

OUTLIVE

The Science and Art of Longevity

“A healthy person wants a thousand things; a sick person only wants one”

Too long; Didn't read (TL;DR): This paper attempts to summarize Peter Attia's recent book about longevity and healthspan. What he describes and what I have written below are not necessarily new or unheard of. However, it is backed by research and there are many nuances that can make a difference in your daily life. It is easy to get bogged down in the details, so if details aren't for you, this is the high-level summary of what you should be doing now to improve your health as you age.

- 1. Exercise as often as possible.** You can do aerobic exercise, strength training, or stability work (or better yet, all three!). Exercise doesn't need to be strenuous to have benefits. In fact, exercising at a comfortable pace (brisk walk or bike ride) is believed to have major benefits. I've put together a spreadsheet to start tracking your exercise [here](#). Many of the details about what you should do and how often you should do it are in the spreadsheet as notes (hover over cells with purple triangles in the upper right corner to display the notes). *In order to edit and use the tracker, you will need to make a personal copy of it first.*
- 2. Avoid the SAD (Standard American Diet).** We eat too much, plain and simple. We also eat a lot of added sugar. No diet is fool-proof, but it seems the healthiest diet is a Mediterranean diet. Avoid liquid fructose like those found in juices and soft drinks.
- 3. Prioritize sleep and relaxation.** Sleep as close to 7.5-8.5 hours as possible every night. Implement routines in your life that decrease your chronic stress level.
- 4. See your doctor at least yearly.** We often wait for too long to intervene on our own behalf. By the time we catch health problems, they are usually already causing symptoms. By getting annual lab work done, we can often see problems months or even years before they cause symptoms and hopefully intervene soon enough to stop them from progressing.

Introduction

Over the past few years, I have spent considerable time attempting to understand the actual data and research behind various exercise regimens, diets, and supplements. These topics are widely discussed, often by loud voices with no evidence to back up their claims other than the

anecdotal. Measured, data-driven, voices of reason are tough to find. However, one physician continued to impress me: Dr. Peter Attia.

Peter had been a guest on a few of my favorite podcasts where he discussed various topics surrounding physiology including exercise, nutrition, and supplements. His opinions were always research-backed, and he was never afraid to admit when he was wrong or to change his suggestions in light of new evidence. He also is a remarkable person: he grew up in difficult circumstances, overcoming various types of abuse, and graduated from Stanford Medical School. He went on to general surgery residency at Johns Hopkins. However, after completing 5 of his required 6 years of residency, he grew disillusioned with surgery and medicine and dropped out, taking a job in the world of finance and equity with McKenzie Advising. After a handful of years away from medicine, he returned with a fresh perspective. Rather than taking up surgery, Peter began working as a physician focused on prevention of disease and prolonging healthspan (to be discussed in more detail later). He practices what he preaches, as he at different times trained to become an Olympic boxer, amateur cyclist, and accomplished swimmer. Peter announced some months ago that he would be releasing a book summarizing his years of research into how we can improve our health through diet, exercise, supplements, and other approaches. I excitedly looked forward to its release as it seemed it would be a compendium of all science can currently tell us about how to live longer, healthier, more fruitful lives. I recently finished the book and it exceeded my lofty expectations. This paper (and associated [tracker sheet](#)) are an attempt to record, explain, summarize, schedule, and track the key points made in Dr. Attia's book.

As I approach my 30th birthday, these topics have become ever more important to me. If no one else benefits from this summary, that is ok; however, I wanted to share what I have learned with people I love in the hopes that they can benefit too.

Notes to readers: Dr. Attia openly speaks of how he treats his body like an experiment on longevity. He works very hard and spends much more time on his health than most of us are able to. As you read the following, try your best to implement what is recommended, but always within reason. Don't stretch yourself too thin by doing too much or skipping rest days if needed. Start with the simplest and highest-yield recommendations. You may never implement everything recommended and that is ok. Some of this evidence is early-stage and it is all subject to change should superior evidence emerge.

This started as a personal project to simply record what I was learning for future reference. Then I decided to share it with friends and family if they were interested. This project grew in formality as more people expressed interest, including those in the Peter Attia subreddit. As such, please forgive this project's shortcomings. If significant changes are suggested or made by those more talented than me, I will update this document and the spreadsheet accordingly.

Purpose

Use all quality information, technology, and resources available to us to improve not only how long we live, but for how long we live healthy, enjoyable, and productive lives.

