



A PATIENT'S GUIDE TO

Rheumatoid Arthritis Testing & Monitoring

Learn about the tests that track RA disease activity, monitor disease progression, and assess treatment success — so you can be more proactive in your care.

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The information in these patient guidelines should never replace the information and advice from your treating physician. It is meant to inform the discussion that you have with health care professionals, as well as others who play a role in your care and well-being.

INTRODUCTION A NOTE FROM CREAKYJOINTS

If you're reading this, it means that you're seeking more information about how rheumatoid arthritis (RA) is affecting your body, your health, and your future. Thank you for trusting us to help you learn more about RA.

We at CreakyJoints know firsthand how frightening and overwhelming it is to receive a diagnosis of arthritis. Our co-founder has been living with a type of spondyloarthritis for 25 years, and many of our staffers live with rheumatoid arthritis, osteoarthritis, fibromyalgia, and other musculoskeletal diseases. We know from experience that knowledge is power. It gives you the tools to actively engage with your health care provider, which can improve the quality of your care and, ultimately, your health and outcomes.

When you live with a chronic, lifelong inflammatory disease like RA, one of the questions that may come up over and over again is: *How am I doing?* There can be a big difference between how you feel on a daily basis and what's happening to your body behind the scenes. You can't always tell whether you have active inflammation or are at risk of underlying joint damage or other RA-related complications. Ongoing testing — in the form of physical exams, blood tests, imaging tests, and your own self-reported assessments — is such a crucial part of managing RA.

We created this guide to make sure you understand the ins and outs of various tests for RA and how disease activity and progression is monitored.

This Patient's Guide to Rheumatoid Arthritis Testing & Disease Monitoring is the first of its kind. It was written and edited by arthritis experts, reviewed by fellow RA patients, and vetted by clinical rheumatologists to make sure it contains the most up-to-date information and is useful to help you have more informed discussions with your health care providers.

For an in-depth look at rheumatoid arthritis treatment options and other aspects of managing your life with rheumatoid arthritis, download our [Rheumatoid Arthritis Patient Guidelines at creakyjoints.org/patientguidelines](https://creakyjoints.org/patientguidelines).

For ongoing education and support for living better with rheumatoid arthritis, become a member, for free, at [CreakyJoints.org](https://creakyjoints.org).



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PART I WHAT IS RHEUMATOID ARTHRITIS?

Rheumatoid arthritis (RA) is a complex disease that causes inflammation, pain, stiffness, swelling, and warmth in many of your joints. Inflammation from RA can damage your joints over time – and affect other organs and parts of your body – if it isn't well controlled by medication. RA can also affect your overall health, your ability to handle day-to-day activities, and your quality of life. Here are a few important things to know about RA:

- 1. RA is an autoimmune disease.** Rheumatoid arthritis is a disease that's caused by autoimmunity, which is a malfunction in your immune system. Normally, your immune system reacts to any external threats (such as viruses, bacteria, or parasites that could cause disease) by releasing antibodies, white blood cells of various types, and other defense systems. But in an autoimmune disease like RA, your body's immune system is confused for some reason. It attacks your own healthy tissue or organs when there's no reason to.
- 2. RA is a chronic disease.** It's a long-lasting disease, not a short-term condition like an infection. There's no cure for RA at this time, but there are many effective treatments to reduce your symptoms, slow down disease progression, and sometimes prevent further damage. **Disease progression** is a term for how RA's effects on your body, especially your joints, may get worse over time.
- 3. RA is systemic.** This means that RA does not only affect your joints, but may affect other organ systems and parts of your body too. In RA, inflammation usually attacks the synovium, or the tissue lining your joints. You feel pain, stiffness, swelling or warmth in and around your joints. But this inflammation can also have a systemic, or body-wide, effect. It may potentially impact your heart, lungs, eyes, skin, liver, or other organs. Because RA is a systemic disease, it also affects how you feel and function on a daily basis. Many people describe having RA as feeling like they're on the verge of having the flu: fatigue, achy, low-grade fever, and just generally unwell. You may experience severe fatigue at times. If your RA is not well controlled



by medication, chronic inflammation may cause weight loss or anemia. Anemia that develops because of chronic inflammation is referred to as anemia of chronic disease (ACD). RA can also make you more susceptible to infections.

4. **RA puts you at higher risk for other diseases.** Known as comorbidities, these are other health problems that are caused by or related to your RA and high levels of inflammation in the body. Comorbidities associated with RA include cardiovascular disease, lung disease, eye disease, gastrointestinal problems, and osteoporosis. There is also a strong connection between RA and mental health conditions like anxiety and depression.
5. **RA is a type of inflammatory arthritis.** When most people think of arthritis, they think of osteoarthritis, which occurs because of wear and tear on your joints over time. But joint pain, swelling, and stiffness in RA happen because of chronic inflammation. Inflammation is actually your body's way of protecting you from an injury or germs. It is one of your immune system's chief weapons against disease or injury. Inflammation causes pain, swelling, heat, redness on the skin, and loss of some function, because there's increased blood flow in that area.

Acute inflammation is short term and a normal part of your body's healing process, such as when you have a cut or a cold virus. Once the healing is complete, inflammation eases off and goes away.

However, when inflammation is uncontrolled it can lead to diseases such as RA. When you have an autoimmune disease like RA, your body releases inflammation to attack healthy tissues. It doesn't shut off as it normally would. It becomes chronic, or long-lasting. Chronic inflammation, if not treated quickly and controlled with medication, can cause damage to your joints and your internal organs. This damage may be irreversible.

PART II RHEUMATOID ARTHRITIS PROGRESSION: HOW RA AFFECTS YOUR BODY

Rheumatoid arthritis can be a progressive disease. This means that its effects on your body can worsen over time, which is called **disease progression**.

Active RA can inflame and wear down the synovial tissue lining your joints. As a result, parts of your joints can become damaged and, if untreated, break down. The spaces between your joints can become narrower and narrower. Joint space narrowing is associated with greater pain now and more cartilage loss in the future. It can also have a big impact on your physical function — how well you're able to use your joints for ordinary tasks.

Inflammation from active RA can do progressive damage to your cardiovascular system too, which raises your risk of clogged arteries (called atherosclerosis), heart attack, stroke, heart failure, and other serious, life-threatening problems. The same inflammation in RA can progressively damage other organs such as your eyes, threatening your vision; or your lungs, leading to serious respiratory problems.

* — Rheumatoid Arthritis Disease Activity

Treating RA promptly with a goal of reducing inflammation and disease activity is key. You and your doctor should work together to track, manage, and check RA disease progression with regular tests and a comprehensive treatment plan. It is very important to see your rheumatologist every few months to discuss your RA symptoms and how they may be affecting your daily function and to have blood and imaging tests that monitor your disease progression and what's called **disease activity**.

