

ANNALS OF MEDICINE

WILL A FULL-BODY MRI SCAN HELP YOU OR HURT YOU?

*Companies like Penuvo and Ezra will use magnetic resonance
imaging to reveal what's inside you—for a price.*

By Dhruv Khullar

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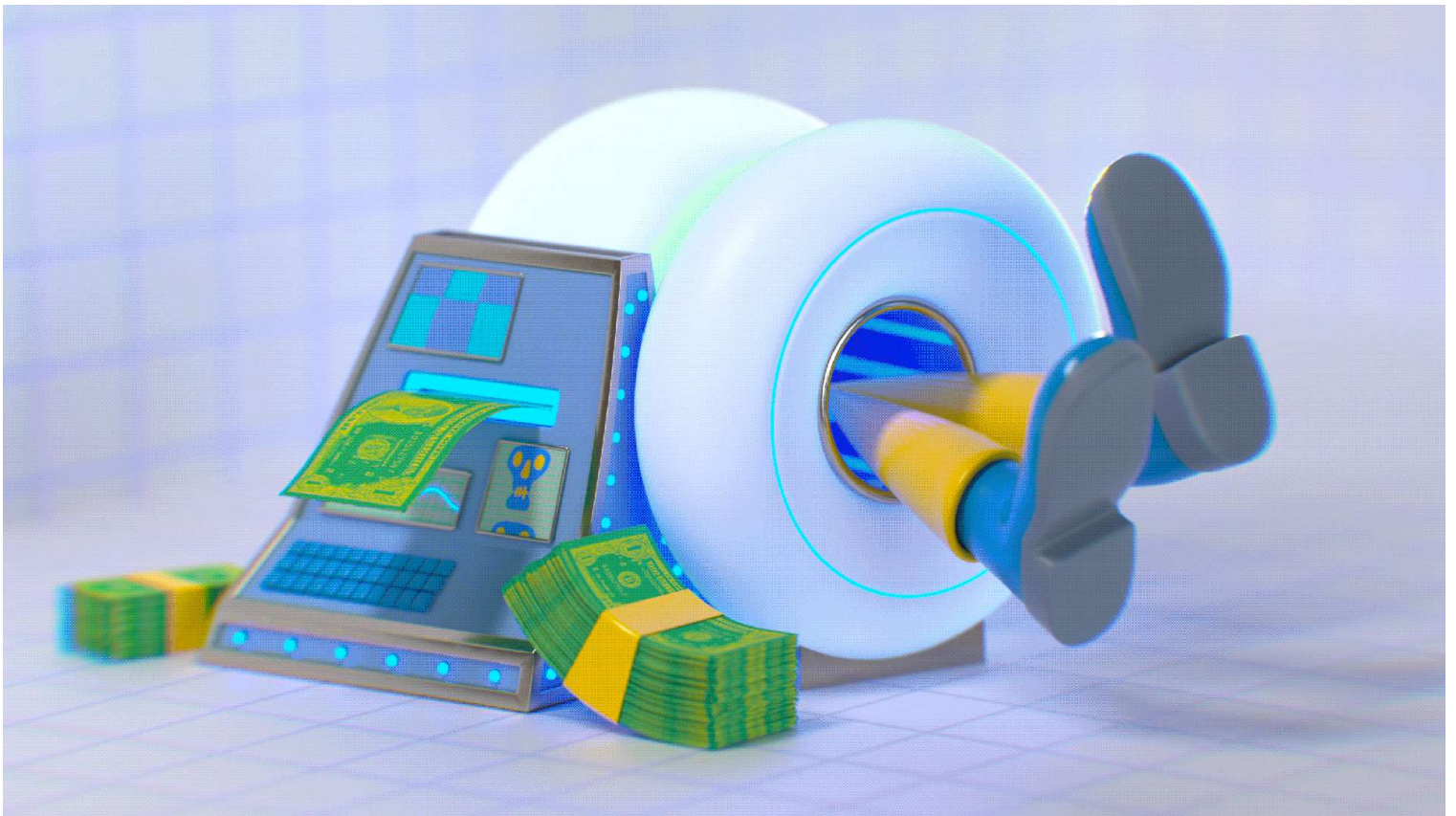
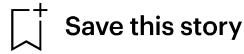


Illustration by Jack Sachs





Ryan Crownholm, a middle-aged Army veteran with luminous green eyes and a strong jawline, likes to describe himself as a health hacker. He has written on LinkedIn that, after founding and running several construction-related companies, he started to think of his own body as a data source. During the pandemic, he attached a continuous glucose monitor to his skin, bought an Oura ring to monitor his sleep, and signed up for a healthy meal-delivery service. “I started tracking each of my data points,” he wrote. “I outsourced my diet.” Every few months, a pricey concierge doctor—“kind of my longevity guy,” he told me—sends his blood for comprehensive testing. To assess his bone health and body-fat composition, Crownholm gets regular dual-energy X-ray absorptiometry, or DEXA, scans, which are normally recommended for older women at risk of osteoporosis. “Quantifying everything allowed me to be successful in business,” he told me. “I think it’s the same with health.”