The goal is not to increase *lifespan* (how long we live), but increase **healthspan** (how long we can live healthy enough to do the things we enjoy). We want to spend as little time as possible in a state of decreased mental, physical, or emotional capacity. Ideally, we would all enjoy long, healthy, fruitful lives and then have a quick descent to the end of our lives, without years of decreased capacity and disease.

The rest of this paper is an attempt to summarize what Dr. Attia recommends. To save space, time and my sanity, the extensive research he cites has been excluded as have various anecdotes. I **highly encourage** you to read the full length book for greater context and understanding of Dr. Attia's recommendations.

The “How”

How do we increase our healthspan? By **avoiding the four primary causes** of decreased capacity, disease, and death as we age. Peter refers to them as, “the four horsemen.” They are senile diseases, meaning they appear with greater frequency as we age. In our era where we are living longer, eating more, and exercising less than ever before in the history of human existence, the four horsemen are increasingly common. The four horsemen are, in no particular order:

1. Metabolic syndrome (an amalgamation of obesity, insulin resistance, hyperlipidemia, hypertension)
2. Cancer
3. Atherosclerotic cardiovascular disease (ASCVD: strokes and heart attacks)
4. Neurocognitive disease (Alzheimer's, other forms of dementia)

The recommendations throughout the rest of this paper have been shown, with varying degrees of certainty, to decrease our chances of acquiring any of the four horsemen. Following these recommendations is not a guarantee to ward off these ailments, but it is the best evidence our science currently has to offer.

Most of these recommendations are based on a philosophy that Peter refers to as “Medicine 3.0.” Medicine 1.0 began with the discovery of antibiotics and our ability to actually treat diseases with some reliability. Medicine 2.0 is what the majority of physicians currently practice: there is greater understanding of cause and effect of various diseases than we've had in the past. We have screening tests for some diseases, but for the most part, treatment of ailments begins *at the time of onset of symptoms*. The issue with Medicine 2.0 is that it is very poor at treating the four horsemen; at the time of symptom onset, these diseases are well-established in our physiology and nearly irreversible. Medicine 3.0 takes the approach of trying to detect and treat conditions well before symptoms manifest. For example, rather than delaying routine blood testing and medication for cardiovascular disease until symptom onset or until some (relatively) arbitrary age of 50, Medicine 3.0 would suggest we conduct regular blood and imaging tests to detect these diseases in their earliest stage. Lifestyle changes and medications should be initiated as early as possible, often decades before Medicine 2.0 would suggest doing anything at all. Thus many of these ideas may seem radical to you or your physician, but they are

supposed to. This is a paradigm shift in medicine that is **necessary** if we want to improve our healthspan and avoid the four horsemen as long as possible. (Note that the guidelines set by Medicine 2.0 for diagnostic workup and intervention are based on the risk vs. benefit of these various tests and interventions at different ages, with a focus on doing no harm. Peter has a slightly different view, suggesting that when the risks of a test or medication are low-risk, it should be implemented earlier or more aggressively than Medicine 2.0 currently recommends.)

Remember that genetics and family history play a large role in our healthspan. Some centenarians (those who live to 100 years old) live relatively unhealthy lifestyles, attributing their healthspan to their daily pack of cigarettes in some cases. However, their genetics help compensate for their unhealthy lifestyle. Our goal with the below recommendations is to mimic the genetics of centenarians through lifestyle modifications and behaviors as we likely do not have the genetics to cover up lifestyle mistakes to the same degree.

I have broken the recommendations into four general categories: nutritional biochemistry (what we should consume), lifestyle (how we should live and exercise), labs and tests, and medications/supplements. The medications/supplements section is appropriately the shortest section, as the other three categories are far more important in Medicine 3.0. I have also created an accompanying [spreadsheet](#) to track your exercise as well as labs and tests over time. Don't get overwhelmed with the exercise recommendations. The spreadsheet makes tracking the recommendations simple. Much of the nitty-gritty information about exercise is also included in the spreadsheet as notes on various cells, indicated by a colored triangle in the upper-right corner of the cell.

Reading this document is the first step. Take time to digest it and plan the changes you want to make, then get to work. One of the first steps is to find a primary care physician you are comfortable with, then starting the conversation about getting the initial labs and tests done (listed on the spreadsheet and in more detail below). Of course your nutrition and lifestyle can be changed as soon as you're ready.

