VITALS VAULT

A VITALS VAULT FIELD GUIDE

Understand your 'normal' lab results in 15 minutes

For anyone told 'your labs are normal' who still has questions. Learn what a range means and read your trend.

7

CHAPTERS

15 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 were told your labs are normal and you still have questions.
- You want to know what a reference range really measures.
- You want to spot when an in-range result deserves a question.
- You want to read your own results over time, not one at a time.

HOW TO USE IT

Read one chapter at a time. Each opens with the one thing to remember. Use the tick-boxes and write-in pages with your own report beside you. Nothing here is a diagnosis. Your action is always to note, ask, repeat a test or talk with a clinician.

WHAT IS INSIDE

01 How a normal range is made

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CHAPTER 1

How a normal range is made

THE ONE THING TO REMEMBER

A reference range is where the middle 95% of a lab's reference group falls. It describes a crowd, not a goal for you.

Think of a shoe-size chart that covers the middle 95% of feet. A size on the chart does not mean the shoe fits you. A reference range (the span a lab calls normal) works the same way. The lab tests a group of healthy-looking people, then draws the lines around the middle 95% of their results.

120

The least number of people a lab needs in its reference group. The range then covers the middle 95% of their results.

WHAT A STUDY FOUND

Researchers built a creatinine range from 252 healthy adults aged 18–74. It was 0.72–1.18 mg/dL for men and 0.55–1.02 for women. A conventional range of 0.40–1.50 is much wider. Same marker, different groups, different lines. Limit: our source gives the numbers, not the lab method.

Junge et al., 2004

Marker	Old line or one method	Newer line or other method
Diabetes by fasting glucose	140 mg/dL (1979)	126 mg/dL (ADA, 2021)
TSH upper limit	10 mU/L, once	About 4.5 mU/L today
Free testosterone	Quest: calculated from total T, SHBG, albumin	LabCorp: direct test, different range

Ranges also differ by lab, because methods, equipment and reagents differ. They differ by age too. Alkaline phosphatase (a liver and bone enzyme) is highest in children and teens, then levels off in early adulthood. An adult range does not apply to a child.

COMMON BELIEF

"Normal means healthy."

WHAT THE EVIDENCE SAYS

The reference group can include people with early, quiet disease. A range can pick up overt disease once damage is done and miss subtle imbalance. Disease can exist inside the range.

ASK YOUR CLINICIAN

- **Which lab's range is this, and who was in its reference group?**
- **Is this range specific to my age and sex?**
- **Would another lab use a different range for this test?**

CHAPTER 2

In range but changing: read your own trend

THE ONE THING TO REMEMBER

One number is a snapshot. Several numbers from the same lab show a direction, and direction can matter before any line is crossed.

A bank balance of $2,000 looks fine. A balance that fell from $6,000 in three months tells you more. Lab numbers work the same way. You may also have a set-point (your own usual level), and a move away from it can matter even inside the range.

WHAT A STUDY FOUND

Andersen and colleagues studied thyroid test results within the same person and described narrow individual variation. That is why a TSH change that stays inside the lab range can still be a real change for you. Limit: our source summary gives no sample size, so treat it as supporting, not proof.

Andersen et al., 2002

2 wks

For heart-risk use of hs-CRP (a sensitive inflammation test), the advice is two readings at least two weeks apart, because people vary.

Marker	What shifts it	Why one value misleads
hs-CRP	Person to person variation	Two readings 2+ weeks apart advised
Testosterone (men)	Time of day, day to day	Draw in the morning and repeat
ALT (liver enzyme)	Daily rhythm	Lowest near 4 am, highest near 4 pm
TSH	Illness, some drugs, assay	Needs stable health for over 2 weeks

Keep the conditions the same each time: same lab, same time of day, same fasting state. Specimen handling, stress and time of day all change results. Experts who work with ranges say the same: repeat labs, use the same lab, and read the pattern with your history and symptoms.