One afternoon, while listening to a business podcast, Crownholm heard about a company called Prenuvo, which promises to help patients take control of their health. For twenty-five hundred dollars, Prenuvo will generate magnetic resonance imaging, or MRI, from your head to your ankles, and analyze the results for abnormalities. Images of Crownholm’s insides sounded like the perfect addition to his regimen; he signed up before Prenuvo had even opened a facility in Los Angeles, where he lives. “I felt great, but I wanted to know what might be lurking inside me,” he said. A few days after receiving the MRI, while he was in a meeting, his phone rang. The scan showed a roughly three-inch-long mass in his right kidney. “The doctor said, ‘We don’t know if it’s benign or malignant, but we better take it out,’ ” he told me. His kidney was cut out, and the pathology returned positive for renal-cell carcinoma, a treatable cancer that, in some cases, can be fatal. Crownholm credits the company with saving his life.

Crownholm is an unusual patient. He is wealthy enough to afford, and eager to use, a wide variety of optional care; he's drawn to experimental technologies, whether or not doctors recommend them. He also had a dangerous tumor at a key stage: large enough to appear clearly in a full-body scan, but small enough to be asymptomatic and removable. In all of these ways, he was an ideal patient for Penuvo. The company ultimately recruited him to appear in a promotional video, and he became a kind of MRI evangelist.

After Crownholm's diagnosis, he sent around a dozen friends and family members to get scanned. None had a dramatic experience like his. "Pretty much all of them have found some sort of incidentals," he said, meaning that their scans showed minor or ambiguous anomalies. Still, he argued that even if Penuvo hadn't saved their lives, the company had still given them helpful data: "At least, now, they have a solid baseline."

As a doctor, I approached Crownholm's story with caution. No professional medical society in America endorses whole-body MRIs as a proactive screening tool. The American College of Preventive Medicine argues that they "waste money and healthcare resources," while the American College of Radiology, which theoretically stands to benefit from more imaging, said in a statement that "there is no documented evidence that total body screening is cost-efficient or effective in prolonging life." Doctors tend to think that if it ain't broke, don't MRI it; for every case like Crownholm's, there are many more that result in false positives, additional scans, needless biopsies, avoidable anxiety, and excess costs. And yet to hear Crownholm's story is to wonder whether you, too, should get a scan.

Penuvo was founded by a man who, like Crownholm, launched companies for a living and was happy to pay a premium for health care. In 2018, Andrew Lacy, a serial tech entrepreneur with an M.B.A. from Stanford, flew to Vancouver to get a whole-body scan from Rajpaul Attariwala, a Canadian radiologist who had purchased his own MRI machine for use on a selective clientele in his private office. (MRI

machines typically cost between one and three million dollars.) Lacy later said that when he reviewed the images, “I was just completely floored. Never before in my life had I had such a strong feeling that I was looking at something that was really the future of an industry.” He felt “a tremendous peace of mind just not to worry about what was going on inside my skin.” He realized that others would pay to feel the same way.

Within a few years, Lacy and Attariwala had opened a clinic together in Silicon Valley. Some of the venture capitalists they screened became investors. Penuvo ultimately raised more than seventy million dollars; its backers include the 23andMe co-founder Anne Wojcicki, the supermodel Cindy Crawford, and the former Google chairman Eric Schmidt. Penuvo’s growth is, in part, a feat of marketing. The company has won the support of business leaders, celebrities, and influencers by crafting a narrative for the social-media era: these scans can catch the hidden health risks that might otherwise kill you. If you take a free “risk test” on Penuvo’s Web site, the company sends a report guesstimating your risk of various conditions—but also persistently calls and e-mails you to try and sell you a scan. This year, at New York Fashion Week, Penuvo arranged free scans for the designer Zac Posen, the model Lily Aldridge, and the editor Olivier Zahm, who completed his scan between runway shows. In August, Kim Kardashian posted a photo of herself in front of an MRI machine, wearing charcoal-gray Penuvo scrubs, to hundreds of millions of followers on Instagram. “It has really saved some of my friends lives and I just wanted to share,” she wrote, adding the hashtag #NotAnAd. (Kardashian has previously used imaging to prove that her butt is real.)