NUTRITIONAL BIOCHEMISTRY

TL;DR: *Caloric* restriction (counting calories and eating less without cutting out specific food groups) is the winner hands down for maintaining a healthy weight and avoiding metabolic syndrome. You have to do it perfectly though by recording calories and not snacking. *Dietary* restriction (avoiding prescribed "forbidden" food groups) is the most common strategy, though less effective. *Time* restriction (only eating during certain hours, but not specifically counting calories or avoiding any food groups) may be the easiest approach, but can still backfire by overeating. Those who time restrict can also end up protein deficient. They may lose weight but their body composition worsens. **If Peter could eliminate one food from everyone's diets it would be fructose sweetened drinks (soft drinks and fruit juices).**

If we take in more energy than we require, it ends up as fat. Our body has a certain capacity to store fat in our subcutaneous tissues (the area just beneath our skin). This space is relatively

safe to store fat and is our body's default fat storage location. However, if we accumulate too much fat, it will eventually overwhelm the subcutaneous fat capacity and spill over into our viscera (organs and area surrounding our organs) and musculature. Having fat accumulate around our organs (visceral fat) and in our musculature is very detrimental to our metabolic health. These are the first steps down the road to insulin resistance, type II diabetes, and metabolic syndrome. Thus Peter subscribes to the age-old notion that calories are calories, regardless of their source, and that calorie restriction (CR; tracking calories and not consuming more than necessary) is key for health maintenance and avoiding metabolic syndrome. Calories in minus calories out. Nothing new here. Note: there are some exceptions to the above (calories from certain food groups *do* appear to be worse than calories from other food groups, which we discuss later), and we can burn calories in ways other than strenuous exercise (to be addressed in the lifestyle section).

There are three general approaches to cutting out excessive caloric intake: caloric restriction (CR), diet restriction (DR), and time restriction (TR). They have various pros and cons, which we will cover here. However, **the best option of these three is whichever one works for you.**

Caloric restriction (CR) is basically calorie tracking with meticulous detail. Peter tells of a study in rhesus monkeys in Wisconsin wherein monkeys eating under CR lived two decades longer than monkeys allowed to eat ad libitum (as much and as often as they wanted). In this study the CR group ate about 25% fewer calories than the ad lib group. The CR group was far less likely to die of age related diseases; even their brains were in better shape. But a later study at the NIH with near identical design found no difference in lifespans. The most profound difference between the two studies was what the monkeys ate. The Wisconsin diet had lots of refined sugar whereas the NIH diet was more natural with far less sugar. One possible takeaway here is that the quality of our diet (natural foods with less sugar vs. refined sugars) may matter as much as the quantity of our diet. In other words, we can take in more calories of more natural, less sugary foods, without all the typical downsides of increased calories. On the flip side, most overeating occurs when we eat refined sugars and junk foods. This may be doubly bad as the caloric excess pairs with the poor nutritional value to increase our long term risks of negative health outcomes and shorter lifespan. There is also a strong link between excess calories and cancer development. CR is most beneficial if you are overweight and need to examine where your excess calories are coming from. If your diet is high quality and you are metabolically healthy, a slight CR can still be beneficial in helping decrease your odds of chronic or senile disease. However, severe CR (any excessive decrease in daily caloric intake) is likely unnecessary. These types of drastic CR diets are likely only beneficial in those with existing metabolic syndrome unresponsive to smaller caloric cuts.

CR without nutrition restriction is useful in slowing aging. Most people cannot CR over long periods, but even sporadically it is helpful. Exercise can also help cause CR. In other words, if you can eat a healthy diet, not depriving yourself of any nutrients, while also living at a caloric deficit for a few days each month, that is helpful in slowing aging. Your caloric deficit can come from decreased intake or increased exercise.

Fructose in whole fruit is ok. **Fructose from other sources, especially liquids (juice and soda) is bad bad.** The way our body digests fructose basically tells your body you are still hungry. Avoid it.

Dietary cholesterol has no bearing on LDL-C. It affects triglycerides but not cholesterol. Bad fats can cause lipid issues but that's about it.

One of the *least bad* nutrition studies (because almost all nutrition studies are of poor quality) showed **dramatic results in favor of mixed nuts and olive oil (Mediterranean diet) over low fat diet.** Seemed to be as effective as far as NNT (number needed to treat) as statins at preventing primary heart disease. Extra virgin olive oil may be the healthiest type of fat. However, nutrition studies are heavily skewed due to individual metabolisms and ability to stick to a diet. Need an individualized approach.

Added sugar, highly refined carbohydrates with low fiber content, processed oils, and very dense caloric foods constitute the basic standard American diet (SAD) and are dangerous when consumed in excess. What we are really talking about is *junk food*. Grain-based desserts are the number one food group of the SAD (cookies, pies, etc.). Further away we can get from the SAD, the better. Eating less is the primary aim though. We can do this through caloric restriction, dietary restriction, or time restriction.

