VITALS VAULT

A VITALS VAULT FIELD GUIDE

Know which numbers predict healthy aging in 25 minutes

For anyone who wants to age well: learn which measurable things matter, then fill in your own scorecard.

8

CHAPTERS

25 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 want to age well and are tired of conflicting longevity advice.
- You want to know which measurable things large studies link with longer, healthier lives.
- You have seen a biological age test and wonder what it really estimates.
- You want one page of your own numbers to bring to a clinician.

HOW TO USE IT

Read one chapter at a time. Each opens with the one thing to remember. Every finding names its study and its limit, because most are links seen in groups, not proof of cause. Use the last chapter to write in your own numbers, and bring that page and the question lists to a clinician.

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CHAPTER 1

Lifespan versus healthspan, in one comparison

THE ONE THING TO REMEMBER

Healthspan is the number of years you can live well and move freely, and it is what most people actually want to extend.

Lifespan is how many years you live. Healthspan [years lived in good health] is how many of them you spend able to think clearly, move freely and look after yourself. Think of a phone battery: lifespan is how long it lasts in total, healthspan is how long it runs before it dims and needs help. One expert describes three parts of healthspan: physical function, thinking, and emotional health. The first two tend to fall with age, so this guide focuses on measurable physical signals.

	Lifespan	Healthspan
What it counts	Years alive	Years living well and independently
Question at age 80	How long will I live?	Can I climb stairs and get up from the floor?
Main threat	Disease that causes death	Weakness, falls, loss of independence
Studied with	Death records	Strength, fitness, blood markers, function tests

WHAT A STUDY FOUND

US death records for adults 65 and older show the fall-death rate rose from about 46 to 60 per 100,000 between 2007 and 2016. Limit: records show falls are harmful, not what prevents them. The authors guessed that people now live longer with chronic disease, not necessarily healthier.

CDC, MMWR (fall deaths, adults 65+), 2018

61.6

deaths from falls per 100,000 US adults aged 65 and older in 2016, about the same rate as the tenth leading cause of death, sepsis (61.7).

COMMON BELIEF

"Slowing down and losing muscle is just normal aging."

WHAT THE EVIDENCE SAYS

The World Health Organization recognizes sarcopenia [muscle and strength loss with age] as a muscle disease. Its listed contributors include inflammation, low vitamin D and inactivity. Some loss comes with age, but the pace varies from person to person.

CHAPTER 2

Fitness and what the big cohort studies found

THE ONE THING TO REMEMBER

In about 122,000 adults, the least fit group died far more often than everyone else, and leaving the bottom group gave the biggest gain.

Cardiorespiratory fitness [how well heart and lungs work] is measured as VO2 max [peak oxygen your body can use] in a treadmill or bike test with a mask. Results come in mL of oxygen per kg per minute, or METs [multiples of resting energy use]; 1 MET is 3.5. Think of an engine's top speed: you rarely drive at it, but it sets your reserve. One expert's view is that about 14 (4 METs) is needed for ordinary daily tasks. That is a framework, not a guideline.

WHAT A STUDY FOUND

About 122,000 adults (average age 53) took a treadmill test, were ranked into five fitness groups and were followed for years. Death rates fell steadily as fitness rose; the biggest gap was between the bottom quarter and everyone else. Limit: observational, and sick people cannot run fast, so some of the link may run backward.

Mandsager et al., JAMA Network Open, 2018

Fitness group	Rank among peers	Death rate over about 10 years
Low	Bottom 25%	Reference group
Below average	25th to 50th	About 50% lower
Above average	50th to 75th	About 60% to 70% lower
Elite	Top few percent	About five times lower

Same study, other risk	Higher death rate
Smoking	About 41%
High blood pressure	About 21%
Coronary artery disease	About 29%
Type 2 diabetes	About 40%
End-stage kidney disease	About 180%

WHAT A STUDY FOUND

London bus conductors, who walked the bus all day, had about half the cardiovascular disease of drivers who sat. This natural experiment [nature sorted people, not researchers] was later reviewed. Limit: jobs were not assigned at random, so other differences between workers may play a part.

Morris and colleagues (reviewed in Vina et al., J Physiol, 2016)

COMMON BELIEF

"Too much exercise is bad for the heart."

WHAT THE EVIDENCE SAYS

Experts disagree. Some studies saw higher death rates at roughly 50 to 75 MET-hours a week; critics say few people sat at those extremes, and a large pooled US cohort showed no such curve. Very high volume does raise atrial fibrillation [irregular heartbeat] risk.

ASK YOUR CLINICIAN

- **Would a fitness test, or an estimate from my walking pace, be useful for me?**
- **Is it safe for me to raise my effort level, given my heart and joints?**
- **How does my fitness compare with others my age and sex?**

CHAPTER 3

Strength, muscle and staying upright

THE ONE THING TO REMEMBER

Strength predicts survival more clearly than muscle size, and fitness plus strength together beat either one alone.

