2.4	16.0	10.7	5.3
Hydrogen ion (H+)	Whole blood	3.5	2.0	1.75	2.6	1.8	0.9	1.5	1.0	0.5	5.8	3.9	1.9
Immunoglobulin A (IgA)	Serum/plasma	5.7	19.5	0.29	4.3	2.9	1.4	7.6	5.1	2.5	14.7	9.8	4.9
Immunoglobulin G (IgG)	Serum/plasma	3.5	17.1	0.20	2.6	1.8	0.9	6.5	4.4	2.2	10.9	7.3	3.6
Immunoglobulin M (IgM)	Serum/plasma	5.9	48.5	0.12	4.4	3.0	1.5	18.3	12.2	6.1	25.6	17.1	8.5
Insulin	Serum/plasma	25.4	33.5	0.76	19.0	12.7	6.3	15.8	10.5	5.3	47.2	31.5	15.7
Insulin-like growth factor-1 (IGF-1)	Serum/plasma	9.4	27.0	0.35	7.1	4.7	2.4	10.7	7.1	3.6	22.4	14.9	7.5
Interleukin-6 (IL6)	Serum/plasma	27.8	33.9	0.82	20.9	13.9	7.0	16.4	11.0	5.5	50.8	33.9	16.9
Iron	Serum/plasma	20.7	32.3	0.64	15.5	10.3	5.2	14.4	9.6	4.8	40.0	26.7	13.3
Lactate dehydrogenase (LDH) activity	Serum/plasma	5.2	12.6	0.41	3.9	2.6	1.3	5.1	3.4	1.7	11.5	7.7	3.8

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Supplementary Table 1. Continued

Measurand	Matrix	EFLM BV DB											
		CV ₁	CV ₆	II (CV/CV ₆)	Imprecision (%)			Allowable bias (%)			TEa (%)		
					Minimum	Desirable	Optimal	Minimum	Desirable	Optimal	Minimum	Desirable	Optimal
LDL Cholesterol	Serum/plasma	8.3	26.6	0.31	6.2	4.2	2.1	10.4	7.0	3.5	20.7	13.8	6.9
Lipase	Serum/plasma	9.2	24.8	0.37	6.9	4.6	2.3	9.9	6.6	3.3	21.3	14.2	7.1
Lipoprotein (a)*	Serum/plasma	8.9	-	-	6.7	4.5	2.2	-	-	-	-	-	-
Luteinizing hormone (LH)	Serum/plasma	22.8	30.8	0.74	17.1	11.4	5.7	14.4	9.6	4.8	42.6	28.4	14.2
Magnesium	Serum/plasma	2.9	5.8	0.50	2.2	1.4	0.7	2.4	1.6	0.8	6.0	4.0	2.0
Neuron specific enolase (NSE)	Serum/plasma	10.9	16.6	0.66	8.2	5.5	2.7	7.4	5.0	2.5	20.9	14.0	7.0
Osteocalcin	Serum/plasma	8.9	32.3	0.28	6.7	4.5	2.2	12.6	8.4	4.2	23.6	15.7	7.9
Parathyroid hormone (PTH)	Serum/plasma	15.7	23.5	0.67	11.8	7.8	3.9	10.6	7.1	3.5	30.0	20.0	10.0
Partial pressure of carbon dioxide (pCO2)	Whole blood	4.8	5.3	0.91	3.6	2.4	1.2	2.7	1.8	0.9	8.6	5.7	2.9
Phosphate	Serum/plasma	7.8	10.7	0.73	5.8	3.9	1.9	5.0	3.3	1.7	14.6	9.7	4.9
Potassium	Serum/plasma	4.1	4.2	0.98	3.1	2.0	1.0	2.2	1.5	0.7	7.3	4.8	2.4
Procollagen type I N-terminal propeptide (PINP)	Serum/plasma	8.8	35.2	0.25	6.6	4.4	2.2	13.6	9.1	4.5	24.5	16.3	8.2
Progesterone	Serum/plasma	18.5	39.7	0.47	13.9	9.3	4.6	16.4	10.9	5.5	39.3	26.2	13.1
Prolactin	Serum/plasma	29.5	43.0	0.69	22.1	14.8	7.4	19.6	13.0	6.5	56.1	37.4	18.7
Prostate specific antigen - free (fPSA)	Serum/plasma	7.1	46.2	0.15	5.3	3.5	1.8	17.5	11.7	5.8	26.3	17.5	8.8
Prostate specific antigen (PSA)	Serum/plasma	6.8	42.0	0.16	5.1	3.4	1.7	16.0	10.6	5.3	24.4	16.2	8.1
Protein (total)	Serum/plasma	2.6	4.6	0.57	2.0	1.3	0.7	2.0	1.3	0.7	5.2	3.5	1.7
Renin	Serum/plasma	30.1	41.6	0.72	22.6	15.1	7.5	19.3	12.8	6.4	56.5	37.7	18.8
Selenium	Serum/plasma	7.8	11.3	0.69	5.8	3.9	1.9	5.1	3.4	1.7	14.8	9.9	4.9
Sexual-hormone-binding-globulin (SHBG)	Serum/plasma	9.7	36.2	0.27	7.3	4.8	2.4	14.1	9.4	4.7	26.1	17.4	8.7
Sodium	Serum/plasma	0.5	1.0	0.50	0.4	0.3	0.1	0.4	0.3	0.1	1.0	0.7	0.3
Suppression of tumorigenicity 2 (ST2)	Serum/plasma	10.5	30.4	0.35	7.9	5.3	2.6	12.1	8.0	4.0	25.1	16.7	8.4
Tartrate-resistant acid phosphatase (TRAP)	Serum/plasma	10.8	13.3	0.81	8.1	5.4	2.7	6.4	4.3	2.1	19.8	13.2	6.6
Testosterone	Serum/plasma	12.5	21.4	0.58	9.4	6.3	3.1	9.3	6.2	3.1	24.8	16.5	8.3
Testosterone - free	Serum/plasma	22.0	29.0	0.76	16.5	11.0	5.5	13.7	9.1	4.6	40.9	27.3	13.6
Thyroglobulin	Serum/plasma	10.6	77.2	0.14	7.9	5.3	2.6	29.2	19.5	9.7	42.3	28.2	14.1
Thyroid stimulating hormone (TSH)	Serum/plasma	17.7	35.9	0.49	13.3	8.8	4.4	15.0	10.0	5.0	36.9	24.6	12.3
Thyroxine - free (fT4)	Serum/plasma	4.9	7.8	0.63	3.7	2.5	1.2	3.5	2.3	1.2	9.5	6.3	3.2
Thyroxine - total (T4)	Serum/plasma	6.4	11.8	0.54	4.8	3.2	1.6	5.0	3.4	1.7	13.0	8.6	4.3
Transferrin	Serum/plasma	3.9	13.9	0.28	2.9	1.9	1.0	5.4	3.6	1.8	10.2	6.8	3.4
Transferritin	Serum/plasma	10.9	19.1	0.57	8.2	5.5	2.7	8.2	5.5	2.7	21.7	14.5	7.2
Triglycerides	Serum/plasma	19.9	37.4	0.53	14.9	9.9	5.0	15.9	10.6	5.3	40.5	27.0	13.5
Triiodothyronine - free (fT3)	Serum/plasma	5.0	8.3	0.60	3.8	2.5	1.3	3.6	2.4	1.2	9.8	6.5	3.3
Tri-iodothyronine - total (T3)	Serum/plasma	9.4	12.2	0.77	7.1	4.7	2.4	5.8	3.9	1.9	17.4	11.6	5.8
Troponin I, cardiac - high-sensitive	Serum/plasma	12.0	35.9	0.33	9.0	6.0	3.0	14.2	9.5	4.7	29.0	19.4	9.7
Troponin T, cardiac - high-sensitive	Serum/plasma	11.4	30.9	0.37	8.6	5.7	2.9	12.4	8.2	4.1	26.5	17.6	8.8