Dietary restriction (DR) is the most common type of “diet”. It entails avoiding certain “forbidden” food groups, depending on the diet being followed (like the keto diet and its avoidance of carbs). Advantage of DR is it's highly individualized. Carb reduction can reduce hunger. Can still easily end up overnourished if you don't restrict the right stuff at the right amounts. Avoid DR that restricts proteins. No right diet for each person. Dr. Attia found keto worked well for him and some patients, but other patients labs got worse with keto (especially ApoB from all the saturated fats they ate) and some didn't lose any weight at all. Nutrition 3.0 attempts to find the diet that works best for each patient based on 4 macros: **alcohol, carbs, fats, proteins.**

Alcohol: really, no amount is good for you. Studies suggesting wine or other alcohols have some benefit are fraught and can't be trusted at this point. Peter tries to really limit his alcohol intake to no more than 2 drinks at any given time and tries to only do that on special occasions. Avoid alcohol consumption if at all possible.

Carbs: Recommends continuous glucose monitoring (CGM) for carbs as it helps us understand how our body handles carbs. We are trying to avoid excess intake, elevated blood glucose (BG), and repeated spikes in BG. Only available by prescription (rx). Should be available without rx soon. Could also track using over-the-counter (OTC) BG monitors, measuring every hour, paying attention to snacks and intake. Could get CGM outside rx from various companies though it is expensive. Really only need it for a month or two to learn which foods are spiking glucose and how to adjust diet. Want BG to be low and steady. Variability and high BG is linked

with large increased odds of all-cause mortality. **Peter wants average glucose at or below 100 with standard deviation less than 15.**

Lessons from CGM:

- One night of bad sleep can spike your BG the next day. Need 8 hours of sleep for optimum glucose control.
- If your BG spikes after falling sleep, likely due to psychological stress.
- Timing of what you eat matters. We are more insulin-sensitive earlier in the day so frontload the day with carbs. Additionally, changing the order of what you eat within individual meals matters. If you eat a carbohydrate load first in a meal, your BG will spike. If you eat other things first (protein, fat, etc.) and *then* eat carbs, your BG will be more stable.
- Exercise plays a massive role in the amount of carbs you can tolerate.
- Less processed carbs and carbs with lots of fiber don't spike BG as much. Peter tries for 50g of fiber per day.
- Oatmeal and rice cause sharp rises in BG.
- Timing, duration and intensity of exercise matter a lot. In general, aerobic exercise is best at reducing BG. High-intensity workouts can spike BG, don't let that concern you.
- Tracking glucose has a positive effect on eating behavior.

Protein: standard recommendations are a joke. 1.6g/kg/day is the minimum he recommends with ideal amount varying for each person. 1g/lb/day is typically a good place to start especially if you are trying to gain muscle mass. Also eat it over the course of the day rather than in one sitting. He usually does two protein based meals, one high protein snack, and one whey protein shake. Research suggests eating daily protein intake over four sittings. Adjust protein consumption with DEXA scans and other biofeedback. Overall quality of protein derived from plants is less than that from meat. Whey protein is better than soy. Protein supplements aren't as good as meat either. It can get pretty complicated trying to compare the quality of various protein sources, so focus on these amounts: you want to consume 3-4g per day of leucine and lysine 3-4g and about 1g of methionine each day. If you are trying to increase lean mass you'll need more leucine, around 8-12g per day. Need more protein as we age to maintain muscle mass.

Fat: Three main types we care about: saturated fatty acids (SFA), monounsaturated fatty acids (MUFA), and polyunsaturated fatty acids (PUFA). Trans fats, a type of unsaturated fatty acid, are the worst and have largely been removed from our diets. SFAs are more stable and are solid at room temp (butter). Unsaturated fatty acids (UFA) are typically liquid at room temp (oils). Most people's baseline fat consumption is about 30-40% SFA and MUFA each and 20-30% PUFA (6-10x more omega 6 than 3). Try to boost MUFA to 50-55%, cut SFA to 15-20%, adjust total PUFA to fill the gap. Boost PUFAs through marine fat sources. Can do blood tests to determine these percentages. 8-12% of RBC membrane composed of EPA and DHA is the goal. **Eat more olive oil, avocados and nuts, and cut back on butter and lard.** Reduce omega 6 rich corn, soybean, and sunflower oils while also looking for ways to increase marine omega 3 from foods like salmon or supplements. Corn and cottonseed oil is bad for us (full of

PUFAs), though increasing PUFA probably makes little or no difference to our risk for cardiovascular disease (CVD) according to Cochrane. Reducing dietary saturated fats reduced cardiovascular (CV) events, though not mortality or CV mortality Cochrane also says. The data are very unclear at least at the population level. Broad insights are almost impossible to find with nutrition. MUFA seems to be the best of the bunch. PUFA has a slight advantage over SFA but it's not clear. Track your own lipids and your FA intake to see what works for you. Almost everyone needs marine omega 3 supplements (EPA and DHA supplements).

