>> Today we bring you the first report of the medical evaluation of the Cuban embassy employees who were exposed to some sort of directional energy source and suffered a brain injury. This information is being presented in the JAMA Clinical Reviews podcast. If you find the content in the JAMA Clinical Reviews podcast informative, please review and rate the JAMA Clinical Reviews podcast in the Apple Store. It helps us bring more episodes directly to you. Toward the end of 2016, U.S. embassy personnel noticed some sort of illness associated with odd noises they heard while in their residences or hotels. There were various forms of these noises but one recording of them sounded like this.

[Background noise]

A number of people were affected by this, so it seemed like there was a deliberate attack on the U.S. diplomats. The odd noise and resultant hearing problems resulted in an initial emphasis on the noise leading to this phenomenon being called a sonic attack.

>> Diplomats' families and non-essential personnel are being ordered to return to the U.S. after at least 21 members of the embassy staff were targeted by what U.S. officials say could have been sonic attacks. U.S. officials believe that starting last November, devices that emit sonic waves could have targeted U.S. diplomats while they were in their homes or staying in hotels. Who is behind the attacks and the motive is still unclear. Cuban officials deny responsibility and say they are investigating the incidents.

>> Because of the noises heard by these people and that the noise caused ear pain and some hearing loss, these embassy employees were evaluated by otolaryngologists. During this evaluation, the clinicians noted these patients had symptoms resembling concussion, yet none of the patients had experienced head trauma. This prompted referral to the University of Pennsylvania's Head Trauma Program, where 21 U.S. embassy personnel underwent comprehensive evaluation. The full report of this evaluation was published online by JAMA on February 15th, 2018. Today, on the JAMA Clinical Reviews podcast, we review the Cuban embassy audio attack and discuss the medical syndrome that was investigated at the University of Pennsylvania. We will speak with Dr. Doug Smith, director of the Center for Brain Injury and Repair and professor of Neurosurgery at the Perelman School of Medicine, University of Pennsylvania. We will also talk with another author of this article, Dr. Randy Swanson, the article's first author who is an

assistant professor of physical medicine and rehabilitation at the hospital of the University of Pennsylvania. Dr. Swanson led the efforts to treat the embassy personnel who experienced some sort of brain injury.

>> In late 2016, staff at the United States Embassy in Havana began complaining of strange noises and among the descriptions that they complained of, high-pitched beam of sound, incapacitating sound, baffling sensation, akin to driving with windows partially open in a car, or just intense pressure in one ear.

>> That was Senator Marco Rubio, who described in Senate hearings what was known in late 2016 when Cuban embassy employees noted a strange constellation of symptoms characterized by hearing odd noises that were associated with ear discomfort. With time, an increasing number of personnel experienced these issues. Eventually, there were 24 people. They were not in the embassy when this happened, they were in their residences or their hotels. These people were sent to the University of Pennsylvania for evaluation and they had the following --

>> While the symptoms may vary, all of the medically confirmed cases -- all 24 of them -- have described some combination of the following symptoms; sharp ear pain, dull headaches, the ringing in one ear, vertigo, visual focusing issues, disorientation, nausea, and extreme fatigue.

>> During the Senate hearings in January, Dr. Charles Rosenfarb, the chief medical officer for the United States State Department, provided an overview of what happened to these patients and what was found when they were evaluated.

>> While the descriptions of the auditory sensations have varied, all medically confirmed cases have described some combination of the following symptoms beginning within minutes to hours of their exposure of the event; sharp localized ear pain, dull unilateral headache, tinnitus or ringing in one ear, vertigo, visual focusing issues, disorientation, nausea, and extreme fatigue. In many of the patients, the acute symptoms seem to resolve within days to weeks.

>> Fortunately, most of these symptoms quickly resolved but other problems, the more serious ones, persisted for longer periods of time.

>> These have included cognitive problems including difficulty with concentration, working memory, and attention, recurrent headache, high frequency unilateral hearing loss, sleep disturbance, and imbalanced walking. As in the acute phases, the duration severity of these later symptoms have varied widely. Defining the prognosis for the confirmed cases is extremely difficult, since no precise analogue for this possibly novel syndrome exists.