Muscle stores protein, uses blood sugar and lets you rise from a chair or the floor. One review puts strength loss at about 1% to 2% a year after 50, and 35% to 40% between ages 20 and 80. Bed rest speeds it: in a 1966 study, three weeks in bed cost five young men about the fitness that 30 years of aging does (tiny sample). Think of a savings account: what you hold at 50 is what you draw on at 80.

A 2019 European consensus flags sarcopenia using strength first, then muscle quantity, then walking and chair performance. The table shows its cut-offs for low. They are screening lines for a clinician to interpret, not personal targets.

Test (cut-off for low)	Men	Women
Grip strength, below	27 kg	16 kg
Limb lean mass index, below	7.0 kg/m2	5.5 kg/m2
Five chair stands, slower than	15 seconds	15 seconds

WHAT A STUDY FOUND

In older US adults, low strength went with higher death risk even when muscle mass was adequate, while low mass with adequate strength did not raise risk significantly. Limit: observational. Adjusting for diabetes or kidney disease can hide effects, because those conditions are tied to low muscle.

Li et al., Medicine and Science in Sports and Exercise, 2018

WHAT A STUDY FOUND

Adults were grouped by fitness and grip strength, with low–low as the reference. High fitness plus high strength went with 47% lower death rates; low strength with high fitness, 42% lower; low fitness with high strength, 29% lower. Limit: observational, and deaths do not measure quality of life.

Kim et al., fitness and grip strength with mortality, 2018

25–60%

of older adults who break a hip or thigh bone in a fall die within a year, a range quoted by one expert, who called 40% to 50% the usual figure. No study was named.

COMMON BELIEF

"If I do plenty of cardio, I do not need strength work."

WHAT THE EVIDENCE SAYS

Fitness and strength together went with the lowest death rates (Kim 2018). In one pair of identical twins, 35 years of endurance exercise gave better blood pressure, lipids and VO2 max, but strength and muscle quality were no better than in the sedentary twin. One pair only illustrates.

CHAPTER 4

Blood numbers in people who reached 100

THE ONE THING TO REMEMBER

In one large Swedish study, people who later reached 100 already had different routine blood numbers at age 65.

Researchers asked: what did the blood of people who reached 100 look like decades earlier? They used routine tests, so you may find these markers on your own report. Think of an old weather record: it cannot call tomorrow, but it shows which patterns came before certain seasons. A quintile [one fifth of a group] means people were split into five equal groups for each marker.

WHAT A STUDY FOUND

Over 44,000 Swedish adults were followed up to 35 years; 1,224 reached 100. Twelve markers measured at ages 64 to 99 were compared. Differences showed from age 65. Limit: observational, so no cause is shown. Centenarians also had fewer chronic diseases earlier and probably healthier habits. The article gave no cut-offs for each fifth.

Murata et al., GeroScience, 2024

Marker	Linked with lower odds of reaching 100
Glucose	Highest fifth
Uric acid	Highest fifth
GGT, ALP, LDH, TIBC	Highest fifth of each
Total cholesterol	Lowest fifth (not the highest)
Iron	Lowest fifth
Creatinine	Highest two fifths
AST	Both the highest and the lowest fifth

On the other side, low CRP [blood marker of inflammation] and a high iron-to-TIBC ratio went with higher odds. The authors credit a mix of genes and changeable factors. These are patterns in groups, not ranges to aim for.

1,224 **people reached age 100 out of 44,636 followed for up to 35 years in the Swedish study.**

COMMON BELIEF

"Lower cholesterol always means a longer life."

WHAT THE EVIDENCE SAYS

In this cohort the lowest fifth of total cholesterol, and of iron, had lower odds of reaching 100. Levels were measured at ages 64 to 99, so this says little about cholesterol in midlife. It is one observational finding, not a reason to raise cholesterol.

ASK YOUR CLINICIAN

- Which of these markers are on my panel, and where do I fall?
- Could an unusually low value for me mean something is missing?
- How do my markers compare with my own earlier results?

CHAPTER 5

Blood pressure, blood sugar and lipids over decades

THE ONE THING TO REMEMBER

These three cause harm slowly and often without symptoms, so trends over years matter more than one reading.

All three are measured at the arm or in blood, and all three do their damage slowly. Think of a smoke alarm that sounds only after a fire has burned for years: by the time a standard 10-year risk score crosses a treatment line, disease may have built for decades. Before about 55 to 60 almost no one crosses that line, yet about half of heart attacks and strokes happen before 60. A single reading is a snapshot; repeated readings show direction.