Examples of MUFAs:

- Olive, peanut, and canola oils
- Avocados
- Nuts such as almonds, hazelnuts, and pecans
- Seeds such as pumpkin and sesame seeds

Examples of PUFAs:

- Sunflower, corn, soybean, and flaxseed oils
- Walnuts
- Flax seeds
- Fish
- Canola oil – though higher in monounsaturated fat, it's also a good source of polyunsaturated fat

Examples of SFAs:

- Pizza and cheese
- Whole and reduced fat milk, butter and dairy desserts
- Meat products (sausage, bacon, beef, hamburgers)
- Cookies and other grain-based desserts
- A variety of mixed fast food dishes

Time restriction (TR) means eating only during specific time periods of the day, thus limiting our intake. Intake is not limited by calorie counting or eliminating certain types of food. Various forms of fasting fall into TR. Fasting triggers many cellular and physiologic mechanisms we want to see that decrease inflammation and aging. Also has potentially serious downsides. Peter is skeptical of intermittent fasting. Still thinks it can be useful for those with severe metabolic syndrome. Intermittent fasting doesn't really work at 16/8 (16 hours fasting, 8 hours eating). Needs to be more like 18/6 or 20/4. Only those windows will give you enough of a caloric deficit. Peter doesn't think it has much benefit beyond caloric restriction from the time limitation of eating. Also virtually guaranteed to miss your protein target if you do this right. Studies of alternate day fasting have also been inconclusive. Made people less active and lost muscle mass. **Bad diets hurt us more than good diets help us.**

MEDICATIONS AND SUPPLEMENTS

TL;DR: Peter is very big on recommending statins and other lipid-lowering drugs to everyone. This and his other recommendations are relatively frowned upon by Medicine 2.0. Talking with

your doctor and doing some additional research is necessary in finding out if these medications/supplements are right for you.

This section is the shortest as it is the least important. I suspect much will be learned in the coming years about how we can improve our longevity with medications and supplements, but right now there just isn't much to be done.

Rapamycin taken cyclically (rather than daily) seems to have gerioprotective effects without immunosuppression. Attia and his patients use it off-label. This is fairly new science and unproven as of right now. Would definitely talk with a doctor and do more research before ever implementing.

Recommends statins (cholesterol-lowering drugs) to basically anyone that can tolerate them. Starts with crestor and only deviates from it if there are side effects (10% of people have muscle soreness on statins; you'll know pretty quickly if you do). Pairing statins with PCSK9 inhibitors (another lipid-lowering drug) is the best way to attack ApoB levels, which he wants at 20-30mg/dL.

Peter also recommends finding a "clean" magnesium supplement along with EPA/DHA fish oil supplements and Vitamin D to most people. Some of these topics are discussed in other places throughout the rest of this paper; if not, you are able to do more reading on your own regarding these supplements and the best versions of them for you. Supplementation is a very hot topic with a wide array of opinions, so it makes sense to do a little reading and form your own opinions before starting a specific regimen.

TESTS AND LABS

TL;DR: Dr. Attia recommends a battery of labs and scans at much more frequent intervals than Medicine 2.0. Many of these labs/scans you do not need a medical referral for, so you can get them on your own, though it will be expensive. Therefore, how often you do them is up to you. Beware feeling totally at ease if your labs come back, "within normal limits." For many labs, this is totally fine (electrolyte levels will be roughly the same for basically everyone). But for other labs (lipid panels) being within normal limits may not be good enough. For a complete list of the tests/labs/scans Peter recommends in Outlive and his goal values for them, see the [Outlive tracker spreadsheet](#).

He has his patients get DEXA scans annually to check their abdominal fat levels. DEXA scans are commonly used to evaluate for osteoporosis but they can also be used for this purpose. Some standalone fitness clinics offer **DEXA scans or full body ultrasounds to quantify body fat percentage and its location (subcutaneous fat vs. visceral)**. As mentioned above when discussing fat storage, fat accumulation in and around visceral organs and in muscle tissue is very detrimental to our metabolic health; we want to avoid it as much as possible. These scans help show you how you are doing at avoiding fat accumulation in these locations better than stepping on a scale or getting a generic body fat % estimate ever could.