Penuvo now has nine locations, with plans to open a dozen more; some employers offer free MRI scans as staff perks. The company also has several competitors—most notably Ezra, a New York-based startup that has raised more than twenty-two million dollars. Ezra offers full-body MRIs at prices ranging from a thousand three hundred and fifty dollars to twenty-five hundred dollars, and five-year memberships for seven thousand. The company recently received F.D.A. approval for an A.I.-

assisted technology that generates data from quicker and less detailed scans; eventually, it hopes to offer fifteen-minute MRIs for five hundred dollars. The founder of Ezra, Emi Gal, often tells stories about patients who have died of conditions that might have shown up on a scan. He told me that his mother died of cancer around the time he founded the company, and he often wishes she were screened earlier. “People should get scanned at least once a year,” he said.

When I asked Gal about the lack of scientific evidence for such a claim, he told me that “state-of-the-art technology is always ahead of the guidelines.” He seemed to be suggesting that some future study will inevitably validate his company’s technology, proving the experts wrong. Modern mammograms were developed in the nineteen-sixties, he pointed out, but it took more than a decade for the American Cancer Society to recommend them as a screening tool, and uniform standards didn’t exist until 1992. (Some doctors now argue that mammograms are overused; one large study found that decades of screening did not reduce breast-cancer death rates, and that one in five diagnosed breast cancers may have been unnecessarily treated with chemotherapy, surgery, or radiation, as they might not have harmed the patient.) “If you go to an epidemiologist and ask, ‘Should we be screening thirty-year-olds for cancer?’, they will say, ‘No way,’ ” Gal has said. “But what if you’re the thirty-year-old who happened to have a headache that turned out to be brain cancer?”

In a 2004 episode of the sitcom “Scrubs,” Bob Kelso, the chief of medicine at Sacred Heart Hospital, runs into a fellow-doctor, Perry Cox, in the hallway. “I am considering offering full-body scans here at Sacred Heart,” Kelso says. “What do you think?”

Cox looks appalled. “I think showing perfectly healthy people every harmless imperfection in their body, just to scare them into taking invasive and often pointless tests, is an unholy sin,” he says.

“Does sound a little sketchy ethically, doesn’t it?” Kelso says. “Thanks, Perry.”

Later, Cox meets a friend at a bar and brags about how seriously his boss seems to have taken his advice. Then he glances up at a television and sees a commercial in which a mother consoles her young daughter.

“Mommy, when’s Daddy coming home?” the girl asks.

“He isn’t,” the mother responds tearfully, pulling the girl to her chest. “If only he’d loved us enough to get a full-body scan at Sacred Heart.”

A message flashes at the bottom of the screen: “CALL NOW!”

“Scrubs” was making fun of a real industry’s boom and bust. In 2000, demand for head-to-toe CT scans—essentially, three-dimensional X-rays—surged after “The Oprah Winfrey Show” featured a Newport Beach doctor who offered them to the general public, without a physician’s referral. The scans weren’t covered by insurance and cost about a thousand dollars each. Whoopi Goldberg called them “the most comprehensive health exam that exists”; William Shatner said, “I’m sending everyone I know.” Similar businesses popped up around the country: CT Screening International, AmeriScan, ScanQuest. One company outfitted vans with scanners and drove them around small towns in the American South. Medical societies, however, warned that the scans had high rates of false positives; they also delivered enough radiation to increase the risk of some cancers that they aimed to detect. Before government-funded studies could properly evaluate the scans’ effectiveness, most of the companies offering them collapsed.

Full-body MRI scans are different from CT scans in two key ways: they don’t subject people to potentially harmful radiation, and they are better at surveying the soft tissue of our internal organs, where cancers commonly arise. The other complaints, however, still seem to apply. MRIs are sensitive enough to pick up subtle abnormalities that can be clarified only with further tests, and sometimes those tests cause harm: pain, radiation, infections, financial and psychological distress. Their

growing popularity suggests that our relationship to medicine has continued to evolve. Increasingly, patients are not passive recipients of care, but active customers. Trust in medical leaders keeps falling; these days, a Kardashian post is worth a thousand academic studies.

