VITALS VAULT

A VITALS VAULT FIELD GUIDE

Read your own blood test report in 20 minutes

For anyone holding a blood count, metabolic panel or lipid report: go section by section and know what to ask.

7

CHAPTERS

20 minutes

Every claim is tied to a named study. References are on the last page.

Educational only. Not medical advice.

THIS GUIDE IS FOR YOU IF

- You have a blood count, metabolic panel or lipid report and cannot tell what it says.
- You want to know what each group of tests looks at before your appointment.
- You got a flag and do not know if it is common or worth a question.
- You want questions to ask, not a diagnosis from a PDF.

HOW TO USE IT

Keep your own report open. Read one chapter per report section and write your numbers on the last page. Each chapter starts with the one thing to remember. Nothing here diagnoses anything or replaces your clinician. Ranges, trends and pre-draw factors are in the companion guide, "Understand your normal lab results".

WHAT IS INSIDE

01 How a lab report is laid out

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CHAPTER 1

How a lab report is laid out

THE ONE THING TO REMEMBER

A flag means a result sits outside one lab's range for healthy people, so treat it as a question to ask, not a verdict.

Each line of a report has a test name, your result, a unit and a reference range (the span most healthy people fall in). Many lines also carry a flag, often H or L. Read the unit first. Hemoglobin is in g/dL, glucose in mg/dL, MCV in fL (a tiny unit of volume), platelets in thousands per microliter. A flag is like a smoke alarm: it says look, not that there is a fire.

Each lab sets its own ranges. For magnesium, one major lab lists 1.5–2.5 mg/dL and another lists 1.6–2.3, in the same unit. Glucose can also appear in mmol/L; 18 mg/dL equals 1 mmol/L. Pre-draw factors and how to track trends are covered in the companion guide, so we only touch them here.

Part of the report	What it is	What to check
Result	Your value on the day of the draw	The unit printed beside it
Reference range	The middle 95% of a healthy group	Which lab made it, and your sex
Flag	A mark when a result falls outside the range	Treat it as a question, not a verdict
Fasting status	Whether you had eaten before the draw	Glucose and triglycerides shift after meals

WHAT A STUDY FOUND

In 46,578 adults whose fasting glucose was under 100 mg/dL (all "normal"), the risk of later diabetes rose 6% for each 1 mg/dL above 89, and 95–99 carried 2.33 times the risk of under 85. The limit: this is group risk, from one older cohort, not a forecast for you.

Nichols et al., 2008

COMMON BELIEF

"If my result is in range, nothing is going on."

WHAT THE EVIDENCE SAYS

A range marks where most healthy people fall, not where risk is zero. It is built from at least 120 similar people, who may include some with early disease, and it differs by lab. The reverse also holds: by design, about 1 in 20 healthy people fall outside it.

95% **A reference range covers the middle 95% of a healthy reference group, so about 1 in 20 healthy people land outside it by design.**

ASK YOUR CLINICIAN

- **Which lab ran this report, and are these its own ranges?**
- **Are any of these ranges different for my sex?**
- **Was I fasting for this draw, and does that change any result?**
- **Which flagged results do you want to repeat, and when?**

CHAPTER 2

The blood count: cells, size and spread

THE ONE THING TO REMEMBER

Read red cells as a set: how much hemoglobin, how big the cells are (MCV) and how much their sizes vary (RDW).

A blood count (CBC) counts red cells, white cells and platelets (cells that help blood clot). Think of red cells as delivery trucks. Hemoglobin is the cargo; it carries about 98% of the oxygen in blood. Hematocrit is the share of blood volume the trucks fill. MCV (average red cell size) is truck size. RDW (how much cell sizes vary) is how mixed the fleet is.

