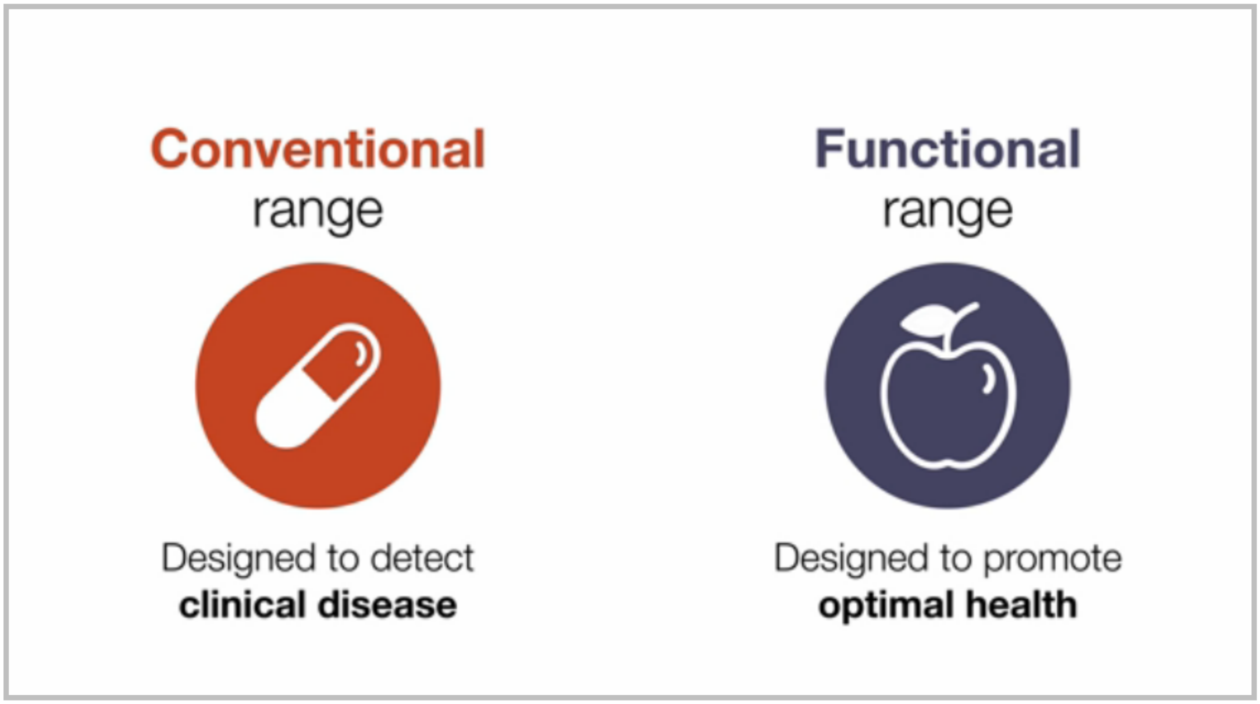
Blood Chemistry Basics - Part 1

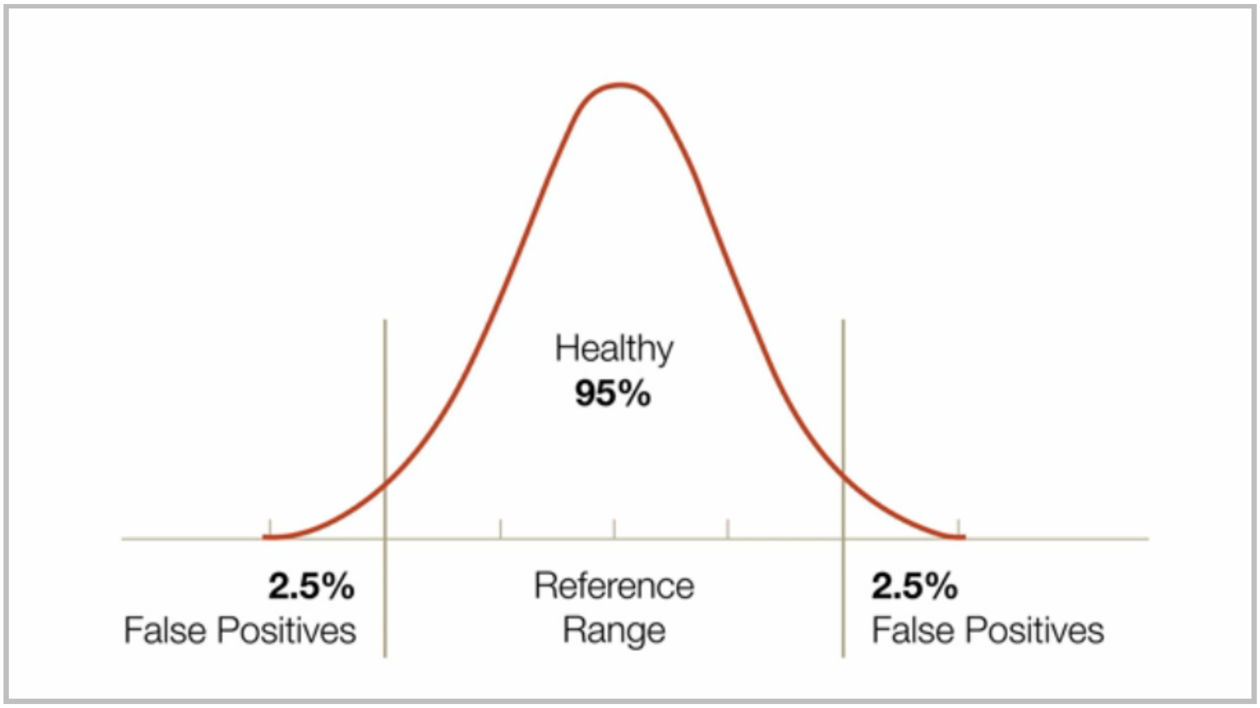
Hey, everybody. In this video, we're going to continue discussing the basics of blood chemistry. In this particular presentation, I'm going to go into detail about functional and conventional lab ranges. As I mentioned in the introductory video, conventional lab ranges are designed to detect disease, whereas functional lab ranges are designed to detect imbalance or pathology that precedes disease. Functional lab ranges are, therefore, crucial for the practice of preventative medicine and health optimization, which is really what we're concerned with as functional medicine practitioners.