You'll hear that term a lot when we talk about RA: So, what is disease activity, exactly?

Disease activity is a measurement of how active your RA is in your body at any given time, or over periods of time. It includes clinical (signs of disease you can see and feel, such as swollen or tender joints) and laboratory (your test results or "numbers") measurements.

Disease activity can also affect how you feel and function each day. Another way to measure and track RA disease activity is self-reporting. Also called "patient-reported outcomes" or PROs, your assessments of how arthritis affects your daily tasks — including how you rank or define the difficulty of simple activities like getting in and out of your car or buttoning your shirt — are a very important tool for measuring disease activity. Your doctor will give you short questionnaires to gather your impressions and score them to measure these PROs. (See page 18 for more about arthritis PROs.)

Your RA disease activity is generally measured as low, moderate, high, or severe. It can go up and down over time. Periods of higher-than-usual disease activity are called flares. Many factors can influence these shifts: how well your medications are working; other health problems; infections; lifestyle habits like diet, exercise, or smoking; and even extra stress — and who doesn't have stress?



RA Can Cause ‘Silent’ Inflammation

You may not always feel active inflammation. Your inflammation can be higher than optimal – even for a long period of time – without you necessarily noticing any increased pain, loss of joint function, or other symptoms.

Just because you don’t feel any symptoms doesn’t mean that elevated disease activity and inflammation aren’t doing any damage to your body behind the scenes. Increased levels of inflammation – even if you feel fairly well – can do irreversible damage to your joints, heart, and other organs. “Silent” inflammation from RA can put you at risk for a heart attack or other serious health events. Even clinical depression, which is not an “inflammatory” disease, per se, is linked to higher levels of inflammation in your body.

That’s why getting regular blood tests to monitor levels of RA disease activity is so important. Certain blood tests can pick up on inflammation that you might not feel and, in turn, affect how you and your doctor decide to treat your RA.

* ——— Your Goal for RA: Remission or Low Disease Activity

There is currently no cure for RA, but you can achieve a state where your disease is unlikely or less likely to cause further joint damage or other serious health problems. This is known as 1) low disease activity; or 2) remission.

Low disease activity and remission are different from each other, but similar: **Remission** means that there is very low or even no active disease, as measured by blood tests and a physical exam. **Low disease activity** means that your disease activity is low and is keeping your symptoms under control and helping you maintain a good quality of life.

Current RA treatments can help lower inflammation to levels that are considered low or very low, which is when you’re considered to be in remission. Getting your RA disease activity to this level as soon as possible is what you and your rheumatologist will aim for.

Why your goal is low disease activity or remission: Even RA disease activity that’s low to moderate for a year can have a negative impact on your health, physical function, and

well-being. If your disease activity stays above the “low” threshold, you’re at greater risk for joint damage. Over time, joint pain, stiffness, loss of flexibility, and function can turn into disability. That means your ability to function in normal daily activities at work or at home becomes impaired. You may even require joint surgery. High disease activity can put you at greater risk for such complications as heart attack, lung disease, serious infections, and hospitalization.

There’s good news: If your RA disease activity stays low or even lower – at remission levels – your overall health, well-being, and function can be very good. You can have better joint and physical function, less pain, higher quality of life, and be more active and productive.

While you can still have pain or other symptoms when your disease activity is low – this can vary a lot from person to person with RA – it’s a great state to be in. Low disease activity means that your treatments are working well to keep inflammation from RA in check. If your disease activity is low and stays low, your risk of heart disease or other serious health problems related to inflammation is lower, as is your risk of damage to your joints.

* — Rheumatoid Arthritis Remission: What Is It?

Remission is a state of very low or even no levels of RA disease activity. Being in remission doesn't mean your RA is cured. Remission doesn't necessarily mean that you'll be able to stop taking medications or going to the rheumatologist for appointments or tests. But remission does mean that your disease's progression and potential joint damage can come to a virtual halt. This is often called "tight control" of your disease activity.

Remission can greatly reduce symptoms, prevent disability, and restore your quality of life. You may be able to gradually reduce your medication dosage, which is called "tapering" your dose.

* — How Is Low Disease Activity or Remission Measured?

Doctors may each use slightly different tools to measure your disease activity, but overall they determine your status with a combination of blood tests to look for inflammation, a physical exam to look at how swollen or tender your joints are, and their and your assessment of how you're generally feeling and functioning.

In 2011, the American College of Rheumatology (ACR) and the European League Against Rheumatism (EULAR), two of the world's largest associations of rheumatologists and rheumatology professionals, released an official definition of RA remission:

Joint count: Based on a physical examination of 28 key joints around your body, you have a swollen joint count of 1 or less and a tender joint count of 1 or less;

Blood test results: Your C-reactive protein (CRP) levels are 1 mg/dL or less; and

Questionnaire results: Your score on a questionnaire that measures aspects of your disease experience, the Patient Global Assessment of Disease Activity, is 1 or less.

Another test, the **Simplified Disease Activity Index (SDAI)**, is a comprehensive measurement of RA disease activity. If your score on SDAI is 3.3 or lower, your RA is considered to be in remission.

Is the current definition of remission as accurate or comprehensive as it could be? This is an ongoing area of study among RA doctors and researchers. You can have active synovitis, or inflammation of your synovium, even if your joint is not swollen, painful, or tender to the touch. In addition to CRP, there are many **biomarkers** of RA disease activity that could send a signal that your inflammation is increased. (A biomarker is a measurable substance, such as a molecule in your blood, other body fluids, or tissues, that is a sign of a normal or abnormal process, or of a condition or disease.) In the future, the definition of RA remission may expand or change to reflect these tests too.





Use ArthritisPower to Track Your Arthritis Symptoms

Created by CreakyJoints, ArthritisPower is a free patient-centered research registry and desktop/mobile application created by arthritis patients for arthritis patients. You can use ArthritisPower as often as you want to track what doctors and researchers called patient-reported outcomes, or PROs. These are short surveys that ask you questions about how your RA is affecting your quality of life and translate them in ways that can be used by your doctor. Symptoms like pain and fatigue might not always show up on a blood test – you can have low levels of inflammation but still experience pain or fatigue – so it's critical that doctors also hear from you about how you're doing and feeling.

You can use ArthritisPower to track symptoms like pain and fatigue and log your medications to track side effects and impact on disease activity.

ArthritisPower is also a research registry, which means you can participate in voluntary studies about arthritis. This helps researchers better understand patients' experiences with arthritis, which may lead to better treatment in the future.