Test	Standard range	A flag often reflects
Hemoglobin	Men 13.2–17.1, women 11.7–15.5 g/dL	Low: iron, B12 or folate shortfall, blood loss. High: dehydration
Hematocrit	Men 38.5–50%, women 35–45%	Low: anemia, blood loss. High: dehydration, COPD
RBC count	Men 4.2–5.8, women 3.8–5.1 million/cumm	Low: anemia, kidney disease. High: dehydration, altitude
MCV	80–100 fL	Low: iron shortfall, thalassemia. High: B12 or folate shortfall
RDW	11–15%	High: mixed shortfalls, inflammation, chronic disease
Platelets	140–400 thousand per uL	Low: marrow, infection, some drugs. High: inflammation

WHAT A STUDY FOUND

In 9,645 NHANES participants with B12 below 190 pg/mL, only 4.4% had an MCV above the standard range, yet 56.2% had raised methylmalonic acid (a better B12 signal). The limit: MCV alone cannot diagnose a B12 or iron problem.

Wolffenbuttel et al., NHANES analysis, 2020

22%

In 8,175 adults 45 and older, death risk rose 22% for each 1% of RDW above 12.6%, even without iron, folate or B12 deficiency (Patel 2009). A group signal, not a forecast.

WHAT A STUDY FOUND

Over 44 years, mortality was lowest at white counts of 3.5 to 6 thousand per cubic mm. Above 10 it doubled; below 3.5 it tripled. The limit: observational, and those who died more often smoked and were less active. Both ends carry risk.

Ruggiero et al., Baltimore Longitudinal Study of Aging, 2007

COMMON BELIEF

“A normal MCV rules out an iron or B12 problem.”

WHAT THE EVIDENCE SAYS

Mixed shortfalls (iron plus B12 or folate) can average out to a normal MCV, which is why RDW is read with it. A low MCV also has causes other than iron, such as thalassemia.

ASK YOUR CLINICIAN

- Do my MCV and RDW point the same way, or are they mixed?
- Is my hemoglobin low for my sex, and has it changed since last time?
- Could dehydration or a recent illness explain a high or low count?
- Does any flagged count need a repeat or a follow-up test?

CHAPTER 3

The metabolic panel: salts, acid balance and sugar

THE ONE THING TO REMEMBER

Salts like sodium and potassium are held in a narrow band, so small shifts can matter; glucose needs its fasting time.

The basic metabolic panel mixes electrolytes (salts the body keeps in tight balance), kidney markers (next chapter) and glucose. Sodium is a concentration, like a glass of juice: less water makes the same juice taste stronger, so dehydration can lift sodium. The line called CO2 is really bicarbonate, the blood's acid buffer (a chemical that steadies acidity).

Test	Standard range	A flag can reflect
Sodium	135–146	High: underhydration. Many drugs, such as diuretics, shift it
Potassium	3.5–5.3 mEq/L	Low: sweat, diuretics, laxatives. Falsely high if sample hemolyzed
CO2 (bicarbonate)	19–30 mEq/L	Low: acid load; thiazide diuretics and some antibiotics lower it
Total calcium	8.6–10.4 mg/dL	Low albumin makes it read low; parathyroid hormone controls it
Anion gap	10–20 mEq/L	Calculated; low albumin lowers it, acid–base problems raise it
Fasting glucose	ADA: 70–99 normal, 100–125 prediabetes, 126+ diabetes	Hours since eating; repeat to confirm a trend

WHAT A STUDY FOUND

In the ARIC cohort, sodium above 142 went with older biological age and 39% more chronic disease; above 144, 21% more early death. Mortality was lowest at 137–142, but risk rose 71% at 135–136.5. The limit: observational, and reading high sodium as underhydration is the authors' hypothesis.

Dmitrieva et al., ARIC cohort, 2022

1%

In ARIC adults aged 70 to 90, a sodium above 143 reflected a water deficit of about 1% of body weight (Dmitrieva 2022).

WHAT A STUDY FOUND

In 10,913 adults without diabetes, compared with fasting glucose under 85 mg/dL, levels of 85–89, 90–94 and 95–99 carried hazard ratios for cardiovascular events of 1.34, 1.47 and 1.53. All sit inside the usual range. The limit: observational, and not a diagnosis.

Shaye et al., CARMA cohort, 2012

COMMON BELIEF

"Lower blood sugar is always better."

WHAT THE EVIDENCE SAYS

Glucose below 70 mg/dL was linked to every category of stroke in 1,197,384 Korean adults (Park 2013). That is observational, and low readings have many causes, so a low result is also a question for a clinician.