He tests patients' uric acid levels as an early warning sign for high blood pressure and diet issues as uric acid levels are correlated with fructose consumption and also increase as we store fructose as fat. He also has them take glucose tolerance tests to check for early signs of hyperinsulinemia. He watches homocysteine, chronic inflammation, even mildly elevated ALT (a liver enzyme), triglyceride levels, triglyceride to HDL ratio (<2:1 is good, <1:1 is even better) and levels of VLDL.

He personally has CTs done looking for coronary calcifications. They will give you a percent of calcification. Any calcification of your coronary arteries is a bad thing.

Tests all his pts with ApoB labs. Long story short, ApoB is a particle found on harmful molecules in our blood (like on LDL). ApoB is thought to be the main driver in atherosclerotic disease, thus the emphasis on measuring it. Peter also recommends a one time test for Lp(a) genetics. If you carry certain versions of the Lp(a) gene, you may be at higher risk for ASCVD.

He works with his patients to lower LDL-C and ApoB as much as possible. He recommends LDL around 10-20mg/dL. This *can* be done with diet and exercise but *usually* requires medications (statins, PCSK9 inhibitors).

He starts colon screening via colonoscopy at 40 and does it every 2-3 years. Sounds like he also does full body MRIs of his pts to look for any glandular tumors in their early stages.

ApoE-E4 is bad for just about everything. Can be detected via genetic testing. There is an increased risk of metabolic syndrome and Alzheimer's if you have it. If you do have it, it's important to watch for metabolic issues. Pay close attention to glucose metabolism, inflammation, oxidative stress, and lipids. For these patients, he would recommend switching to a Mediterranean style diet with lots of monounsaturated fats, regular consumption of fatty fish, and avoiding polyunsaturated fats and refined carbs.

LIFESTYLE

Chronic stress and lack of sleep leads to increased cortisol which increases your abdominal fat.

Metabolic syndrome to any degree lessens our ability to utilize our fat stores. Thus starts the vicious cycle of metabolic syndrome: our mitochondria are deconditioned and less *capable* of using and less *likely* to use our fat stores as energy, meaning that even when we exercise and eat properly, our fat remains. It seems the only way to lose weight once we've reached insulin resistance or metabolic syndrome is to recondition our mitochondria which, according to Peter, takes 4-5 months of Zone 2 exercise (discussed in detail later in this section).

Most powerful tool for preventing cognitive decline is lots of exercise. Endurance and strength training are probably both important in stress reduction, memory, and decreasing chances of

neurodegenerative disease, as is sleep. Gingival health (brushing, flossing, regular dental cleanings) and sauna use (4 sessions per week of at least 20 minutes each of 179F or hotter) reduces risk of Alzheimer's Disease (AD) and ASCVD.

What's good for the heart (CV health generally) is equally good for the brain. What's good for the liver and pancreas is also good for the brain.

Peak cardiorespiratory fitness as measured by **VO2 Max is perhaps the greatest predictor of longevity we have.** Being below average for your age in VO2 max leads to a 2-4x greater increased risk in all-cause mortality than the fittest groups. There appears to be no upper limit to the benefits either. **Muscle strength (not size) may be almost equally beneficial in terms of health and lifespan.**

Setting goals for exercise should revolve around generalization rather than specialization. Think of yourself as a decathlete. What activities of daily living (ADLs) or hobbies do you want to be able to do in your 80s or 90s? Work on your strength and VO2 Max accordingly, planning on your strength and VO2 Max decreasing about 10% with each decade after 40. See where you need to be now if you want to be at a certain point in your 80s or 90s.

Peter does 4 days of strength training each week. Studies recommend lifting heavy weights and you can start at any age.

Exercise and training focused should be focused on three areas: **Aerobics, strength, and stability.**

Aerobic training should be focused on two areas/types of exercise: long, steady endurance work in Zone 2 and maximal aerobics where VO2 Max comes into play. Zone 2 training (exertion such that conversation is still possible but it may be strained) is key to mitochondrial health. Mitochondrial health allows us to use fat more efficiently, staving off metabolic syndrome. It also builds a base of endurance for any other higher strain activity you pursue. "Feeling the burn" is a sign of lactate build up and shows you are likely going too hard, beyond zone 2. You want lactate between 1.7 and 2.2, steady. You can check this during lab-based exercise studies or with an at-home monitor. **The most accurate way to measure Zone 2 levels of exertion without being in a lab setting or checking your lactate is using relative effort.** You should be able to breathe through your nose only during all zone 2 work. An alternative gauge is being able to carry on a conversation. The person on the other end of the conversation should be able to tell you are exercising but the conversation should not be disrupted by the exercise. Could also measure by 70-85% of max HR, though HR is not considered an accurate zone 2 measure. **3 hours/wk of zone 2 is the minimum to reap benefit.** Can track your zone 2 progress by tracking watts/kilo. 2-3W/kg is good, 4 is really good. It should improve over time.