Learn more and join at arthritispower.org.

As new research studies in RA treatment, management, and monitoring emerge, the definition of low disease activity and remission will be refined. Rheumatologists will adjust their recommended treatment approaches to reach that “target” of remission and stay there – so you protect your joints, prevent joint damage and other serious health problems, feel better, and have a good quality of life.

* ——— Treat to Target (T2T or TTT): What Is It?

Remission or low disease activity are the ideal “targets” for your RA treatment plan. You and your rheumatologist will craft your treatment plan to help you reach this target.

Many rheumatologists follow a detailed strategy called “**treat to target**,” which is a comprehensive treatment approach that includes RA medications and recommendations on when to increase dosage or switch medications if you don't reach your target.

Many doctors want patients to achieve a target of remission, or the absence of signs and symptoms of inflammatory disease activity in your joints and your blood test results. In people who've had RA for many years, remission may be a difficult target to reach, so in those cases, low disease activity is a more realistic target.

Treat to target is sometimes called “T2T” or “TTT.” It's a concept that rheumatologists generally follow in the current treatment and management of RA that's based on measurable goals or targets. Your progress or status is monitored with a variety of tests and tools:

- ▶ Blood tests for signs of inflammation and disease activity
- ▶ Physical examination of your joints
- ▶ Imaging tests or scans that look for any signs of joint damage or narrowing
- ▶ Patient-reported outcomes (PROs) that you provide based on your own observations of your daily experiences and function

Why should you and your rheumatologist follow a treat-to-target strategy? Many studies show that following a treat-to-target plan can help you achieve these goals:

- ▶ Reduce disease activity
- ▶ Improve disease progression measured on your X-rays and other imaging scans (a term called **radiographic progression**)
- ▶ Improve physical function and quality of life

Treat to target doesn't have a universal list of prescription medications and dosages for every patient. There are many medications approved to treat RA disease activity, control inflammation, and reduce symptoms. Your rheumatologist will work with you to create a treatment plan that is personalized for your needs. It should take into account such factors as:

- ▶ Potential side effects of various medications
- ▶ How different drugs are administered (pills vs. injections vs. infusions)
- ▶ Which medications are covered by your insurance plan
- ▶ Medication cost
- ▶ Your unique disease and health characteristics, including any comorbidities that you have

While the measurable clinical "target" or goal for treating your RA is to achieve remission, other goals are just as important:

- ▶ Achieve long-term quality of life
- ▶ Control your RA symptoms
- ▶ Prevent structural joint damage
- ▶ Achieve good physical function so you can enjoy life, work, or stay active

Your treat-to-target plan will aim to stop your RA inflammation and keep it in check with medications. Based on regular blood tests, physical exams, imaging, and conversations with your rheumatologist about your symptoms and quality of life, your plan may be adjusted as needed. In order to reach your disease activity target, they may suggest you:



Understanding Shared Decision Making

One of the essential components of the treat-to-target approach is that you and your rheumatologist make decisions about your care as a team, which is known as shared decision making. Your values and preferences matter a great deal. Your rheumatologist should clearly and carefully review and discuss your personal treatment targets and recommendations, including the effects, mechanisms, and potential side effects of any medications. If you have any questions or concerns, or anything seems unclear, speak up! Never feel that any question is too minor. If you don't understand any aspect of your treatment or feel that you may have missed something that your rheumatologist already discussed, ask them to go over it again.

- ▶ Change the dosage of medication
- ▶ Switch to another medication or a combination of medications

If your medication causes side effects that are bothersome or that you cannot tolerate, you and your doctor can discuss options like switching to a different medication, lowering the dosage, or adding other treatments to alleviate the side effects.

What's in a treatment plan? A comprehensive treatment plan for RA includes not only disease-modifying medications that target disease activity and inflammation, but could also include:

- ▶ An exercise plan to build strength, flexibility, and cardiovascular health
- ▶ Physical therapy or occupational therapy
- ▶ Techniques to manage your stress
- ▶ Lifestyle modifications to manage joint pain, stiffness, muscle aches, or fatigue
- ▶ Recommendations for a healthy diet and lifestyle





Inflammation vs. Pain: What's the Difference?

Does pain always mean you have inflammation? Does inflammation always cause pain? These are actually two different things that may overlap in people who have RA.

Inflammation is a mechanism that naturally occurs in your body's immune system as a response to infection or injury. Inflammation isn't always a bad thing. Acute inflammation can help your body fight off a virus or alert you to a new wound. Inflammation may cause pain, swelling, redness, and heat as part of the healing process. In an autoimmune disease like RA, inflammation is chronic. It doesn't shut off. Inflammation in an autoimmune disease attacks your healthy tissues by mistake. It can cause damage, as well as ongoing pain, swelling and heat, and all-over symptoms like fatigue.

You can have inflammation even when you don't feel any pain or notice other symptoms. Inflammation can persist at low levels and do silent damage to your joints and internal organs, like your blood vessels or eyes. That's why you need to be sure your RA treatments are controlling your inflammation even if you don't feel any arthritis pain.

Pain is a symptom. You know when you're in pain — you hurt, ache, throb, or burn in the affected area. Pain may be a sign of inflammation and active disease in RA. Your joints can hurt very badly, and they may also feel stiff, look swollen, and feel hot to the touch. Pain in RA can become chronic (or long-lasting), and something that you deal with every single day. In some situations, you may have unusually strong pain because you're having an RA flare, or a period of higher disease activity.

However, pain doesn't always mean you have inflammation or high disease activity. You can feel pain if you've overused your joint or injured it. You can feel pain from other conditions that don't involve inflammation, like fibromyalgia or osteoarthritis. Pain around your joints can be caused by injuries to your soft tissues, such as muscles, tendons, ligaments, or bursae.

It's important to protect your joints if you have RA. Move and use your joints in a way that reduces the chance of a painful injury. If you're not sure how to protect your joints when you're doing your daily activities, ask your rheumatologist, or consult a physical therapist or occupational therapist. If you have pain that's unusual or doesn't go away, let your rheumatologist know. You may need to have an exam and take some blood tests or imaging to diagnose the cause of your pain. Your doctor may prescribe a short-term dose of medication to feel better.

Your rheumatologist or therapist can also suggest at-home remedies for occasional joint pain:

- Wrapping your sore joint in a warm, moist towel
- Icing a mildly swollen joint with a bag of frozen corn or peas
- Rubbing a topical capsaicin cream on the painful area
- Using a splint or supportive device to help the joint in pain

PART III RHEUMATOID ARTHRITIS TESTING



How do you measure and monitor RA? You and your rheumatologist have a variety of tools, both simple and sophisticated, to measure your inflammatory disease activity, monitor your disease progression, and track the success of your treatment plan at each appointment.