ASK YOUR CLINICIAN

- **How many hours since I last ate when this glucose was drawn?**
- **Should we repeat my glucose, and add an A1C to see the longer picture?**
- **Could my medicines or fluid intake explain my sodium or potassium?**
- **My calcium looks off: was my albumin taken into account?**

CHAPTER 4

Kidney numbers: creatinine, eGFR and BUN

THE ONE THING TO REMEMBER

Creatinine reflects muscle as well as kidney filtering, so read it with eGFR and context, never alone.

Creatinine is waste made from creatine (a fuel store in muscle). Kidneys filter it out, so it reflects lean mass as well as kidney clearance. Think of it as muscle's trash: more muscle, more trash, even with healthy kidneys. eGFR estimates kidney filtering from creatinine, age and sex, without a 24-hour urine collection. BUN is nitrogen from urea, a protein waste made in the liver.

Test	Standard range	What can move it
Creatinine	0.40–1.50 mg/dL	Muscle mass, cooked meat, hard exercise, dehydration
eGFR	60–160 mL/min/1.73m2	Age, malnutrition, obesity, pregnancy, muscle mass
BUN	7–25 mg/dL	Protein intake, dehydration, GI bleeding, heart failure
BUN:creatinine	6–22	Above 20 often a cause outside the kidney, such as dehydration
Cystatin C	0.5–1.00 mg/L	Less muscle effect; thyroid disease changes it

WHAT A STUDY FOUND

In 252 healthy adults aged 18–74, the creatinine interval was 0.72–1.18 mg/dL in men and 0.55–1.02 in women. That is narrower than the 0.40–1.50 conventional range and differs by sex. The limit: one study, and lab methods vary.

Junge et al., reference intervals for creatinine, 2004

90

An eGFR of 90 or above counts as normal, 60–89 as mildly decreased and 45–59 as mild to moderate. eGFR also drifts down with age, so clinicians check urine protein before concluding (Glassock 2009).

WHAT A STUDY FOUND

In 42,038 adults, the BUN:creatinine ratio had a U-shaped link to death from any cause: lowest risk at 11.43 to 14.64, higher below 11.43 or at 18.57 and above. The limit: observational, and age, drinking and other illnesses differed between groups.

Shen et al., general-population cohort, 2022

COMMON BELIEF

"A normal creatinine means my kidneys are fine."

WHAT THE EVIDENCE SAYS

Creatinine may not rise until kidney function has fallen 50% or more (Kar 2018). Muscle mass, cooked red meat and hard exercise also move it, and cystatin C is a better early marker while eGFR is still 60 or above (Pandey 2022).

ASK YOUR CLINICIAN

- Is my eGFR based on creatinine only? Would cystatin C help, given my muscle mass?
- Did hard exercise, dehydration or a lot of cooked meat come before my draw?
- Do any of my medicines affect kidney numbers?
- Is my eGFR steady across past reports, or sliding?

CHAPTER 5

The liver group: ALT, AST, ALP, GGT, bilirubin, albumin

THE ONE THING TO REMEMBER

Liver numbers also rise with muscle, heart, bile and medicine causes, so the pattern matters more than any single flag.

Think of liver enzymes as alarms in different rooms. ALT sounds mostly in the liver room. AST also sounds in the muscle and heart rooms. ALP (found in bone, liver and bile ducts) and GGT (recycles glutathione, the body's main antioxidant) point toward bile or bone. Bilirubin comes from breaking down hemoglobin. Albumin is about 60% of blood protein.

Test	Standard range	Raised with
ALT	6–29 IU/L	Fatty liver, hepatitis, some drugs, hard exercise, celiac disease
AST	10–35 IU/L	Muscle breakdown, hard exercise, heart attack, alcohol, some drugs
ALP	35–150 IU/L	Bile duct or liver disease; bone disease if GGT is normal
GGT	3–85 IU/L	Alcohol, bile blockage, toxin exposure; sensitive to bile problems
Total bilirubin	0.20–1.20 mg/dL	Hemolysis, hepatitis, bile blockage; Gilbert syndrome is benign
Albumin	3.6–5.1 g/dL	Low: inflammation, surgery. High: usually dehydration

WHAT A STUDY FOUND

In 3,769 Chinese adults, researchers lowered the healthy ALT upper limit from 40 to about 22 IU/L; higher values tracked with BMI, alcohol, cholesterol and triglycerides. A US analysis of 18,518 people proposed 29 for men and 22 for women. The limit: experts disagree on cut-offs.