Doctors sometimes use a barnyard analogy to talk about the vast differences between cancers. A tumor can be a turtle, a bird, or a rabbit, depending on its speed and ability to escape; the goal of screening and treatment is to fence the cancer in. Turtles move so slowly that, fence or no, they'll never make it out. Birds are so flighty that fences are irrelevant; even if you spot them, there's no real way to stop them. Only the rabbits can actually be fenced in. By some estimates, at least a quarter of cancer diagnoses can be considered overdiagnoses. These tumors are turtles; they never would have left the barn.

South Korea inadvertently illustrated this point when a government program, starting in 1999, offered free screenings for several common cancers. A thyroid-cancer screening wasn't included, but many patients opted to add one for a fee. Between the early nineties and the early twenty-tens, rates of thyroid cancer soared fifteenfold—a development that would have been worrying, except that death rates from thyroid cancer never rose, and remained very rare. Diagnosing these cancers wasn't saving lives: almost all were papillary thyroid tumors, which are present in as many as a third of all adults and rarely cause problems. Nonetheless, tens of thousands of South Koreans had their thyroids removed and started taking lifelong hormone supplements. They'd fenced in turtles.

When doctors screen healthy people with highly sensitive tests like MRIs, they tend to turn up a barrage of ambiguous findings. Is that an aneurysm waiting to burst, or a harmless vascular variant? Is that a deadly cancer, or just a blob of fibrous tissue? “You pick up some incidental finding and get put on the surveillance train,” Saurabh Jha, a radiologist at the University of Pennsylvania, told me. “And sometimes that train derails.” I've seen this happen. I send off a patient to be scanned for a blood clot,

which inadvertently reveals an abnormality in the lung. It's probably nothing, but, just in case, I schedule the patient for a biopsy, meaning that someone will have to cut into him and slice off a bit of lung. The biopsy causes an infection, which requires antibiotics, which causes diarrhea; a hospitalization and lengthy rehabilitation follow. The biopsy is negative. "It's like a Greek tragedy," Jha said. "Once you have the information, you can't unsee it. You are compelled to act."

Ishani Ganguli, an assistant professor of medicine at Harvard who's conducted foundational research on such "cascades of care," said that patients may start to see themselves as unwell by default. One of her patients incidentally learned that they had developed a small aneurysm. The aneurysm is "probably never going to affect them medically, but it's completely changed the way they experience symptoms," Ganguli said. "Now, every time they have a headache, they seek urgent care."

On top of all that, there's the cost—not only to the individual, but to the system. Follow-up testing to clarify ambiguous findings is often covered by insurance, meaning that in the end, we all share its costs. Ganguli studied patients who received a routine electrocardiogram before a low-risk cataract surgery. As many as one in six experienced a care cascade that often included ultrasounds, stress tests, and visits to a cardiologist, adding up to an estimated thirty-five million dollars in extra medical spending nationally each year. These follow-ups don't appear to help most people, Ganguli said. The only thing stopping full-body MRIs from triggering an even larger wave of spending, she added, is that the typical patient can't afford the scans, and they haven't been proved to be beneficial; as a result, they remain relatively niche. "The reality is that they're unlikely to be covered by insurance, because there is no study showing that full-body MRIs have net benefit," she said.

Compared with stories about deadly tumors hiding in our bodies, conversations about scientific studies and insurance coverage can seem bloodless. In this respect, Ezra and Prenuvo have a clear narrative advantage. "If I was a layperson, I would find this incredibly bewildering," Matthew Davenport, a radiologist who co-directs a cancer

center at the University of Michigan, told me. “Like, why can’t you just use this technique to find cancer? My empathy for that view is high—but, unfortunately, the common sense is wrong.” Davenport guesses that the average person would benefit from a full-body MRI less than 0.1 per cent of the time—whereas “you have something happen to you that is expensive, annoying, psychologically harmful, or physically harmful maybe five or ten per cent of the time.” He went on, “You’re searching for a needle in the haystack—only the haystack causes harm.”

In September, I set out to receive my own Prenuvo scan. On the company’s Web site, I clicked past a stock photo of a cheerful woman and child and discovered that zero appointments were available for several months. According to the *Wall Street Journal*, wealthy New Yorkers, returning from summers in the Hamptons, were to blame. I took to checking for openings several times a day. One evening, after putting my kids to bed, I saw one and felt a rush of excitement—but, by the time I clicked, it was gone. I felt like a Taylor Swift fan trying to buy sold-out concert tickets.