In between office visits, you can also keep track of your RA symptoms, medication side effects, your physical function, and general well-being in a

journal, or learn more about how our ArthritisPower app can help on page 8.

Until you reach your disease activity target, your rheumatologist may adjust your therapy as often as once every three months. That doesn't necessarily mean you'll switch to new medications. You may only need to adjust the dose you take to reach your target, or in some cases, add a medication.

If you reach remission and maintain it, you may be able to see your rheumatologist less often. Some people with RA who are in remission may only need an annual office visit for tests to measure disease activity, a physical exam, and a conversation about how you're doing.

* — Tests to Measure Disease Activity and Monitor Disease Progression

Here are some of the tools your rheumatologist can use to monitor your RA disease activity and assess how your therapy is working for you:

1. Physical Examination and Health Check

RA often causes swollen and tender (or painful) joints, especially on both sides of your body, or symmetrical swelling. Early on, you may have swollen joints just on one side. RA can cause other physical signs and symptoms that may be signs of disease activity, so your rheumatologist will perform a physical and joint exam at your regular office visits. Your physical exam will likely include a count of 28 different joints all over your body, tallying how each joint is swollen, tender, painful, or difficult for you to use.

Your joint examination will look for signs of inflammation or disease progression. Your doctor will

carefully touch, apply pressure to and articulate (gently bend and move), joints such as these:

- ▶ **Hands**, including the metacarpophalangeal (MCP) joints at the bases of your fingers and the proximal interphalangeal (PIP) joints in the middle of your fingers, and your grip strength in your hands, as this can be adversely effected by active disease in RA.
- ▶ **Cervical spine**, the joints in the uppermost part of your spine (your neck). Disease activity in RA can cause pain and stiffness in your neck.
- ▶ **Upper limb joints** like your wrists, elbows, and shoulders. Your doctor may test these joints to see if they've lost their range of motion or developed hard bumps called rheumatoid nodules.
- ▶ **Lower limb joints** like the metatarsophalangeal (MTP) joints in your feet, your ankles, knees, and hips. Your doctor may check for heel or toe pain. Later in RA, you may develop visible changes in your feet like claw toes or bunions that can cause pain or problems with your gait.

Your joint examination includes assessment of these key signs of active disease:

Function: Your rheumatologist will assess each joint's function, including how you move the joint through its range of motion. They may also gently bend and move your joints and then measure the range of motion using a tool called a goniometer.

Tenderness and Swelling: Your rheumatologist will palpate (or touch) your joints to look for any tenderness, swelling, or warmth on the skin that may indicate inflammation. Swollen joints may be caused by build-up of fluid or thickening of your synovium. Your doctor can check for swelling in your joints by just touching them with slight pressure or, for larger joints like your knees, measuring the joint. They will count how many joints in total have any swelling or tenderness.

Joint Pain: They will ask you about any joint pain you experience when you use each joint. Your doctor may apply slight pressure to your joints to see if this causes any pain. They may also ask you to move your joints and describe your pain, or even rate it on a standardized pain scale.

You will also be asked to fill out questionnaires that provide more details and your observations about your day-to-day symptoms or health status. These Q&A tests provide what are called "patient-reported outcomes," or PROs. There are several different questionnaires designed to help patients with RA provide information about various symptoms of their disease. We'll go over these in more detail later.

Your exam may begin with a general health check:

- ▶ Blood pressure
- ▶ Weight
- ▶ Pulse
- ▶ Heart and lung function

2. Blood Tests

Blood tests are a very important part of monitoring RA. Your clinic visits will include blood tests to measure signs of disease activity in your body. The presence of certain autoantibodies, inflammatory proteins, or enzymes can indicate active disease.

* — Tests for Signs of Inflammation

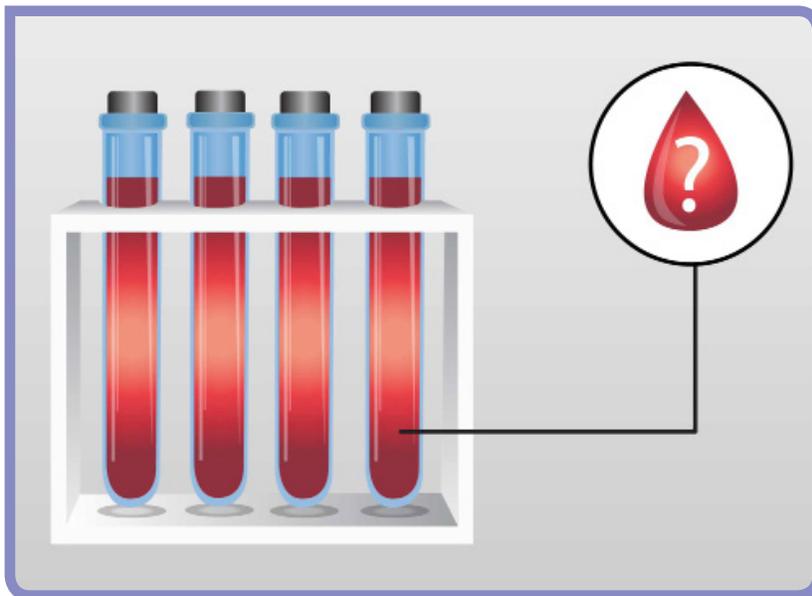
Erythrocyte-sedimentation rate (ESR): Also called your “sed rate,” ESR tests how quickly red blood cells fall through whole blood samples in a tube. It’s a way to indirectly measure your inflammation. An ESR result of 100 mm/hour or higher indicates active disease. Normal ESR results are 0-15 mm/hour in men under 50, 0-20 mm/hour in women under 50 or men older than 50, and 0-30 mm/hour in women older than 50.

C-reactive protein (CRP): CRP is a protein that is part of your immune system and its response to disease or external threats. CRP levels can be high if you have active inflammation. Normal CRP levels for adults are under 10 mg/L, and a higher result may indicate inflammation is present.

Something to remember: Both CRP and ESR results may be high for reasons other than elevated RA disease activity. These are widely used tests for a variety of health conditions. They are not specific markers. You can have a high result if you have an active, short-term infection, or if you have other conditions that cause either acute or chronic inflammation, like an injury or inflammatory bowel disease (IBD).

These are the standard tests included in the Disease Activity Scale-28 (DAS-28) test, a composite measurement of disease activity that includes either the ESR or CRP plus a count of your tender and swollen counts.