>> It is these latter symptoms that resemble what is seen in head injury and concussion, except that none of these patients had experienced a head injury. Because these patients all had some form of brain injury that closely resembled what is seen with head trauma, they were all sent to the University of Pennsylvania's Brain Injury Center for complete evaluation. And I spoke to Doctors Smith and Swanson to better understand what they found when they evaluated these patients. When these patients came to you, you did a series of objective tests. One thing that's a little hard to follow in the manuscript is what those tests were and what they show. So, what kind of testing did you do on these patients and what did those tests show?

>> The truth is that our primary objective -- when we started this -- was the multidisciplinary clinical evaluation and treatment and coordinated rehabilitation of these patients, that was our primary objective. And so, to that end, patients came in and we had it set up that they saw a series of providers, including physical medicine rehabilitation physicians specializing in brain injury medicine, occupational medicine, neurology, neurosurgery, and neuro imaging. And then so each one of these providers did their own comprehensive history and physical, just like they do when any other patient that they're seeing is part of clinical care. So, it's their expert opinions and from this, we determined what the clinical need was for patients that needed additional evaluations with vestibular therapy. So, when patients were identified by the multidisciplinary team to have balanced deficits, they were referred to vestibular therapy for comprehensive evaluation. It's a special type of physical therapist that works on balance and coordination. When patients were found to have ocular motor problems or problems with the way that the brain controls the coordinated movement of both eyes, they were sent to neuro-ophthalmology and neuro optometry. And then when patients were determined to have cognitive problems, they were first sent for neuropsychological testing, and after testing was complete -- so after the day of the test -- I know this is a little confusing on the manuscript -- after we completed the test but before, you know, it

was graded and scored, then we released patients to start cognitive rehabilitation because that's what was clinically indicated. And the reason why it was held is we didn't want to skew and the results of the neuropsychological testing. So, that was a point that their editors and the reviewers had some comments on.

>> The original goal was to know what this is and to bring in a series of experts who deal with neurological injuries and have them independently evaluate the patients. We then got back together, had a few meetings, and tried to develop a program -- a kind of a systematic program --of evaluating these patients. So, initially, everybody was seen by all of these specialists and bit by bit, we winnowed it down to kind of working more of a referral system once we felt pretty sure that this did resemble a persistent concussive symptom type of scenario. And so that's -- that's really why we had so many multidisciplinary folks to start with.

>> These patients were thought to have findings similar to concussion, so I have a two-part question for you. First is, from your expert perspective, what is a concussion? How do patients present? What findings do they have? And then, what did these patients have that made the clinicians taking care of them think they had had a concussion or some syndrome similar to what is seen in head trauma?

>> So, when patients come in after sustaining a mild traumatic brain injury or concussion, they usually have a constellation of symptoms which include problems with the balance system, problems with the coordinated motion of your eyes, and cognitive problems. In addition to sleep problems and some irritability and things like this, that's the common thing. And there's a difference if it's in the super acute phase, a day or two after concussion, versus what we see two, three months after concussion, or in the military population with their long-term problems. But by and large, patients have a problem with the coordinated motion of their eyes and how that manifests clinically is things like as they're going throughout their day and they're reading on their computers, they can't converge and diverge the same way, there's been an acute change. They have problems with saccadic eye movements, or the rapid movement, side to side and up and down of our eyes, that you need for reading and navigating your world. And they have problems with coordinating all this and so it causes eye strain, and fatigue, and headaches. And as they go throughout the day, it gets more and more. So, that's typically seen in concussion and that's what we see in this patient population. Also, it's very common to have sensitivity to light and, you know, like in the VA population, for example, we give people multiple different prescription glasses to filter out certain wavelengths of light and a large percentage of these patients also had that. As far as the balance system, in a concussion or mild brain injury, patients can normally walk into your

office. They're not overtly falling over but when you do higher level dynamic balance in testing, that's where they have problems. So, the concussion screenings is things like tandem stance, and non-dominant Lin singledom stance, and standing on foam pads where you're taking proprioception out of the equation, that's when concussion patients have coms with this dynamic balance, and that's the same thing we see in this patient population. So, those are two of the big things. And then the cognitive deficits. So, patients are having problems with working memory, and sustained attention, and concentration. And they also -- sometimes, just like in concussion -- patients who are highly motivated and highly educated may still be able to perform a task. They still may be able to go to work and get their work done but it takes them so much more energy because they don't have the cognitive reserve, something's happened to their network and it takes them so much more energy so they're fatigued. And by the end of the day, they have massive headaches and things like this. That's the same thing that we saw in this patient population. So, those are some of the things and some of the overlap.