Number	What it is	A key limit
Blood pressure	Pressure in your arteries (mmHg)	Home readings beat one office reading
Fasting glucose	Blood sugar after fasting	Moves about 7.5 mg/dL day to day
HbA1c	Average blood sugar over months	Red blood cell life span can skew it
LDL-C	Cholesterol in LDL particles	Usually calculated, not measured
ApoB	Count of plaque-causing particles	A separate test; experts differ on its role

WHAT A STUDY FOUND

SPRINT randomized adults at higher cardiovascular risk to a systolic target under 120 or under 140 mmHg. The tighter group had about 25% lower cardiovascular risk after roughly a year, and the trial stopped early. A Chinese trial (STEP) found 26% fewer outcomes at under 130 versus under 150. Limit: higher-risk people; not a universal target.

SPRINT Research Group, NEJM, 2015; STEP trial, 2021

WHAT A STUDY FOUND

Across randomized trials, cohorts and genetic studies, each fall of about 1 mmol/L (about 40 mg/dL) in LDL-C went with lower heart disease risk: about 22% over 5 years in trials, about 32% over 12 years in cohorts, and more with lifelong genetic differences. Limit: genetic methods are strong but imperfect; these are group figures.

Ference et al., European Heart Journal, 2017

WHAT A STUDY FOUND

In more than 5,000 adults, fasting glucose varied about 7.5 mg/dL from day to day. Of people called normal by one fasting reading, a week's average from a wearable glucose sensor reclassified 40% as prediabetes and 3% as diabetes. Limit: a research sample; guidelines still accept one A1c or fasting test.

Shilo et al., Nature Medicine, 2024

10–15 **years: how long insulin resistance [cells respond poorly to insulin] can build before type 2 diabetes appears. A clinical reference says the early stage can be reversed with lifestyle.**

ASK YOUR CLINICIAN

- Should I measure blood pressure at home, and with which cuff size?
- Is my LDL-C calculated or measured, and would apoB add anything for me?
- Do my glucose results suggest repeating a test or adding another?

CHAPTER 6

Biological age tests, and what they really estimate

THE ONE THING TO REMEMBER

A biological age is a statistical estimate from a model, and nobody has yet shown that changing the number changes your health.

Biological age [age your body's chemistry suggests] differs from the years on your birth certificate. Tests estimate it from routine blood markers, from DNA methylation [chemical tags on DNA] patterns, from telomeres [protective caps on chromosome ends], or, in research, from brain scans. Think of a used-car value: it blends mileage and condition into one figure, but two cars with the same figure can fail in different ways.

Test type	What it uses	Main limit
Blood-marker pattern	Albumin, creatinine, CRP, glucose, blood counts	Group model; units differ by calculator
DNA methylation clock	Tags at hundreds of DNA sites	Clocks disagree; lab noise
Telomere length	Length of chromosome caps	No standard range; not routine
Brain MRI model	About 99 brain scan features	Research only; needs an MRI

WHAT A STUDY FOUND

In 9,926 US adults (NHANES III), a score built from nine routine blood markers predicted 10-year deaths and held up in a second survey. Each extra year of biological age went with about 9% higher death risk; a DNA-methylation version, about 4.5%. Limit: a group model; it cannot say how long one person will live.

Levine et al., Aging, 2018

WHAT A STUDY FOUND

In DO-HEALTH, nearly 800 mostly Swiss adults aged 70+ got three years of vitamin D, an omega-3 supplement or home strength exercise, alone or combined; four clocks were measured. Only the omega-3 arm moved some clocks, by about 3 months; one clock moved in no arm. Limit: small, clock-specific, meaning unknown.

Bischoff-Ferrari et al., Nature Aging, 2025

WHAT A STUDY FOUND

A model trained on brain scans of about 875 people in a New Zealand birth cohort predicted pace of aging. In UK Biobank (about 42,000 adults), faster pace went with 32% higher death risk, but only about 1% in absolute terms over 7.5 years. Limit: moderate prediction; not available to consumers.

Whitman et al., Nature Aging, 2025

COMMON BELIEF

"A biological age 10 years older means 10 fewer years of life."

WHAT THE EVIDENCE SAYS

Nobody has tested that. A gap between two same-age people is a signal in groups; whether it equals years of life is an open question. Clocks built on blood, DNA and scans often disagree, and risk per year of biological age applies to groups, not to one person.

ASK YOUR CLINICIAN

- **What does this number tell me that my routine labs do not?**
- **Which clock is it, and how repeatable is the result?**
- **What would I do differently if it moved by a few months?**
- **Is anything sold alongside the result?**

CHAPTER 7

What the evidence does not support

THE ONE THING TO REMEMBER

Most longevity claims are not false; they are untested, small, or true only for some people, and a fair reader keeps those apart.

This chapter lists claims that go further than the studies in this guide. It is not a verdict on anyone's choices. Where experts disagree, both views are given. Three questions help with any claim: how big was the study, did it test a change or only watch people, and was the result large in absolute terms or only in relative terms?