* — Tests that Measure Antibodies and Help Diagnose RA



Rheumatoid factor (RF): This is an autoantibody present in up to 80 percent of people with RA. It is linked to chronic inflammation and is typically used to help diagnose RA. Normal or “negative” RF levels are less than 60 U/ml (units per milliliter), and any result higher than that may be considered “positive.” Older adults may have a higher threshold for normal levels of rheumatoid factor.

Anti-cyclic citrullinated peptide (anti-CCP): These are antibodies

your body makes as an immune system **reaction** to an amino acid called citrulline, which is a byproduct of joint damage in RA. A normal anti-CCP result is less than 20 U/ml, and any result above that is “positive.” The higher the levels of anti-CCP in your blood, the more likely it is that you have RA inflammation. Anti-CCP may be more useful as a very specific way to diagnose RA, but not as useful for monitoring your ongoing disease activity. These antibodies may not tell us enough about how your RA disease activity goes up and down over time.

The majority of RA patients have high levels of RF and/or anti-CCP. This is known as having **seropositive rheumatoid arthritis**. But it is possible to have rheumatoid arthritis without having high levels of rheumatoid factor or anti-CCP. This is known as having **seronegative rheumatoid arthritis**.

* — Tests That Measure General Health

Complete blood count (CBC): Your rheumatologist may give you a complete blood count, a very common and comprehensive blood screening that’s used to detect infection or other health problems, not specifically inflammatory disease activity. Results that are too high or too low may indicate health problems related to your RA or therapy, such as anemia.

CBC includes these tests. Anything outside the normal ranges in parentheses may indicate a health problem.

- ▶ Red blood cell count (4.35 to 5.65 trillion cells/L for males, 3.92 to 5.13 trillion cells/L for females)
- ▶ White blood cell count (3.4 to 9.6 billion cells/L)
- ▶ Hematocrit (38.3 to 48.6% for males, 35.5 to 44.9% for females)
- ▶ Hemoglobin (13.2 to 16.6 grams/dL for males, 11.6 to 15 grams/dL for females)
- ▶ Platelets (135 to 317 billion/L for males, 157 to 371 billion/L for females)

Metabolic panel: This test can measure liver and kidney function. RA medications pass through your liver and kidneys after you take them, so these tests can spot any problems that could indicate that you need to change your medication dosage or take a temporary break from your treatment regimen (but always guided by your doctor). A metabolic panel includes measurements of sodium, creatinine, potassium chloride and glucose (sugar) levels, and two liver enzymes: alanine aminotransferase (AST) and aspartate aminotransferase (ALT). Normal levels of AST are usually 40 units per liter (U/L) and normal levels of ALT are usually 50 U/L.

Keep in mind that you should not try to make conclusions about your health after looking at your bloodwork results. Your doctor is the best person to help you understand what these numbers mean in the context of your overall health.



When Vectra Results Seem Confusing

High Inflammation, Few Symptoms

Inflammation doesn't necessarily correlate with pain or other RA symptoms. You could have moderate or high levels of underlying inflammation without corresponding pain. High inflammation can also increase your risk for other health problems related to RA, such as cardiovascular disease. In this scenario, your doctor may recommend a change in your treatment to get your inflammation under control.

Low Inflammation, Lingering Symptoms

On the other hand, just because your Vectra score says you have low disease activity doesn't mean you may not be experiencing joint pain or stiffness, or other symptoms like fatigue. Your symptoms may be caused by reasons other than RA disease activity, active inflammation, or ineffective therapy.

For example, many people with RA may also have osteoarthritis (OA), which can cause pain and stiffness in your joints and loss of mobility, but isn't caused by an autoimmune response. A very high percentage of people (with or without RA) develop OA as they age or after a joint injury – in fact, tens of millions of Americans develop OA at some point in their lives. Other very common conditions that can cause joint pain but don't involve autoimmune inflammation include fibromyalgia, low back pain, bursitis, tendinitis, and joint injuries. Many conditions can cause fatigue as well, including anemia and diabetes. You may have fatigue when you do too much physical activity or in times of great stress.

If you're confused because your test results say your disease activity is low, but you have joint pain, stiffness, fatigue or other symptoms, talk to your doctor. They may be able to diagnose the reason for your symptoms and prescribe treatment or determine if your symptoms are related to your RA despite your test results.

* ——— Test That Measures RA Disease Activity and Predicts Future Joint Damage

Vectra Score: This is a newer, more comprehensive, blood test that measures inflammation caused by your rheumatoid arthritis (RA), predicts your risk of future joint damage (radiographic progression), and helps monitor disease activity and treatment. While blood tests like ESR and CRP provide a single measure of inflammation, Vectra measures 12 different aspects of your blood – called biomarkers – that each play a different role in RA disease activity and inflammation. The Vectra test also takes into account your age, adiposity (body fat composition) and sex, so it's highly personalized.

This combination of data can more accurately assess underlying inflammation – and predict the risk of future damage – than any single test.

You can track changes in your Vectra Score over months or years. Vectra can help assess how you are responding to your current therapy.

A Vectra Score ranges from 1–100:

- ▶ 1–29: Low Disease Activity
- ▶ 30–44: Moderate Disease Activity
- ▶ 45–100: High Disease Activity

The Vectra score is a good way to assess how much underlying inflammation is happening in your body, even if you're not aware of it. People with high disease activity are at a greater risk of having radiographic damage to their joints. Your doctor can use your Vectra score to adjust and optimize your treatment plan to endure your inflammation levels are in a low, healthy range.

3. Imaging Tests

Imaging scans allow your rheumatologist to see what's going on inside your joints. There are different imaging tools and technologies used to assess RA. They each have their pros and cons, including accuracy, utility, and cost (although that can vary a lot depending on what your insurance will cover).

Your rheumatologist may perform or prescribe imaging tests to assess whether there are signs of joint damage. Imaging can be an important tool to help you and your rheumatologist monitor how well your therapy is working to prevent joint damage, along with blood tests, physical exams, and other measurements.

X-rays: The oldest form of imaging, X-rays (also called radiographs), use mild radiation to take a photo of your joints. X-rays can be used to look for signs of disease progression (or “**radiographic progression**”) like joint space narrowing from cartilage destruction, loss of mineralization in the bones around your joints (osteopenia) or joint malalignment. X-rays are widely available, relatively cheap, and quick.

But X-rays don't tell the whole story. They are not a great tool to use in early RA because they cannot show the subtle signs of early synovitis (or swelling in the synovial fluid around a joint) that may be a sign of active disease. These early signs of synovial inflammation can be a red flag to intervene and prevent joint damage. X-rays are a good tool for assessing joint damage in RA that has already occurred. X-rays can show how much your inflammation has already damaged your joints, and help you and your doctor keep track of worsening damage. The type of joint damage seen on X-rays is often irreversible, though.