Peter has unfit patients train in zone 2 for four months or so before beginning VO2 max training. Zone 2 training improves VO2 max somewhat, but training VO2 Max specifically helps it to

improve more. VO2 max can be improved at any age. Never too late to start. Peter recommends 2 sessions each week as follows: 4 minutes at as fast as you can go without slowing down for those 4 minutes, then 4 minutes at a very easy pace. Repeat this 4-6 times plus a cooldown for one session. Make sure your rest 4 minutes are sufficient to get you as close to fully rested as you can before the next sprint or you will miss much of the benefit. These exercises should be done at a notch below peak-HIIT intensity. Aim to be in the top 2.5% of VO2 Max for your age and sex. Then, aim to be in that same percentile for your sex two decades younger. This is the way to turn back the clock and be able to live as if you were decades younger.

Strength training: heavy lifting trains type 2 fibers. We lose type 2 fibers (strength and power) much faster as we age. And gains here become more difficult with age as well. Heavy lifting also improves bone mineral density (BMD). Peter recommends incorporating carrying exercises into workouts (walking with dumbbells for example). He also is a proponent of rucking: carrying a heavy backpack on walks/hikes as this trains strength, stability, and CV fitness at the same time. Rucking inclines is an important part of rucking. Goal is to carry 1/4-1/3 of your weight in your pack. Peter rucks for an hour 3-4 days per week, walking at a pace brisk enough to cover 3-4 miles each session.

Dr. Attia focuses his weight training on four areas: grip strength, concentric and eccentric motions (setting weight down with control, muscle lengthening with control), pulling motions at various angles (rows, pullups), and hip hinging movements like deadlift and squat. Trains grip by walking for a minute with weights in each hand (bonus points for carrying it with shoulder and elbow flexed at 90 degrees each). Goal: Men carry half body weight in each hand (carrying their full body weight in total) for one minute with females doing 75% of their total body weight. Keep shoulder blades down and back rather than up and hunched forward. Could also dead hang once in a while. Hang for two minutes (M) or 1.5 minutes (F).

Eccentric (lengthening the muscle or setting the weight down with control) strength is where many falter as they age. Focus on eccentric loading while lifting. You don't need to do this with every rep or set. Just make sure to focus on eccentrics at some point in your workout.

Stability training: harder to measure but helps us have a strong base that resists injury. Breakout of the mindset that every workout must push you to your limit, always lifting heavier, especially if you don't have adequate stability yet. This is a sure path to injury. Racecar analogy: you want to be the track car. Less horsepower, but more stability. Cross trained and stronger than you look. Flexibility and form over brute strength. Dynamic Neuromuscular Stimulation (DNS) is the theory and approach Peter believes in for training stability. Have to relearn the perfect movements we learned as toddlers before we had injuries and ingrained habits. He discourages his patients from doing any of the lifting mentioned in the strength section without establishing stability first through DNS. To learn more go to rehabps.com or the PRI's website (posturalrestoration.com). Peter does an hour of stability training 2x/wk with 10-15 minutes on other days.

Potential ideal training week given unlimited time and a high level of baseline fitness:

Monday: 45 min zone 2, weight training (1hr45min).

Tuesday: 45 min zone 2, weight training (1hr45min).

Wednesday: VO2 max training (40min)

Thursday: 45 min zone 2, weight training (1hr45min)

Friday: 45 min zone 2, weight training (1hr 45min)

Saturday: Rest day/free training/VO2 max if you can

Sunday: Rest day

Work rucking in for an hour 3-4 times/week, work stability 10-15 minutes on T, Th, F and one hour on W, Sat.

This is obviously a lot and far too much for most people with normal schedules and lives. Start by prioritizing Zone 2 work. Once you feel fit enough to pursue VO2 Max, add VO2 Max sessions. Try to prioritize 30 minutes (or more if you can) of strength training on Zone 2 days.

Feet are also key to stability. Too much time spent in cushy shoes weakens our feet, which naturally dampen pressure absorbed by our knees and hips. [Peter's website](#) has examples of toe yoga exercises to increase toe strength. He and his trainers recommend cutting out weight training for about 6 months while working on gaining stability through the aforementioned exercises and drills.