Next, I called Prenuvo’s customer line in the hope of sweet-talking someone. A representative named Ben asked, “Hey there, how can I help you?”

Ben had a low-key confidence that I associate with lacrosse players. “Hold on a sec,” he said. “Our system is kind of bugging out right now.”

After a few minutes, he returned with bad news. “Sorry, bro,” he said. “There’s nothing until the week of Christmas.”

“It didn’t used to be this hard to get a scan,” he went on. “We kind of blew up recently.” He texted me his direct line.

A few days later, on the subway home, I checked my phone, and saw a new opening. I rushed up to my apartment so I could spend eighteen hundred dollars on a head-

and-torso scan. Prenuvo made me feel like I'd won something—the chance to see inside my own body. At the same time, I felt guilty. I was trained in evidence-based medicine, and the evidence suggested that I was wasting resources. The night before the scan, my guilt turned to anxiety. Was I about to learn something that I didn't want to know?

When the day came, I took the subway to Penn Station and found Prenuvo's office next door to a Five Guys. The building was splashed with testimonials. "Prenuvo gave me the peace of mind I deserve," declared a partner at an investment firm. The waiting room was heavily perfumed, with soaring wood ceilings that reminded me of upscale hotels. As I helped myself to a free seltzer, a shelf full of health books caught my eye. One was dubiously titled "Super Human: The Bulletproof Plan to Age Backward and Maybe Even Live Forever."

After I donned Prenuvo scrubs, a bearded technician named Zach led me to a large room that housed the MRI machine. It looked like a giant white doughnut.

"Seems like it's been busy," I said nervously.

"After Kim Kardashian posted on Instagram, we got, like, a hundred thousand more followers in a week," Zach said. "It was nuts."

Zach eased me onto a padded table. He lowered a shield over my chest and covered my head with a helmet. For a moment, panic and claustrophobia swelled within me. I was about to spend an hour like this.

"Try some deep breaths," Zach said soothingly. Then he placed headphones over my ears and a mirror in front of my eyes, so that I could watch a television behind me. As the table rolled into the scanner, Taylor Swift started playing. I'd finally made it to my concert.

Most of the people I spoke with for this story told me that they were happy they got a preventive MRI. Some expressed a sense of relief in discovering that a nagging pain wasn't anything serious. A young woman who received an ambiguous finding, which later turned out to be benign, told me, "It was absolutely worth knowing about. The scan gave me a sense of control." Almost everyone said that they'd recommend the scan to others. "The medical profession is all about fixing what's broken," one man said. "This made me feel I could actually get ahead of potential problems." This is a select group—early adopters with disposable income and access to plenty of doctors. But their conviction suggests that, in a stochastic world, medical information fosters a feeling of agency.

Whether this sense of control is justified is ultimately an empirical question, and one that full-body MRI companies seem only selectively interested in engaging with. Prenuvo was happy to share with me that it had made half a million clinical findings, but it offered few specifics about what these findings were. (Things like mild arthritis presumably count, and the total includes conditions that patients already knew about.) The company claims that around five per cent of people had been alerted to "potentially lifesaving" findings. Prenuvo wouldn't tell me what proportion of people received incidental findings, or even how many individuals it had scanned. This makes it impossible to do the math when Lacy argues, as he often does, that if everyone in America got a full-body MRI every two years—at a total cost of fifty or sixty billion dollars—the scans would pay for themselves, "because everything is caught early." Claims like these have a bada-bing, bada-boom quality to them, more reflective of Silicon Valley pitch decks than lived experience.

At the same time, it's hard not to feel that our current system needs to change. Half a century after the U.S. declared war on cancer, the disease remains the nation's second leading killer, and many malignancies are diagnosed after they've spread. It's easy to understand why patients would be frustrated with a medical system that only screens for a handful of cancers, and simply waits for most others to emerge. "This debate

pops up from time to time, and it's now playing out along disappointingly familiar lines," Daniel Sodickson, Ezra's chief scientist and a radiology professor at N.Y.U. Langone, told me. "Tech enthusiasts: positive. Medical professionals: skeptical. I think the medical community, in response to some earlier failures, has developed a kind of allergy to the idea of proactive imaging." Sodickson acknowledged that false positives are a problem, but argued that if patients get scanned often enough, artificial intelligence could separate the red flags from the red herrings. "If you see something and it's largely unchanged from a prior scan, you can effectively rule it out as an item of concern," he said. "We don't want to scan more because we're afraid of false positives—but, actually, scanning more is the best way to deal with false positives!"