>> Let me see if I can restate that because I'm trying to understand this like any of our readers will. You guys are experts, so for you, this is all very obvious. And obviously, there's been a lot of criticism about calling it concussion, you know, what is concussion, in terms of what we've seen in the peer review and the discussions about this paper. So, let me see if I can restate it. Tell me if I've got this right. Normally in concussion, the patient experiences some sort of head trauma -- head injury. And that's followed by problems with balance, ocular motor problems, cognition difficulties, sleep problems, irritability. This group of patients didn't have any head injury but was exposed to some sort of odd acoustic directional energy source that nobody knows what it is but then had balance problems, difficulties with their eyes, cognition problems, sleep difficulties, and irritability. Is that a fair statement?

>> So, this is really concussion without concussion. I mean it really looks like concussion without the history at the head trauma. And, you know, initially, because of the complaints about the odd sounds and some of them being very at high decibels and there was ear pain -- so there was more of an ear exam and a concentration on otolaryngology type of exams. But it became clear, over time, that these patients were most distressed over cognitive problems; like, for example, a very consistent finding was issues with word finding where people just -- their word is on the tip of their tongue, they're trying hard to come up with it and they just can't, and that's a very common thing you'd see in persisting concussion. Similarly, they might finally have to read the same email three or four times just to, you know, grab hold of it -- again, a very consistent finding. So, that's the most distressing thing. That's what we see in persisting concussion about the ability to remember things and how quickly people think they're processing speed, which is why this

came out so clear. But then that also is typically accompanied by exactly what you just said, balance, oculomotor, sleep, headaches. But this group looks extremely like the concussion group, just without the concussion.

>> Yeah, that's really very helpful because, again, you saw that in the peer reviews, some of the neurologists that looked at this said, well, we don't even know what concussion really is. And that may be fine, but it is a well-defined syndrome and people get that diagnosis all the time. You guys deal with it all the time. So, I think that explanation that you just provided will be extremely helpful in sort of laying out for the doubters what this is all about. Can you speculate what might have caused this? Because another criticism has been, well, these people reported an acoustic phenomenon and there's no known acoustic phenomenon that can cause this symptom constellation? I'll lead into my next question, which is when I was looking into this, I found some reference to the Moscow signal and some investigations done I think in the 1970s and '80s about microwave irradiation to U.S. embassy personnel in Moscow. So, is there anything else out there that people have thought about that might have caused this?

>> There's been a lot of speculation and I agree with you that there is no known mechanism for audible sound to injure the brain. At high enough decibels, it can certainly injure your ears, your hearing, so therefore, we have to suspect that that's a consequence of something else, that it's just kind of a side effect. And you can't imagine that if somebody's perpetrating this that they'd want even some kind of sound identifying what's going on. So, we do not think it's the sound itself, that there's another kind of exposure that's there. With reference to the Russia experience in the literature -- and I'm speaking as a non-expert in what they call directed energy type of injury -- but I have read and I'm familiar with the Russian circumstance, where people have taken things, like looked at microwaves, infrasound and ultrasound, and used animal models and there have been reports in all these models that you can have brain injury. The problem is that speaking to some experts is how would that be used technically. How could you, for example, project it over long distances and through structures. So, that's something we don't know about but clearly, I think the thing that we are pretty certain is it was not the sound itself that caused the injury.

>> Yeah, the way I think about it is like, I don't know if it's still the case, but in the old days, when you used to get dental x-rays, you'd hear the machine it go buzz and you'd feel like this vibration on your skin but you get an x-ray and it's this energy that -- very high energy that goes right through you. But it was associated with like a

sound, even though the sound wasn't the fundamental basis of what the energy was being used for.

>> I think that's a good example because the sound is way back, it was probably just the operation of the machine itself, but you aren't hearing the x-ray.