Zhang et al., Chinese adults, 2015

WHAT A STUDY FOUND

Among 155 people with ALT of 500 IU/L or more, the commonest causes were bile duct gallstones, ischemic hepatitis (liver injury from low blood flow), viral hepatitis, drug-induced injury and liver cancer. The limit: these were very high values, not mild flags.

Bjornsson et al., 155 patients with ALT of 500 or more, 2016

COMMON BELIEF

"A high AST or ALT always means liver damage."

WHAT THE EVIDENCE SAYS

AST also sits in muscle and heart and rises with heavy exercise, muscle breakdown and heart attack. An AST:ALT ratio above 5 suggests muscle breakdown or strenuous exercise. ALT also follows a daily rhythm, lowest near 4 am and highest near 4 pm.

22

In 6,997 men free of heart disease and diabetes, GGT of 22 IU/L or higher went with fatal coronary disease and stroke, far inside the 3–85 range (Wannamethee 2008). Association only.

ASK YOUR CLINICIAN

- **Are only ALT and AST up, or ALP and GGT too? What does that pattern suggest?**
- **Could a workout, alcohol or a medicine in the past week explain it?**
- **Should we repeat it, and at what time of day?**
- **Are my albumin or bilirubin changing across past reports?**

CHAPTER 6

The lipid panel and how LDL is calculated

THE ONE THING TO REMEMBER

LDL on most reports is calculated, not measured, and the estimate drifts when triglycerides are high.

Fats travel in blood inside lipoproteins (carriers for fat and cholesterol). Think of buses and passengers. LDL-C counts the cholesterol passengers in LDL buses. ApoB counts the buses, one per atherogenic (plaque-promoting) particle. Non-HDL-C is total cholesterol minus HDL-C and comes free with a standard panel. LDL-C is usually an estimate: total minus HDL minus triglycerides divided by 5.

Test	Standard range	What it measures
Total cholesterol	125–199 mg/dL	Cholesterol in all particles
LDL-C	Under 100 mg/dL	Cholesterol in LDL; usually calculated
HDL-C	46–100 mg/dL	Cholesterol in HDL; very high is not clearly better
Triglycerides	0–150 mg/dL	Fat in blood; rises 20–30% for about 2 hours after a meal
Non-HDL-C	0–130 mg/dL	Total minus HDL; often closer to ApoB than LDL-C is
ApoB	52–80 mg/dL	Count of plaque-promoting particles

WHAT A STUDY FOUND

In 13,015 people taking statins (a class of cholesterol-lowering medicine), mortality was lowest at ApoB 73 mg/dL on a J-shaped curve. Non-HDL-C and ApoB predicted heart attack better than LDL-C. The limit: observational, in treated people, so not a personal target.

Johannesen et al., statin-treated cohort, 2021

WHAT A STUDY FOUND

In ARIC and Framingham Offspring data, heart and stroke events rose even below the 150 mg/dL triglyceride line. The lowest quartile (under 83) had the lowest risk and the highest (153 and up) the highest. The limit: observational, and fasting and non-fasting values differ.

Aberra et al., ARIC and Framingham Offspring, 2020

COMMON BELIEF

"My LDL is a direct measurement."

WHAT THE EVIDENCE SAYS

On most reports it is calculated: total minus HDL minus triglycerides divided by 5. It becomes less accurate as triglycerides climb and when LDL is very low. Sources disagree on where it starts to drift, from 150 to 400 mg/dL of triglycerides. A direct LDL can be requested.

5

The formula divides triglycerides by 5 because VLDL carries about 5 times more triglyceride than cholesterol (Friedewald 1972). It is an estimate, not a measurement.

ASK YOUR CLINICIAN

- Is my LDL calculated or direct? Would a direct LDL be more reliable for me?
- Was this sample fasting? Triglycerides rise after a meal.
- Would ApoB or non-HDL-C add anything to my LDL?
- Could my thyroid, glucose or medicines be changing these lipids?