Jha, the University of Pennsylvania radiologist, told me that serial scans would be more profitable for Penuvo than for patients. You sometimes need many scans over many years to spot the difference between benign and life-threatening lesions. He worried about an overdiagnosis epidemic, like the one in South Korea. "It's extremely hard to say to someone that *you personally* were overdiagnosed," Jha told me. "Overdiagnosis emerges when you look at a population. Everyone individually can feel that their cancer was caught and treated appropriately—even though we know, statistically, that this isn't true."

When I asked Lacy about the psychological toll of ambiguous findings, he said that ninety-nine per cent of patients that Penuvo surveyed reported a positive experience. "We will know we've succeeded when getting diagnosed with something is not anxiety-inducing," he argued. "It's affirming, it's empowering, because you now have more options available for treatment."

About a week after my MRI, Penuvo called to say that the results of my scan would arrive soon. I scheduled a consultation with one of the company's nurse practitioners. Usually, a report is sent in advance of the appointment; as my consultation approached without any sign of one, I started to worry. Then the nurse

called. “Sometimes they don’t release it ahead of time, because it’s better if we go over things together,” she said. This did not reassure me.

There were no visible problems in my lungs, liver, pancreas, or brain, the nurse said. My sinuses were a little swollen, probably from allergies. There was, however, a solitary spot on my prostate. Lesions are graded on a scale from one to five, she explained, based on their likelihood of being cancerous. “Your score is a three, smack dab in the middle,” she said.

The nurse observed that if the lesion proved dangerous, there was always the option of “just scooping it out,” as though it were an errant raisin that had fallen into some ice cream. She encouraged me to talk to my primary-care doctor and a urologist. They’d probably order some tests, she said, and maybe a biopsy. My cascade of care had begun.

After we hung up, I sat at my desk, processing. A three? I thought of an episode of “Seinfeld,” in which George visits a doctor for a growth on his lip. “When I asked him if it was cancer, he didn’t give me a ‘get outta here,’ ” George tells Jerry indignantly. “That’s what I wanted to hear.”

Doctors have a word for accidental findings that produce more questions than answers: incidentaloma. I knew that I probably didn’t have prostate cancer, and that most prostate cancers don’t prove deadly. But I also knew that, because it is so common, it ranks as the second leading cause of death from cancer among men.

A few days later, I sheepishly informed my primary-care doctor that I’d had a full-body MRI. She graciously ordered a blood test; a urologist recommended a dedicated prostate MRI, and, if the results weren’t too alarming, regular follow-ups after that. The immediate cascade would probably cost several thousand dollars, split between me and my insurance. I thought about the other ways in which the money could be spent: months of insulin for diabetic patients; scores of inhalers for asthmatic

children; colonoscopies that are proven to find cancer and save lives. When I told Davenport, the radiologist, he shook his head and face-palmed. “Prenuvo probably views your story as a success—I view your story as a tragedy,” he said. “They’ve created in your mind this uncertainty. You were a healthy person, and now you’ve become a patient.”

In the book “Too Much Information,” Cass Sunstein, a Harvard law professor and policy scholar, argues that people want information for two main reasons. Information might have affective value—you feel good when you hear it—or instrumental value, meaning that you can do something with it. Sometimes these values are in conflict: calorie labels at movie theatres can inspire healthy decisions, but they also kind of miss the point of going to the movies. Information also means different things to different people. Continuous glucose monitors are incredibly useful for people with diabetes, but, these days, they’re popular among so-called biohackers, who are often young and healthy and stand to gain much less from them. Too often, the future of medicine isn’t equally distributed. The people who pay for health information may be least likely to need it; they get it to feel good.

If, next year, the lesion in my prostate grows to twice its size, I’ll be happy that I know about it. But odds are that it won’t—and, in the coming years, I’ll need recurring prostate MRIs simply to reassure myself that I am healthy. In this sense, my scan inverted my conception of health. I no longer assume that I’m fine; I want a test to prove it.

Two days after Thanksgiving, Ben from Prenuvo sent me an e-mail. The subject line read “Share the Good News: Your Prenuvo Experience Can Benefit Others!”

Ben sounded as much like a missionary as a marketer. “As you know, our goal is to spread the message of preventative health,” he wrote. “Feel free to connect me to your friends, family or colleagues that could benefit from our scan.” ♦

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*Dhruv Khullar, a contributing writer at *The New Yorker*, is a practicing physician at Weill Cornell Medicine and an assistant professor at Weill Cornell Medical College.*

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