Ultrasound: Also called sonography, ultrasound uses high-frequency sound waves to create a visual image of the soft tissues in and around your joints. It is being more widely used in rheumatology clinics because it is less invasive than other scans and doesn't use any radiation. It is also comparatively cheap and simple to perform, and you get your results immediately. An ultrasound is performed with a handheld instrument called a transducer that's moved around the surface of your skin in the area that's being examined. A cool gel is spread over your skin to help the transducer slide around. The images are viewed on a screen and can be downloaded.

Ultrasounds take detailed images of any changes or swelling in the soft tissues around your joints, as well as muscle, bursae, and tendons. Ultrasounds can also guide your doctor or nurse when they're giving you an intra-articular injection of corticosteroid medication. An ultrasound is a good tool to spot early joint erosion in RA and to show early joint inflammation. Your doctor may use ultrasounds to help diagnose your disease. Ultrasounds are also becoming more widely used to help monitor RA progression over time, because they can help track joint deterioration.

Magnetic resonance imaging (MRI): MRI uses a strong magnetic device to scan your body and create a very detailed image of your internal joint structures and organs. You lie very still on a table that is moved into a tube where the MRI image is taken. You hear loud bangs while magnetic pulses take the image, which can be disturbing to some people. MRI can detect small bone and soft tissue changes that may indicate disease progression. MRI images can show slight abnormalities in the cartilage, tendons, and nerves in and around your joints, not just the bone.

MRI has its disadvantages as a monitoring tool. It can be much more expensive than X-rays or ultrasounds, although what you pay out of pocket may vary a lot depending on where you live and what your insurance policy covers. One MRI scan could cost a few hundred dollars in one center and thousands of dollars in another center. Be sure to ask up front about cost and if you have any choice about where to have your MRI done. MRIs are most useful at showing early, subtler signs of inflammation and destruction of bone that may not be permanent yet, enabling you to change your treatment to prevent irreversible damage.

Computed tomography (CT): CT is a more sophisticated imaging tool that uses a very thin X-ray beam to create multiple digital images or “slices.” It’s also called a CAT scan. CT can image in much more detail than X-ray, and may be used to detect bone, soft tissue, or blood vessel changes in and around your joints, even very small abnormalities. Sometimes a liquid substance is injected into your bloodstream to enable contrast on the images and create very detailed views. CT scans can be used to accurately assess disease progression and how your RA may be damaging joints and organs. CT scans use radiation, and having more than two CT scans in one year exposes you to more radiation than doctors recommend. In addition, the contrast dye that may be used in some scanning technologies can cause some people to have a reaction. The cost of CT scans is also high, though your insurance may cover a great deal of this cost. Your cost depends on your insurance plan, so ask up front about any potential out-of-pocket costs you may incur to get a CT scan. CT scans that use a contrast agent are a valuable tool to assess your joints for problems that may be caused by active RA, like synovitis and tenosynovitis, or inflamed, swollen tendons around the joint. It may be used instead of MRI in some cases, because it takes such a detailed image.

4. Composite Disease Activity Measures and Patient-Reported Outcomes (PROs)

Several composite screenings used to measure RA disease activity have been recommended for use in the doctor’s office by the American College of Rheumatology (ACR), the largest professional association of rheumatologists. Composite means that these measures include multiple types of tests: not only blood tests and joint examination results, but also your own assessment of your health, pain and other symptoms, your ability to do daily activities, and other patient-reported outcomes, or PROs. That term describes the outcomes of living with RA, assessed and reported by you.

PROs are valuable part of assessing your RA disease activity, because they reflect your lived experience with RA. PROs provide a standardized way to communicate your individual experience of living with RA and the impact of the disease on your body and quality of life. They’re an integral element in patient-centered care and management of RA, because they include your experiences, feelings, and perceptions of your disease. However, PROs are not subjective. They were developed by the National Institutes of Health (NIH) to find measures that could be used to communicate the unique experience of each patient in a way that can be used by physicians and researchers.

As you live with RA on a day-to-day, year-to-year basis, your perceptions of “how you’re doing,” or how you rate or measure your pain or fatigue, can shift. You may develop coping mechanisms to live with joint stiffness every morning or after feeling wiped out from cleaning your house.

PROs are an important component of your monitoring, along with blood tests, physical exams, or imaging. One person with RA may perceive pain, fatigue, or loss of function when performing a task (like opening a jar) very differently from another person with RA. Many factors may affect how you view the ways RA has changed your life, including your lifestyle, career, level of physical activity, and social support network.

PROs are an essential component of shared decision making in RA management and disease activity monitoring. They can complement your blood tests, imaging results, physical exam, and your doctor's assessments of how you're doing to help you and your rheumatologist monitor the success of your treatment plan and your disease activity between office visits.

PROs are based on questionnaires that you fill out at your rheumatologist's office, via email or online via a secure portal. They usually only take a few minutes to complete. Answer as honestly and openly as you can. Some questions may seem repetitive, but they are not. Each question serves a specific purpose. If you don't understand any questions or don't know exactly how to answer them, speak up – your rheumatologist, rheumatology nurses, physician assistants, nurse practitioners, and other health care professionals are there to help. Candor and specificity will make your results more meaningful.

Here are the currently recommended composite measures of RA disease activity that incorporate PRO questionnaires, and what your results mean:

1. Patient Activity Scale (PAS): There are two versions of the Patient Activity Scale measurement: PAS I (or simply PAS) and PAS II.

PAS includes:

- ▶ **Health Assessment Questionnaire Disability Index test (HAQ-DI):** This includes a variety of questions to measure your difficulty with daily tasks like getting dressed, grooming and showering, rising up from a chair, getting in and out of bed, cutting meat, lifting a glass and drinking from it, opening a milk carton, walking on flat ground, climbing steps, driving, shopping, vacuuming your house or grasping household items. It adds up to a composite score of 0–3.
- ▶ **Pain Visual Analog Scale test (VAS):** This asks you to rate your pain on a scale from 0–10, where 10 is the worst pain you can imagine.
- ▶ **Patient Global Assessment of Disease Activity Visual Analogue Scale (Pt Global VAS):** This asks you to rate how well you've been doing in the last week living with your disease overall on scale from 0–10, where 10 is the worst.

PAS II is a more concise test with fewer questions that's quicker to complete, but still has the same level of accuracy.