So, let me give you a simple but really common example. The lab range for thyroid-stimulating hormone, or TSH, is typically 0.5 to 4.5, but the functional range is 0.5 to 2.5 or even 2, in my case. If the patient has a TSH of 4.0, she would be seen as having normal thyroid function in the conventional model, and nothing would be done. In 10 years, it's likely that in that patient, TSH will continue to rise, and the patient may develop full-blown clinical hypothyroidism. In functional medicine, however, we'd see a TSH of 4.0 as a potential sign that the thyroid is malfunctioning, and we'll talk more about when that may be the case and when it may not be the case when we discuss the thyroid in particular. Then, we would take steps to address that right then rather than just waiting 10 years for clinical hypothyroidism to develop. We might follow up a TSH of 4 with antibody testing and testing of free thyroid hormones to get more information, perhaps even genetic tests or family history, and determine if she has antibody production and Hashimoto's, which we know dramatically increases the risk of her developing clinical hypothyroidism at some point. Then we might address her immune dysregulation, if she does have Hashimoto's, because we know that environmental factors can significantly determine whether a patient progresses from just antibody production alone and being euthyroid to developing full-blown clinical hypothyroidism. This is just one example. There are many others of why the functional range is so important relative to the conventional range.

Another benefit of using functional ranges is that it is far easier to correct imbalances that are detected in the functional range. For example, if a patient only has mildly elevated fasting glucose, it has been shown that it is entirely possible to correct this with just diet and lifestyle changes, but if we wait until a patient has a fasting glucose of 150, it's probable that he has already lost beta cell function, and although dietary and lifestyle changes may be able to reduce that fasting blood sugar and partially reverse that condition, it is possible or perhaps even likely that he may require ongoing supplementation or even medication to keep his blood sugar in the normal range. So, this brings to mind the ancient Chinese proverb, "The wise physician treats disease before it occurs." The earlier that we intervene on that disease spectrum, the easier our job is going to be, and the more effective our treatments will be.

Before we talk about how functional medicine ranges are developed, I first want to talk about how the conventional medicine reference range is typically constructed. This isn't true in all cases, but in many cases, there is simply a bell curve of results from a reference sample of a population.