>> Let me move on to rehab and I would appreciate a discussion about rehab of concussion patients in a general sense. So, I'm assuming these patients got the same rehab as any concussion patient does. So, could you tell me a little bit about what is done for concussion patients and how effective that rehabilitation is?

>> So, it's a strange thing that concussion is not a real diagnosis, since the name itself doesn't embody the underlying cause. So, here's the problem, somebody comes in, they were hit on the head and they're being evaluated. In the emergency room, for example, they'll be examined and to rule out if there's a bleed or another issue but typically, they're sent out on their own in the wind. And of those individuals, about 20% have persisting symptoms, you know? The other 80% return to normal function and go back to work or school. But the remainder often have a really hard time with the referral system so they're out in the wind for a while, becoming very frustrated and ultimately, they find their own way or are referred to a rehab center.

>> Yes. And so when those patients come that are in that persistent stage, then we evaluate them, just like we did in this patient cohort, with a physical exam that is comprehensive, but focused on the cognitive, the vestibular, and the ocular motor systems. And then depending on the patient's deficits, they will get a combination of vestibular therapy, which just really works on the balance deficits the patient is having, and also incorporates some of the ocular motion difficulties into movement. So, as the patient is moving throughout the world and they're also navigating their world with their eyes, that coordinating motion, if a patient has cognitive problems, they will get a combination of either speech therapy or occupational therapy for cognitive rehabilitation, depending on the specific needs. And again, if they're having ocular motor problems with reading and stuff, some of that therapy will be incorporated into their daily tasks of cognitive therapy, so how they have to scan and use things for returning to work and all that. And then if they have dedicated problems with vergence or converging and diverging and they have an acute convergence insufficiency, they will get dedicated neural optometric rehabilitation. And patients that are concussion patients, the civilian -- or military will get a combination of all those and [inaudible] then will get all three. They'll also get

medications for headaches, and for sleep disorders, and special prescription glasses to filter out certain wavelengths of light for photo phobia, and different things of that nature. And this is the same type of thing that these patients in this cohort we're receiving. So, you can see in the paper and the tables that a large percentage of them required all three of those disciplines and the coordinated rehabilitation between the different disciplines on an individual case. And then in rehabilitation, let's say we talked about convergence insufficiency, for example, we're basically bringing that to the conscious level to force a patient to use muscle memory to learn how to converge again and throughout the course of rehabilitation, then they're able to do that more automatically. And that corresponds to being able to perform better at work, and read on the computer, and do things without symptom exacerbation of headaches and things like this. So, rehabilitation is really a combination of trying to work on some neural plasticity and getting things to recover and or working on getting the patient habituated to deficits. And you learn strategies to manage those deficits and still be able to have optimal function to return to work in daily life.

>> I don't know if this is an answerable question but if you take, for example, cognition deficits as a result of a head injury, what exactly do you do to attempt to rehabilitate a cognitive deficit?

>> It's so highly individualized and based on what the person's goals are. So, a large percentage of it is strategies, initially. A large percentage of it is -- especially when you have someone that's really high functioning, which a lot of these people in this cohort are. You break it down to strategies of how they can manage their energy, how they can learn things, like okay, now they are having memory difficulties, for example. And how that translates is they're having problems at work during a meeting and they can't remember all the things that they used to. And they get back to their office and their notes are all in disarray in organizing that stuff, so systemic structured ways of learning how to approach a problem like that and new techniques for memory, and then helping them to incorporate that into their daily lives. That's a big part of the cognitive rehabilitation. Besides that, it's very individualized to try to actually strengthen certain deficits that a person is having.

>> The other thing that might be important for this particular case is that it's a little bit of dealer's choice. So, as opposed to like a certain bacteria you want to approach with a certain antibiotic, this is really a lot of style. So, there's some art to it where, you know, somebody has to [inaudible] to where the patient is and then apply the individualized therapies for them. And that really might change from provider to provider and center to center. So, where people have success in one place, it may be

-- you know, they might -- another center might have a completely different set of tools and still might have success.

>> There have been some recommendations made for the employees at the embassy to have baseline evaluations performed before they go to Cuba. What are those evaluations?