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Supplementary Table 1. Continued

Measurand	Matrix	EFLM BV DB											
		CV	CV ₆	II (CV/CV ₆)	Imprecision (%)			Allowable bias (%)			TEa (%)		
					Minimum	Desirable	Optimal	Minimum	Desirable	Optimal	Minimum	Desirable	Optimal
Tumor necrosis factor (TNF)	Serum/plasma	16.1	26.8	0.60	12.1	8.1	4.0	11.7	7.8	3.9	31.6	21.1	10.5
Tyrosine	Serum/plasma	7.5	11.9	0.63	5.6	3.8	1.9	5.3	3.5	1.8	14.6	9.7	4.9
Urate	Serum/plasma	8.3	22.4	0.37	6.2	4.2	2.1	9.0	6.0	3.0	19.2	12.8	6.4
Urea	Serum/plasma	13.9	21.0	0.66	10.4	7.0	3.5	9.4	6.3	3.1	26.6	17.8	8.9
Vitamin A	Serum/plasma	6.1	21.0	0.29	4.6	3.0	1.5	8.2	5.5	2.7	15.7	10.5	5.2
Vitamin B1 (thiamine)	Whole blood	5.0	12.0	0.42	3.8	2.5	1.3	4.9	3.3	1.6	11.1	7.4	3.7
Vitamin B12 (cobalamin)	Serum/plasma	7.2	36.1	0.20	5.4	3.6	1.8	13.8	9.2	4.6	22.7	15.1	7.6
Vitamin C	Serum/plasma	25.0	24.8	1.01	18.8	12.5	6.3	13.2	8.8	4.4	44.1	29.4	14.7
Vitamin E	Serum/plasma	7.1	17.3	0.41	5.3	3.5	1.8	7.0	4.7	2.3	15.8	10.5	5.3
Vitamin K	Serum/plasma	38.0	44.0	0.86	28.5	19.0	9.5	21.8	14.5	7.3	68.8	45.9	22.9
Zinc	Serum/plasma	8.5	8.8	0.97	6.4	4.3	2.1	4.6	3.1	1.5	15.1	10.1	5.0

*Goals for allowable bias and TEa have not yet been proposed because no reliable studies on CV₆ have been included in the meta-analysis.

Abbreviations: EFLM, European Federation of Clinical Chemistry and Laboratory Medicine; BV DB, biological variation database; CV, within-subject biological variation; CV₆, between-subject biological variation; II, index of individuality; TEa, allowable total error.