KEEP YOUR TREND HONEST

- [ ] Same lab each time when possible
- [ ] Same time of day for the draw
- [ ] Same fasting status
- [ ] Note illness, travel or hard exercise before the draw
- [ ] Keep every old report, from any lab

YOUR NUMBERS OVER TIME

Marker

Value and lab range

Date and lab name

Fasting? Time of draw?

CHAPTER 3

When studies point to a narrower band

THE ONE THING TO REMEMBER

Some studies link risk to values inside the lab range. These are group findings, and any 'optimal' range is one group's view.

A normal range works like a smoke alarm that sounds only once the room is full of smoke. Some studies suggest earlier signs of risk. These are associations (two things that travel together) in groups. They do not tell you your own risk, and they do not prove that moving a number changes an outcome.

WHAT A STUDY FOUND

A 22-year follow-up of healthy non-diabetic men found higher cardiovascular death in the top fasting glucose quarter (86–109 mg/dL) than in the lower three (52–85), after adjusting for age, smoking, lipids, blood pressure and fitness. Limits: men only, an old cohort, observational, one study.

Bjornholt et al., Diabetes Care, 1999

WHAT A STUDY FOUND

In 19,630 adults with no prior cardiovascular disease, heart events were lowest at fasting glucose under 90 mg/dL. Moving from prediabetes to diabetes carried 1.3 to 3.6 times the risk. Limit: observational and group-level, so it cannot show that lowering a number lowers risk.

Bancks et al., 2019

Marker	Usual lab line	Where one study saw lowest risk
Fasting glucose	Normal under 100 mg/dL	Under 90 (19,630 adults)
A1C (3-month sugar average)	Normal under 5.7%	Under 5% (10,232 adults, 45–79)
Triglycerides	Under 150 mg/dL	Under 83 (ARIC and Framingham)
Sodium	135–146 mmol/L	137–142 (ARIC cohort)
TSH	About 0.40–4.50 mU/L	1.2–1.95 (9,020 people)

COMMON BELIEF

"A result just inside the range means no extra risk."

WHAT THE EVIDENCE SAYS

Risk often rises gradually. In 46,578 people with fasting glucose under 100, those at 95–99 mg/dL had 2.33 times the diabetes risk of those under 85. Still a group finding, not a verdict on one person.

Experts disagree here. Standard guidelines still use the lab or ADA lines. One group publishes 'optimal' ranges, such as fasting glucose 75–86 mg/dL and TSH 1.0–2.0 mU/L. Those are that group's view, not the standard. A TSH ceiling of 2.5 is a recommendation from one expert body, not what most labs print.

ASK YOUR CLINICIAN

- I am inside the range. Is any number worth watching over time?
- Do any of my results sit near the edge of the range?
- Would you use a narrower band for someone like me, and why?

CHAPTER 4

Results that look fine because two problems cancel out

THE ONE THING TO REMEMBER

Some markers are averages or stand-ins. Two problems pushing opposite ways can land on a normal number.

Picture a tug-of-war between two equal teams. The rope does not move, yet both teams pull hard. MCV (average red blood cell size) can work this way. Low iron makes cells smaller. Low B12 or folate makes them larger. With both, the average can land in the normal range. RDW (how much cell size varies) can help show it.

WHAT A STUDY FOUND

Among 9,645 US adults with B12 below 190 pg/mL, only 4.4% had a large MCV. Yet 56.2% had raised methylmalonic acid, a better B12 indicator. Red cell size missed most low-B12 cases. Limit: a survey snapshot, and the marker is a signal, not a diagnosis.