>> Right now, the DoD -- for all service members -- take these baseline tests. So, it would be things like cognitive tests, but as well as, you know, sensory function. And the important thing for that is that let's say if somebody has very high function, has a high IQ, they might have an extensive neuro psych test after an injury and look like they're doing better than normal but they actually are really devastated as far as they're feeling for function. So, these baseline tests are very important to measure against the patient themselves. These DoD -- they're often similar to kind of like these sideline tests you see for athletes so you can compare whether they have a change over time. And the one that the -- is now being employed by the State Department is quite similar to some of these athletic tests, or the DoD tests.

>> Are there names for these tests? Is there like a battery of them that they get or --

>> It's based on a very common battery and the -- what they call their particular test is called the [inaudible].

>> Okay. Do you have any other thoughts about this whole thing -- this whole clinical issue?

>> The important thing is that this really is a public health matter and that we have to be concerned that there could be other individuals out there who might have been exposed we don't know about. Unfortunately, this could be repeated, and so people need to be prepared and I would say that our report is really just preliminary. So, we've recognized the constellation of symptoms, we, you know, have more of a method of how to go through evaluating the patients, but we need more diagnostics. For example, just like athletes, we would be thinking about blood biomarkers to determine who's going to have persisting symptoms or we might

want to develop advanced neuroimaging to see what changes there are in the brain and determine if those are pathognomonic for this type of exposure. So, we're really just at the beginning of this, it's not a -- just like I said about concussion -- it's not a real diagnosis. It's really a description of symptoms. So, we have to work towards developing an operational diagnostic criteria to find other individuals with this same issue.

>> What's happening with all the hysteria about this paper coming out?

>> Yeah, I mean there's a lot of political intrigue, where there's the recent reports from Cuban officials that suggest that Americans who served in Cuba have kind of this mass hysteria type of effect.

>> Yep, and I think that, you know, while the literature is mixed on this and the characteristics of a group -- the characteristic of a group of patients who experienced mass psychogenic illness such that the symptoms are short-lived, they're often benign in nature, and there aren't consistent physical exam findings, which is completely opposite of what we see in this patient population.

>> Yeah that's really key, because that that criticism keeps coming up and it came up in one of the reviews and I think that's what people want to pawn it off as, as just sort of a hysterical reaction.

>> To have that, you'd have to have everybody kind of in collusion together to make sure all their symptoms match and that's actually not the case. There's a subset of individuals who didn't know any of the others. So, there was a larger group that had been interacting about discussing their symptoms but still, it's kind of hard to understand why some who'd never even met them would have the same constellation of symptoms.

>> Right, and these patients are so highly motivated. All they want to do is get back to work and get back to continue to serve our country. And throughout the course, we have seen what symptoms they experience in the subacute phase and then when we saw them, what they were having, the uniform symptoms, the objective findings,

and the response to rehabilitation. And so, taking all this into account, this is just not the picture that you see with mass psychogenic illness. And again, these patients want nothing more than to go back to the service of our country. And in fact, we, as medical providers, have had to hold them back more to facilitate their rehabilitation because they constantly want to push the envelope and have symptom exacerbation and things, so it's quite the opposite.

>> So, I guess in a nutshell, if I understand this, this is someone who doesn't know much about this syndrome, mass hysteria that is, or any of this, it's the fact that -- I mean mass hysteria, you would expect there to be uniform symptoms of short duration and in this case, there were a lot of similarities but there was some heterogeneity. They were long lasting and there were objective findings and that's the argument against mass hysteria. Is that a good summary?

>> Yes, I would say that. I would say that is correct.

>> There's another aspect too, is that you know there's constellation of symptoms really that resemble a persistent concussion type of symptoms is to understand that and mimic that would require somebody to research it. You know, a group would have to get together, you have to think of some big conspiracy that they research it, practice it, see a series of experts in different fields, be examined, and uniformly convince everybody they have this syndrome. And that includes a couple of the tests that are really virtually impossible to fake. The simpler answer is that there's something real here.

>> Right. And I think that while there are many open questions that remain, we are collectively convinced that these individuals, as a group, sustained a neurological injury. So, the constellation of signs and symptoms and their response to rehabilitation mirrors what we see in patients with, you know, mild traumatic brain injury, both in the civilian population and in our military population -- the veterans coming back from the wars.

>> Given your experience with these patients, if someone thought they were being exposed to a similar sort of radiation, how would they know it and what should they do to minimize the consequences? You know, can they jump out of the way or how do they react to it?