CHAPTER 7

Calculated numbers and your write-in page

THE ONE THING TO REMEMBER

Some lines are calculated, so one off input moves the result; use the page below to note every flag and question.

Some report lines are math, not measurement. A calculated value is like a grade average: if one grade is off, the average moves. Anion gap uses sodium, potassium, chloride and bicarbonate, and each 1 g/dL fall in albumin lowers it about 2.5 mEq/L. eGFR uses creatinine, age and sex. NLR divides neutrophils by lymphocytes (two white cell types).

Value	Made from	Standard range	Catch
Anion gap	(Na + K) minus (Cl + bicarbonate)	10–20 mEq/L	Low albumin lowers it
BUN:creatinine	BUN divided by creatinine	6–22	Dehydration, protein intake
AST:ALT	AST divided by ALT	0–1.0	Above 1 can flag fibrosis
NLR	Neutrophils divided by lymphocytes	1.00–3.00	Cut-offs mostly from hospital groups
PLR	Platelets divided by lymphocytes	Under 150	Not a stand-alone diagnosis
TG:HDL	Triglycerides divided by HDL-C	0–2.0	Study cut-offs run 0.88 to 3.6

WHAT A STUDY FOUND

In NHANES, among 2,747 people with normal ALT, the lowest AST:ALT quarter (under 1.12 in women, under 0.93 in men) had 75% greater insulin resistance risk than the highest (1.47 or more, 1.26 or more). The limit: cross-sectional, an association and not a test.

Visaria et al., NHANES, 2022

WHAT A STUDY FOUND

In 8,711 adults aged 45 and up, NLR averaged 1.76. Survival was best below 1.6 and worst above 2.41. The limit: hospital studies use other cut-offs (2.54 to 4.71), so no one number fits everyone, and it is not a diagnosis.

Fest et al., Rotterdam Study, 2018 and 2019

BEFORE YOU READ EACH SECTION

- [ ] Check the unit on every result
- [ ] Note the lab's own range, not one from a website
- [ ] Note whether the sample was fasting
- [ ] Mark each flag, then circle only those to ask about
- [ ] Look at last year's report for the same line

YOUR REPORT, SECTION BY SECTION

Blood count: flagged results _____

Metabolic panel: flagged results _____

Kidney numbers: flagged results _____

Liver group: flagged results _____

Lipid panel: flagged results _____

Calculated values: flagged results _____

Medicines and supplements I take _____

Draw date, fasting hours, last workout _____

ASK YOUR CLINICIAN

- Which flags matter most, and which are likely noise?
- What should be repeated, and when?
- Do my flags point to one cause or to different ones?
- Which results should I track over time, and how?

THE WHOLE GUIDE ON ONE PAGE

If you remember nothing else

1. A flag means outside one lab's range, built from healthy people. It is a question, not a verdict.
2. Read the unit first, then your result, then the range, then the flag.
3. Blood count: read hemoglobin, MCV and RDW as a set; mixed shortfalls can hide in a normal MCV.
4. Metabolic panel: salts sit in narrow bands, and glucose needs its fasting time.
5. Kidneys: creatinine reflects muscle too, so ask about eGFR and cystatin C.
6. Liver: ALT and AST also come from muscle and heart; ALP with GGT points to bile.
7. Lipids: LDL is usually calculated and drifts when triglycerides are high; ApoB counts particles.
8. Calculated values move when one input moves. Bring your page of flags and questions.

WHAT THIS GUIDE CANNOT DO

This guide cannot tell you what your results mean for you. It does not use your history, symptoms, medicines or age, and one report is a single moment in time. It cannot diagnose anything, and the ranges and cut-offs come from group studies and differ by lab. What it lacks is your own numbers over time, which show whether a flag is a one-off or a pattern.

A FREE NEXT STEP

Try the free 60-second lab check on our site. It suggests which markers fit your goal, and you do not need to give an email. It is a way to see which numbers are worth tracking.

vitalsvault.com/lab-check

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This guide is educational. It is not medical advice and not a diagnosis, and it does not replace a clinician who knows your history. Study findings describe groups of people and may not apply to you.