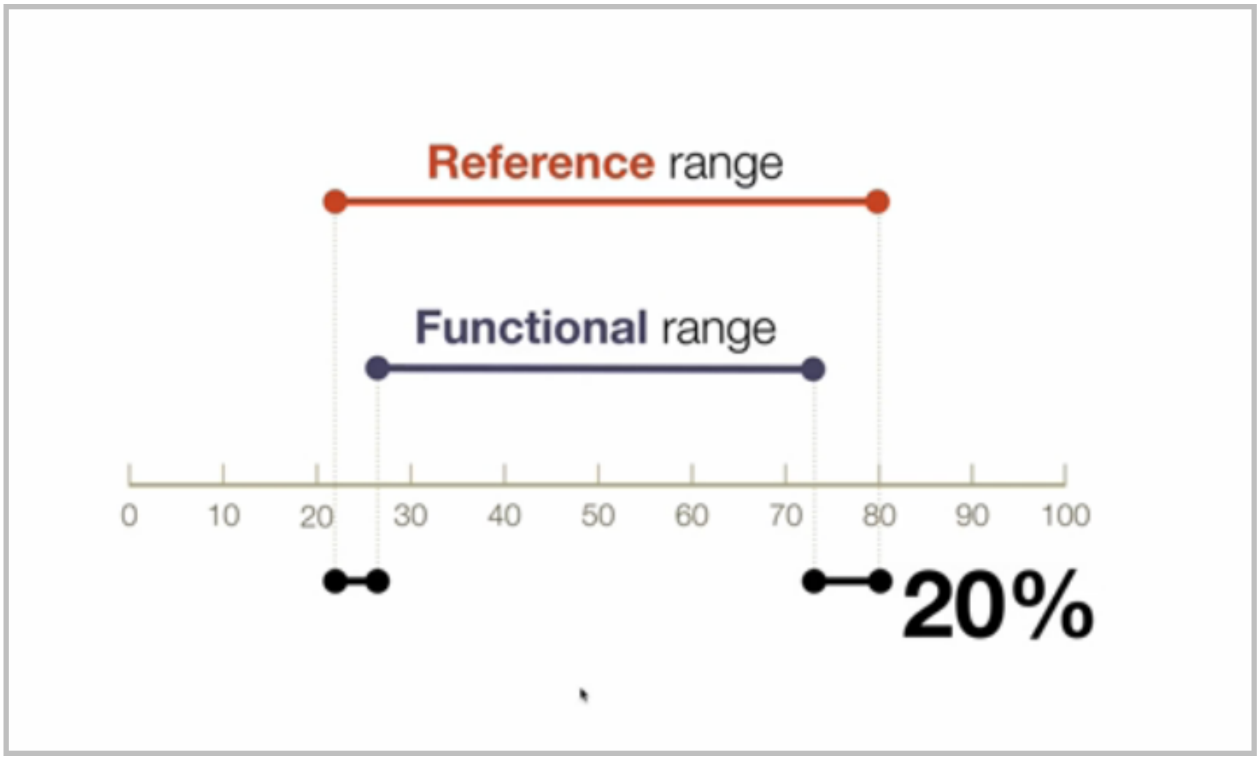


For example, the conventional reference range for serum magnesium was based on a U.S. population sample of 16,000 individuals aged 18 to 74 in the NIH Nurses' Health Study cohort. Now, this resulted in a reference range of 1.6 to 2.5. However, studies have shown that many, if not most, of U.S. adults consume significantly less than the RDA of magnesium, and the RDA itself, as we know, is based on the amount of magnesium needed to avoid acute deficiency, not on the amount that is needed for optimal function. Therefore, it makes no sense to use serum levels of U.S. adults to determine a reference range for magnesium. Not surprisingly, later studies revealed that over 90 percent of people with serum magnesium levels of 1.7, which is still within the laboratory reference range, are actually deficient in tissue body magnesium, whereas only 1 percent of people with levels above 2.2 are deficient. This suggests that the cutoff, the lower end of the range for magnesium, should actually be 2.0 or 2.1 rather than 1.6. Again, we'll talk more about specifics on magnesium in that section of the blood chemistry unit. I'm just using it here as an example of why the conventional reference range is often insufficient.

So that's how the conventional ranges are developed, but how are the functional ranges developed? Well, in some cases, the functional range is determined by organizations that embrace functional or at least preventative medicine. For example, some functional ranges come from groups such as the American Association of Clinical Chemistry, the AACC. The AACC has several divisions, and one of them is a division of preventative medicine, and another is a division of nutrition, so they have contributed some of the functional ranges. In other cases, the functional ranges are established by individual clinicians or groups of researchers based on extensive review of the published scientific literature.

So, let's use the TSH example, the thyroid-stimulating hormone example I gave earlier. The functional range, depending on what study you look at, and there is some controversy here that we're going to talk about later, would be anywhere from 0.5 to 2 or 2.5. Now, remember, the conventional range of 0.5 to 4.5 was developed by testing a large number of people and then taking a bell curve of the results. Those early studies did attempt to exclude people with known hypothyroidism, people with high TSH or low T4 or even people with positive thyroid antibodies, but, unfortunately, there is still a large number of participants with occult or hidden autoimmune thyroid disease in those study populations because we know that about 20 to 30 percent of patients with Hashimoto's don't produce antibodies. The only way you can detect it is by a thyroid ultrasound or aspiration of the thyroid gland. Those populations that the reference range was defined against had a significant number of people who actually had hypothyroidism, so that skewed the reference range upwards.

Most recent studies where they took greater pains to eliminate people who had hypothyroidism and autoimmune hypothyroidism found that the range of TSH for someone with a completely normally functioning thyroid gland is probably 0 to 2. There are also many studies, as we'll find when we talk about thyroid, that show that as TSH climbs above 2, the risk of future hypothyroidism increases significantly. As TSH climbs above 2, you start seeing an increased risk for metabolic and cardiovascular disorders, even when the patient is euthyroid, which means when they have normal T4 and T3.



Finally, in some cases, functional ranges have been created simply by shrinking the conventional range by 20 to 30 percent. This is based on the same principle I just explained with TSH. In many cases, sample populations used to determine lab ranges include a lot of sick people, so in theory, shrinking the range on both sides by 20 to 30 percent makes it more indicative of a value that reflects health than a value that simply identifies disease.

That said, I am definitely less confident in functional ranges that have been determined this way because it's not really evidence based, and it's more of an estimate or an approximation. In some cases, doing it this way may not even make sense given the physiology for that particular marker. So as we go through the blood chemistry unit, I'll try to make it clear where each functional range that we discuss came from, and you'll probably get the idea just by looking at the research that I present as we go through the material for each unit. Of course, you can also ask me in the Q&A if you have questions.