What your results mean: PAS and PAS II both generate a final score of 0–10 to measure your disease activity:

- ▶ Remission: 0.00–0.25

- ▶ Low/Minimal: 0.26–3.70
- ▶ Moderate: 3.71 to <8.0
- ▶ High: 8.00–10.00

2. RAPID-3: The Routine Assessment of Patient Index Data-3 test, or RAPID-3, pools together three measurements of function, pain, and your assessment of your overall well-being with RA. RAPID-3 is a very short questionnaire, and your score can be calculated in a few seconds.

The RAPID-3 questions ask you to assess your level of difficulty (no difficulty, with some difficulty, with much difficulty, or unable to do at all) with activities like dressing, getting in and out of bed, washing and drying your body, lifting a glass to your mouth, walking, turning faucets on and off, or bending down to pick up something off the floor.

It asks you to assess your levels of depression and anxiety, your ability to sleep well or participate in social activities, and to rate your levels of pain and well-being on a scale of 0–10.

What your results mean: Based on your answers, you get a composite RAPID-3 measurement of your disease activity from 0–10:

- ▶ Remission: 0–1.0
- ▶ Low/Minimal: >1.0–2.0
- ▶ Moderate: >2.0–4.0
- ▶ High: >4.0–10

3. CDAI: The Clinical Disease Activity Index (CDAI) is a composite measure of your RA disease activity that combines input from you and your rheumatologist based on your physical exam. It includes tenderness and swelling seen in 28 of your joints: both shoulders, elbows, wrists, your five MCP joints in your hands, your five PIP joints in your hands, and knees. It adds in your Patient Global Assessment of Disease Activity, a rating of how well you're doing overall living with RA on a scale of 0–10, with 10 meaning very poor. The final element is the Provider Global Assessment of Disease Activity, or your rheumatologist's rating on the same scale (0–10).

What your results mean: Based on your and your doctor's input, the CDAI measures your disease activity on a scale of 0–76:

- ▶ Remission: ≤2.8
- ▶ Low/Minimal: >2.8–10.0
- ▶ Moderate: >10.0–22.0
- ▶ High: >22.0

4. DAS28 (with either CRP or ESR tests): The Disease Activity Scale-28 or DAS28 is a

measurement of RA disease activity that includes a tender and swollen joint count of those same 28 joints included in the CDAI, plus either your ESR blood test results or your CRP blood test results, and your Patient Global Health Assessment, a questionnaire that measures your perception of your overall health on scale of 0-100, where 100 is the worst.

What your results mean: Based on your and your doctor's input, DAS28 measures your disease activity on a scale of 0.0-9.4:

- ▶ Remission: <2.6
- ▶ Low/Minimal: ≥ 2.6 -<3.2
- ▶ Moderate: ≥ 3.2 - ≤ 5.1
- ▶ High: >5.1

5. SDAI: The Simple Disease Activity Index (SDAI) test is a composite of your 28-joint tender and swollen joint count, your CRP blood test results, your Patient Global Assessment of Disease Activity results measured on a scale of 0-10, and your Provider's Global Assessment of Disease Activity on a scale of 0-10.

What your results mean: Based on your and your doctor's input, your SDAI results measure your disease activity on a scale of 0-86:

- ▶ Remission: ≤ 3.3
- ▶ Low/Minimal: ≥ 3.3 - ≤ 11.0
- ▶ Moderate: >11.0- ≤ 26
- ▶ High: >26



Diagnostic vs. Prognostic vs. Predictive Tests: What's the Difference?

Many tests are used to diagnose and manage rheumatoid arthritis: blood tests, joint counts, imaging tests, patient-reported outcomes questionnaires. They all serve a different function in your treatment. Test results can give you and your rheumatologist a snapshot of how you're doing now, but some tests can also give some indication of how your disease may progress in the future.

Diagnostic tests: These are used mainly for diagnosing a disease. There's no single test used to diagnose RA; multiple diagnostic tests are used together to pinpoint RA as the cause of your symptoms. The diagnosis of RA isn't always a quick, simple screening process. Many diseases and conditions can cause similar symptoms, especially early on. And not every person with RA tests positive for all biomarkers.

Blood tests like **anti-CCP** and **rheumatoid factor** are considered diagnostic tests, although a percentage of people with RA are "seronegative," which means that they test negative for these two biomarkers. **CRP** and **ESR** blood tests are also used to help diagnose RA, but they can be elevated in other diseases too. Other blood tests, such as **ANA**, which detects anti-nuclear antibodies, can help your doctor rule out other causes for your inflammation, like lupus (which almost always causes you to test positive for ANA) or Sjögren's syndrome.

Diagnostic tests for RA don't always involve blood tests: Tender and swollen joint counts are another way that your rheumatologist confirms an RA diagnosis. Imaging tests like X-ray, MRI, or ultrasound can be used to detect swelling or deterioration in your joints that help confirm an RA diagnosis.

Prognostic Tests: Some tests can help you get a clearer picture of your likely long-term prognosis — or how well you will do — with RA. Blood tests for the anti-CCP antibody, rheumatoid factor, and antibodies to an immune system protein called IL-1a, are just a few that can show if you're more likely to have severe disease and worse outcomes, like irreversible joint damage. This information can help you and your rheumatologist make treatment decisions and select more aggressive therapies early on to control your inflammation. Imaging tests can also be prognostic. Early in RA, if your imaging shows that you already have joint damage, such as bone swelling on an MRI, it's a sign that you may have more aggressive disease and are at higher risk for joint damage.

Predictive Tests: Some tests can be predictive of your future outcomes with RA. Vectra is a blood test that combines 12 different biomarkers into one score. Studies show that it can be an effective predictive screening to show if you're likely to have radiographic disease progression (joint damage that can be seen on X-rays) on your current treatment plan. A high Vectra score (a result of 45 or higher) means that you're more likely to experience radiographic progression in the coming year. If your Vectra Score test predicts that your disease is more likely to progress, then you and your rheumatologist can discuss changes to your therapy that may prevent this.

If you have any questions about the tests you're given at your clinic appointments, ask your rheumatologist or nurse why they matter and how often they're recommended. As a patient, you have a right to know why any medical recommendation is made for you, what any test involves, any out-of-pocket costs you will incur by taking a test, and if it involves any pain or discomfort. Speak up, ask questions, and get the information you need to make the choices that are best for you.

PART IV RHEUMATOID ARTHRITIS TREATMENT PLAN

Monitoring your RA disease activity, including changes to your inflammation levels, over a few months, helps you and your rheumatologist ensure that your RA treatment plan is working well. Your treatments should help you achieve and maintain “tight control” of your disease activity so you stay in low disease activity or in remission.

There are many RA medication options. More types of treatments are being studied now and new treatments are approved regularly. It’s important to be sure that your current medications are effective at controlling your disease activity and preventing joint damage.