Claim	What the studies show	Strength
One number sums up aging	Clocks often disagree, even in one trial	Weak
Moving a clock extends life	Not tested; changes so far are small	Untested
Lower is always better	Lowest cholesterol, iron fifths did worse at 65+	Observational
Longer telomeres are better	Lengthening may raise cancer risk	Risk flagged
Fasting glucose is enough	One test can miss early insulin resistance	Expert view

COMMON BELIEF

"You can outrun a bad diet."

WHAT THE EVIDENCE SAYS

In one set of fitness and diet data, diet quality mattered for death rates in less fit people but little in the fittest. Experts disagree: one says you can, but it takes far more exercise than people realize; another says not in a high-calorie, low-activity world. No single study settles it.

COMMON BELIEF

“Exercise protects like a vaccine.”

WHAT THE EVIDENCE SAYS

It does not. A famous marathon champion who trained all his life still had plaque in his coronary arteries at autopsy, though his arteries were very large. People with very poor lipids can still get heart disease despite exercise. Exercise lowers risk; it does not erase it.

WHAT A STUDY FOUND

In 45,782 people with prediabetes, returning glucose to normal within three years did not by itself lower death rates. Normal glucose plus healthier habits (more activity, no smoking) went with substantially lower death risk and longer life expectancy. Limit: observational; habits and glucose are tangled together.

Cao et al., prediabetes cohort study, 2023

ASK YOUR CLINICIAN

- **Was this proven in a trial, or seen only as a link in groups?**
- **What was the absolute change, not just the percentage?**

CHAPTER 8

Your personal scorecard

THE ONE THING TO REMEMBER

Fill in what you know, mark what you do not, and bring the page to a clinician, who can say what each number means for you.

Ranges are left off on purpose. Normal ranges differ by lab, age, sex and health history, and some popular targets are one group's view. The aim is a record you can compare with your own earlier results. Date each entry. Where you have no number, write 'ask'. Life's Essential 8 [a heart association's eight-item checklist] is a similar scorecard.

HEART AND BLOOD VESSELS

Home blood pressure (average of readings) _____

LDL cholesterol (LDL-C) _____

ApoB, if measured _____

Triglycerides _____

Date and lab for these results _____

BLOOD SUGAR AND BLOOD MARKERS

Fasting glucose _____

HbA1c _____

Fasting insulin, if measured _____

hs-CRP (inflammation marker) _____

Creatinine and cystatin C, if measured _____

STRENGTH AND FITNESS

Grip strength, if tested (kg) _____

Five chair stands (seconds) _____

Fitness test or estimate (VO2 max or METs) _____

Falls or near-falls in the past year _____

BEFORE YOUR NEXT APPOINTMENT

- [ ] Latest lab report printed or saved
- [ ] Home blood pressure log started
- [ ] Family history of heart disease or diabetes noted
- [ ] List of all medicines and supplements written down
- [ ] Changes in strength, balance or energy noted

WHAT A STUDY FOUND

In a study of biological aging, higher scores on the American Heart Association's checklist (diet, not smoking, weight, activity, glucose, cholesterol, blood pressure, plus sleep) went with a more desirable biological age. Limit: observational, so it shows a link, not a cause.

Zhang et al., Journal of Translational Medicine, 2023

ASK YOUR CLINICIAN

- Which two numbers on this page matter most for me?
- Which should I repeat, and how soon?
- Which ranges apply to someone of my age, sex and health?

THE WHOLE GUIDE ON ONE PAGE

If you remember nothing else

1. Healthspan is years lived well. Weakness, falls and lost independence are what threaten it.
2. Fitness: in about 122,000 adults the least fit group had the highest death rates; leaving it gave the biggest gain.
3. Strength predicts survival more clearly than muscle size; strength plus fitness beat either alone.
4. People who reached 100 already had different routine blood numbers at 65. It is a link, not proof.
5. Blood pressure, blood sugar and LDL cholesterol do harm slowly; repeated readings beat one.
6. Biological age tests are models. Clocks disagree, and no one has shown that moving the number extends life.
7. Lower is not always better, and a big relative change can be a small absolute one.
8. Your scorecard is a record to bring to a clinician, not a verdict.

WHAT THIS GUIDE CANNOT DO

This guide cannot tell you what your numbers mean, what your targets should be, or how long you will live. Most studies here watched groups of people, so they show links, not proof of cause. It gives no personal ranges and cannot replace a clinician who knows your history. Only your own results, repeated over time, can show your direction.

A FREE NEXT STEP

Try the free biological age calculator on our site to see how the idea works, remembering the limits in chapter 6. Bring the result, with your scorecard, to a clinician as a starting question, not an answer.

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.