Wolffenbuttel et al., 2020

A normal result	Can hide	Why
MCV in range	Low iron plus low B12 or folate	Small and large cells average out
Iron markers look high	Low iron behind low B12	In 75 people, low iron showed after B12 was treated
A1C in range	Anemia or odd red cell turnover	A1C is sugar on hemoglobin, so cell changes skew it
Fasting glucose in range	Early insulin resistance	Extra insulin can hold fasting glucose steady for years
LDL cholesterol in range	A high LDL particle count	LDL cholesterol is an estimate of particle number

LDL cholesterol is calculated from other numbers. Some lipid specialists argue that when it disagrees with particle count (apoB), risk follows the count. Sniderman (2014) is cited for this. It is one expert view, and guidance has been changing, so treat it as a question to ask.

COMMON BELIEF

"A normal MCV rules out low B12."

WHAT THE EVIDENCE SAYS

In 9,645 adults with low B12, only 4.4% had a large MCV. Red cell size is a poor screen. Methylmalonic acid and homocysteine give a fuller picture, and B12 deficiency can exist without anemia.

ASK YOUR CLINICIAN

- **Could two problems be hiding each other in my red cell numbers?**
- **Should RDW and iron studies be read with my MCV?**
- **Is LDL cholesterol enough, or should apoB be checked too?**

CHAPTER 5

Things that move a result before the draw

THE ONE THING TO REMEMBER

Meals, water, hard exercise, time of day and some supplements change numbers. Note them before the draw, not after.

A blood test is a photograph taken on one day. If you were mid-jump, the photo shows it. Recent food, how much you drank, a hard workout, a bad night or a cold can all change what the photo shows. So can what you take. High-dose biotin (a B vitamin) can distort some thyroid and vitamin D tests.

WHAT A STUDY FOUND

In 63 healthy men, average fasting glucose was 80.61 mg/dL and average non-fasting glucose was 85.53. The highest non-fasting value was 117. Same people, different timing, different number. Limit: a small study of men only.

Razzak et al., 2018

20–30%

Triglycerides typically rise this much for about 2 hours after a meal, so the timing of your last meal changes the number.

Marker	What can move it	Note
Creatinine	Cooked red meat, hard exercise, dehydration	A big meat meal can raise it for a short time
ALT	Time of day, strenuous exercise	Lowest near 4 am, highest near 4 pm
Sodium, hematocrit	Water intake, sweating	Dehydration concentrates both
Thyroid, vitamin D tests	High-dose biotin	Can distort results; tell your clinician
Testosterone (men)	Time of day, day to day	Morning draw, then repeat
Post-meal glucose	A recent meal	Rises for about 30 minutes, then should fall within 2 hours

COMMON BELIEF

"Fasting does not matter for a blood test."

WHAT THE EVIDENCE SAYS

Fasting means 8 hours or more without calories. Non-fasting glucose runs higher, and triglycerides rise after a meal. Ask which your test needs, and tell the clinician if you did not fast.

BEFORE YOUR NEXT DRAW, NOTE

- [ ] Hours since your last meal
- [ ] Water and caffeine that morning
- [ ] Hard exercise in the past 2 days
- [ ] Any illness or fever this week
- [ ] Supplements and medicines, including biotin

CHAPTER 6

When slightly out of range is usually nothing

THE ONE THING TO REMEMBER

A result a hair outside the range is common. A repeat test and the context decide whether it matters.

A range is built on the middle 95%, so some healthy people are always flagged. It is like a smoke alarm that chirps when you burn toast: sensitive on purpose. A panel with many markers makes a stray flag more likely. The useful questions are how far out, how long, and with what else.

WHAT A STUDY FOUND

Researchers in 3,769 Chinese adults proposed lowering the ALT upper limit from 40 to about 22 IU/L. A US survey of 18,518 people proposed 29 for men and 22 for women. Even the line for one enzyme is debated. Limits: different populations, and these are proposals, not standards.

Zhang et al., 2015

5%

By design, about 5% of a healthy reference group falls outside the range on any one test, split between the low and high ends.