Regular monitoring allows you and your doctor to do this with confidence. Monitoring results can inform shared decision making around whether to start a new medication, stop using a current therapy, or adjust the dosage of your current drug.

Here are a few examples of how disease monitoring can inform shared decision making:

Scenario: You were diagnosed with RA six months ago. On your PRO, you note that you regularly experience symptoms like pain and difficulty performing tasks. You have been taking methotrexate, a disease-modifying anti-rheumatic drug (DMARD) that is a first-line treatment for rheumatoid arthritis. However, your RA disease activity still measures as moderate to high based on your blood test results, as well as other important aspects of your physical exam like tender and swollen joint count and your PRO results.

Action: You and your rheumatologist discuss your options to achieve better control of your disease activity, including taking more than one DMARD in combination, or adding a biologic drug that inhibits tumor necrosis factor, a protein that plays a role in RA inflammation. You discuss the potential benefits and side effects of each choice and other concerns, such as cost. Together, you decide that you should continue taking your current drug and add a biologic drug.

Scenario: You’ve had RA for a little more than a year. Six months ago, you started taking a biologic drug. You mostly feel OK, but sometimes your joints feel very sore and tender, especially in your hands. You’re worried that your RA will soon limit your ability to do ordinary things, like driving your kids to sports practice or tying your shoes.

Action: You and your rheumatologist talk about your blood test results and your tender/swollen joint counts, which show that your disease activity is still moderate. You also go over your



A Patient’s Guide to RA Treatment Options

For a detailed look at available rheumatoid arthritis medications and other aspects of managing your life with rheumatoid arthritis, download our **Rheumatoid Arthritis Patient Guidelines** at creakyjoints.org/patientguidelines

patient questionnaire answers about your difficulty with daily activities, and see that certain tasks are becoming harder to do. Together, you review some options, including switching to a biologic drug that works in a different way to lower inflammation. You both decide that, based on current recommendations and data about which option is more likely to work, to switch to different kind of biologic drug.

Scenario: You've had RA for three years. You've been taking a TNF inhibitor biologic drug, and it's clearly working for you. Your monitoring, including repeated blood tests, imaging, physical exam, and PRO questionnaire scores, show that your RA is in remission.

Action: You visit your rheumatologist and discuss if you should still take your medication at the same dosage, or if you can lower it and still stay in remission. You go over your past MRI scans, the last two years of your blood testing, and other factors that may affect your RA, like your active lifestyle and healthy weight. Together, you decide to taper your dosage of your current medication and begin taking a lower dose. You both decide that it's a good idea to continue treating your RA even in remission.



RA Flares: Common Causes You May Not Expect

Why does your RA sometimes flare up? Flares are short-term, sudden spikes in your disease activity. It means that you have active inflammation. You may feel symptoms like pain, severe fatigue, low-grade fever or all-over, flu-like yuckiness. What causes an RA flare? Here are a few common RA flare triggers, including causes you may not have realized:

- 1. Your treatment plan isn't working.** If your disease activity is high, it may mean that your current medications are not effectively controlling your inflammation. You and your rheumatologist may need to monitor your test results, including how they may have changed over the past few months or year, and make decisions about whether you need to make changes to your therapy.
- 2. You smoke.** Not only does smoking increase your risk of getting RA in the first place, smoking also raises your risk of RA flares. If you still smoke tobacco in any form — cigarettes, cigars, pipes — get help to quit now.
- 3. Your diet may promote inflammation.** Although there's no clear evidence about the connection between foods and flares, some foods are considered to promote an inflammatory response in the body. These include processed meats, deep-fried foods, sugar, and trans fats found in baked goods and margarine. Keep a food journal to help you track what you eat and if your arthritis feels worse after you eat certain meals. Focus on eating fresh, healthy foods that are considered anti-inflammatory, like the healthy fats in salmon, tuna, nuts, and avocados; whole grains; and fruits and vegetables.
- 4. You're under stress.** RA flares can be triggered by periods of psychological stress and anxiety. If you're under unusual stress for any reason — job, family, moving, money problems — it can make you more likely to have an RA flare-up. Try to find ways to manage your stress:
 - Explore mindfulness techniques or meditation.
 - Take a yoga or tai chi class to gently move your body.
 - Go for a walk and listen to your favorite music on some headphones.
 - Check out RA support groups online, such as CreakyJoints, to find ways to cope with stress.

REVIEWERS



SHILPA VENKATACHALAM, PHD, MPH

Shilpa Venkatachalam, PhD, MPH, is a rheumatoid arthritis patient who has been living with RA for nearly three years. She was diagnosed a year after joining the Global Healthy Living Foundation (GHLF). Dr. Venkatachalam is Co-Principal Investigator (PI) of GHLF's ArthritisPower® Patient-Powered Research Network and Associate Director of Patient-Centered Research

Dr. Venkatachalam utilizes her firsthand experience with RA and her rigorous academic training in patient-centered research to manage several longstanding research projects, including a collaborative research group on Autoimmune and Systemic Inflammatory Syndrome and the GHLF ArthritisPower research registry, which is part of 20 patient-powered research networks of the Patient Centered Outcomes Research Net.

Dr. Venkatachalam completed her undergraduate degree in Mumbai, before moving to the U.K. to complete a master's degree in literature at the University of Durham. She earned her PhD in critical theory at the University of Nottingham, U.K. Following significant life events that required navigating health systems as patient and a caregiver, she earned an advanced master's degree in global health from New York University, during which she also won the prestigious Paul Ambrose Scholars Program fellowship awarded by the Association for Prevention Teaching and Research. She was among 25 chosen by The Young Persons Chronic Disease Network in collaboration with the American Cancer Society and the Harvard Global Equity Center for The Global Cancer Advocacy Training. In addition, Dr. Venkatachalam has been a regular panelist on global health topics from the Ambassador's Club at the United Nations. She has international experience in health care and has worked in India and in Chad in both private sectors and public sectors on chronic disease-related projects.



VINICIUS DOMINGUES, MD

Vinicius Domingues, MD, is a clinical rheumatologist, assistant professor of medicine at Florida State University, and a medical advisor for the Global Healthy Living Foundation/CreakyJoints. In his role as medical advisor, Dr. Domingues helps oversee the rheumatology educational content and programming for patients; advises on patient-centered research studies; and attends, reports, and interprets research from

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In addition to his work with the Global Healthy Living Foundation, Dr. Domingues is very active with the American College of Rheumatology. He has served on multiples committees, including those on rheumatologic care, the fellows committee, the education committee, and the annual meeting planing committee, on which he currently serves. Dr. Domingues also serves as a consultant for various biopharmaceutical companies regarding clinical trials and data analysis.

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