Sleep: chronic sleep debt is worse than acute sleep debt. Less than 7 hrs/night leads to worsened health outcomes in almost every way. Need to sleep about 7.5-8.5 hrs each night. Getting more or less will cause problems in the long run. Strength decreases on the day after a poor night of sleep. Sleep is a performance enhancing drug. Chronic sleep deprivation gives you "old man blood" with poor lipids, testosterone, etc. Poor sleep also helps tilt us into metabolic dysfunction and insulin resistance relatively quickly (after just three days of poor sleep, maybe as little as one day). Long sleep (11+ hours) is also problematic in the same way. Short sleep leads to us eating worse the next day. Link is most likely stress, which leads to poor sleep, and poor sleep leads to more stress. Less than 6 hours of sleep per night gives 20% increased risk in heart attacks. Chronic poor sleep is a risk factor for Alzheimer's. Deep sleep during our 40s and 60s are especially important for avoiding Alzheimer's. Trazadone is really the only sleep med (50-100 mg or even less) that improves sleep architecture. Other sleep rx may help you fall asleep, but they disrupt the typical pattern of sleep (sleep architecture) seen in patients with healthy sleep cycles. Goal is to find a dose that improves sleep without next-day grogginess. Also has had success with supplements like glycine, ashwagandha and phosphatidylserine.

Tips and strategies for improving sleep: admit we need more sleep. Give yourself permission to sleep. Then assess sleep habits. Perhaps use a sleep tracker unless it stresses you out more. First requirement for good sleep is darkness. Recommends removing light from bedrooms including TVs and electronic devices or at least putting tape over their indicator lights. Digital clocks are especially deadly. You *cannot* look at a clock if you wake up. The light makes it hard to fall asleep and the time can make you start thinking or worrying. Reduce light exposure,

especially from blue lights, 2-3 hours before bed. Watching TV and reading books is less likely to create difficulty with sleep onset than phones or video games (the more active the interaction with the device, the more likely it will lead to sleep difficulties). Try to banish phones and laptops to another room one hour before sleep. Temperature is also important. 65 degree bedroom seems to be optimal. 30 minutes or more of zone 2 exercise can help encourage sleep, especially if it's outside, but try to avoid zone 2 exercise within 2-3 hours before bedtime. 30 minutes of sunlight during the day can help keep our circadian rhythm set for sleep that night. Avoid anything that may activate the sympathetic nervous system (fight or flight response). No emails, news, anything that could get you worried or worked up. Meditation can also help. He likes sauna use in the evening too. Don't eat anything less than 3 hours before bedtime; it's best to go to bed with a little bit of hunger. Avoid anxiety provoking activities 1 hour before bed. Go to bed 8 or 9 hours before you need to wake up. Set your wake up time and don't deviate from it, even on weekends. If you feel you need more sleep on certain days, vary your bedtime rather than wake time.

For emotional regulation, he likes mindfulness meditation and dialectical behavioral therapy. Another strategy he likes is called "opposite action." If you don't like how you're feeling in a situation, try doing the exact opposite. For example, Peter shares an experience where he was very busy on a Sunday and just wanted to be left alone to get work done. He was very stressed and grumpy. He put "opposite action" into practice by jumping in the car with his wife and kids and spending a passive day at the creek. His mood completely changed. Changing behavior can change your mood. Rucking in nature without audio is also very soothing and beneficial.

Big picture regarding longevity: Are you building resume virtues (things you've accomplished) or eulogy virtues (personality characteristics, memories, loving bonds, etc.)? Longevity is worth nothing if we are unhappy. People get old when they stop thinking about the future. If you want to know someone's true age, listen to them speak. If they speak only of the past they are old. If they speak of their goals and dreams and aspirations they are young.

For more info:

[Outlive Book](#)

[Peter Attia's Website](#)

[Peter Attia's Podcast](#) (where he discusses these and other topics in greater detail)

[Peter Attia Subreddit](#) (where people discuss Outlive and Peter's podcast as well as their own implementation of the above)

There are many other helpful resources as well as speakers and thinkers adjacent to Peter's line of work. Many of them can be discovered through his website, podcast, and especially the subreddit. This is not meant to be an exhaustive list, but a starter's guide.

Helpful apps/resources:

I personally like the MacroFactor app for tracking intake. It is premium only, meaning it requires you pay for it, but I think it is the best app out there for nutrition tracking, as do many others online.

I also like the Strava app paired with a wearable fitness tracker (Apple Watch, Garmin, FitBit, etc.) to monitor HR during exercise. If you pay for premium it will also track your "zones" as you exercise, helping you narrow in on zone 2, though how accurate it is with pinpointing your zone 2 is yet to be determined.