Flagged marker	Often a short-term cause	Note
Ferritin (iron storage)	Infection or inflammation	Acute rises peak in 3–5 days and should pass
TSH	Acute illness, some drugs	Persistent only if repeats agree
Alkaline phosphatase	Age and growth	Highest in children and teens
Creatinine	Low muscle mass, meat, exercise	Under 0.6 mg/dL likely reflects low muscle mass
BUN to creatinine ratio	Dehydration, high protein intake	Above 20 often a temporary cause outside the kidney

COMMON BELIEF

"Any flagged result means something is wrong."

WHAT THE EVIDENCE SAYS

About 5% of healthy people fall outside on any single test. Clinicians weigh a flag against symptoms, history and a repeat. One flag is a reason to note it and ask, not a diagnosis.

Not every flag is noise. Several markers drifting the same way, a result that stays out on repeat, or a flag that matches your symptoms deserves a conversation. A ferritin of 30 ng/mL or below was a strong sign of low iron stores in healthy students (Daru 2017), and low ferritin can bring fatigue even when the blood count is normal.

ASK YOUR CLINICIAN

- **Is this flag likely short-term? When should we repeat it?**
- **What would make this worth following up?**
- **Do my other results move in the same direction?**

CHAPTER 7

What to bring to the appointment

THE ONE THING TO REMEMBER

Bring the whole report, your older results and your questions. Markers explain each other, so one flagged line is not enough.

One flagged line is a single puzzle piece. Many markers depend on each other. A1C needs hemoglobin to be read well. Ferritin needs inflammation markers. TSH needs free T4. Clinicians can only connect them if they can see the whole report, with its ranges and dates.

WHAT A STUDY FOUND

In 87,284 people without anemia or diabetes, lower hemoglobin went with higher A1C even when fasting glucose was below the diabetes range. So A1C is best read beside the blood count. Limit: an observational study of association; our source does not give effect sizes.

Bae et al., 2014

BRING TO THE VISIT

- [ ] The full report with lab ranges, not a photo of one line
- [ ] Older reports from any lab
- [ ] A list of medicines and supplements, including biotin
- [ ] Notes on illness, travel or hard exercise before the draw
- [ ] Your top three questions

ASK YOUR CLINICIAN

- **Which of my results would you repeat, and when?**
- **Which results do you want read together?**
- **Do you see a trend across my past results?**
- **What would change your plan for me?**

RESULTS I WANT TO DISCUSS

Marker

My value and the lab range

Date and lab name

Earlier values

WHAT I NOTICED

Symptoms and when they started

Sleep, stress or illness lately

Medicines and supplements, by name

Fasting? Time of the draw?

THE WHOLE GUIDE ON ONE PAGE

If you remember nothing else

1. A reference range is the middle 95% of a lab's reference group. It is not a health target.
2. About 5% of healthy people fall outside the range on any one test, so a small flag is often noise.
3. Your own trend, from the same lab and time of day, tells you more than one number.
4. Some studies link risk to values inside the range. They are group findings, and 'optimal' is one group's view.
5. Two problems can cancel out. MCV, A1C and LDL cholesterol can each look fine while something hides.
6. Meals, water, hard exercise, time of day and biotin can move a result. Note them before the draw.
7. Repeat before you worry. Bring the whole report, your history and your questions.
8. Note, ask, repeat. Diagnosis and medicine decisions belong to you and your clinician.

WHAT THIS GUIDE CANNOT DO

This guide cannot show you your own numbers or your trend. It can explain how ranges work, but it cannot say whether a given result matters for you. That depends on your history, symptoms, medicines and how your results change over time. It does not diagnose and does not replace your clinician.

A FREE NEXT STEP

Take a free 60-second lab check on our site. It suggests which markers fit your goal, so you know what to ask about and track. No email needed.

vitalsvault.com/lab-check

REFERENCES

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17. Kashani et al., Creatinine, muscle mass and diet, 2020
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19. Reference interval method: middle 95% of at least 120 reference people (white paper on blood chemistry ranges and trends)

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.