>> So, that's something that we noticed and we use the word directional because several of these individuals described moving out of one location where they were feeling this funny sensation and moving away just behind a concrete wall or to another room was enough to mitigate that. Some then returned to the original spot and then experienced this same sensation. So, clearly, just getting out of the way or moving is one of the main things that should be done. The other thing -- again, back to the directional aspect, is that in addition to mass hysteria, people are worried about poisons and infections, et cetera, but it's kind of hard to reconcile that when you can get out of the way and have symptoms resolved and then can return if go back again. So, this, to us, you know, really points to a -- an exposure to something that's not like a poison or infection.

>> Right and in the overwhelming majority of cases that we report, the immediate onset of symptoms happened and coincided with either sound and or sensory -- or perceived phenomenon. It was an instantaneous thing and then the development of subacute symptoms, over time.

>> Did the symptoms worsen with time or, you know, did they get exposed to this and then no -- immediately have problems or did those problems evolve with time?

>> Yeah, that's a great question. So, in -- let's go back to concussion and persisting symptoms is that patient's either complain that they've had a slight resolution of symptoms but they're still not where they want to be or that they haven't resolved, they kind of plateau and that's why they're showing up at a rehab center. This group -- we're not sure, but there might be a hint that some of the symptoms get worse. I mean, you know, it's the patient's own history that's kind of guiding you but there could have been a worsening of symptoms in some cases, which is very curious to us.

>> Over the days to week or so after exposure -- days to weeks after exposure.

>> And you don't see that.

>> Yeah. And some patients seem to be just plateaued for months. The good news is when they had rehab, uniformly, they've improved, they've all improved. But some just seem to be hanging in this place that is not acceptable to them and then others -- like I said, there's some cases where it seems like, you know, there's according to these individuals that the symptoms actually got worse over time, which you would never see in persistent concussion.

>> There's been a lot of attention paid to the phenomenon experienced by the State Department employees in Havana. You've heard from Doctors Smith and Swanson that they were exposed to some sort of external energy source. The source was associated with a noise. It caused some ear symptoms, maybe some pain. But they also developed a brain syndrome similar to concussion. And that brain syndrome could not possibly have been caused by the noise itself. Doctors Smith and Swanson explained that after a head trauma when patients experience concussion, they have problems with their balance, eye movements, cognition, difficulties with sleeping, and irritability. Those symptoms tend to occur right after the concussion and improve with time. In contrast, the Cuban embassy employees were exposed to some sort of directional energy source. They heard it, they felt it. They could move out of its way. They experienced some ear pain and ear discomfort but then over time, developed worsening symptoms of balance, eye problems, cognition, sleep problems, and irritability, just like having a concussion, but none of them had a history of head trauma. It's not quite clear what's causing this problem but it's a very real problem. Doctors Smith and Swanson also countered the arguments that this could be a mass hysteria phenomenon because in mass hysteria, typically patients all with the same symptoms and that they're short-lived. The Cuban embassy employees had very similar symptomatology, but it was not exactly the same between individuals. It evolved with time and it lasted a long time. These are findings not consistent with mass hysteria. It's not quite clear what happened in Cuba, but something did happen and fortunately, the government has supported aggressive efforts to investigate this phenomena and provide rehabilitation to these employees. I'm sure with time, we'll know more about this syndrome and possibly find out what caused it. But for now, all we know is that these individuals were exposed to some sort of energy source and suffered a brain injury similar to concussion. I'm sure in the near future, we'll learn much more about this syndrome. That wraps up this episode of the JAMA Clinical Reviews. We can always continue this conversation online. You can find us on Facebook, Twitter, Apple podcast, Stitcher or Google Play. If you're on Apple podcast, please review and rate our podcast. It really helps us know how we're doing and makes it easier for other people to find our content. A very special thanks to today's guests who were the authors of the original research report in JAMA published on February 15, 2018 that reports the preliminary findings of the evaluation of the Cuban embassy employees exposed to some sort of directional energy source. Those doctors were Randy

Swanson and Doug Smith from the University of Pennsylvania. Thanks to Lisa Harden who schedules our guests for the JAMA podcasts. Today's episode was produced by Michelle Grazinski [assumed spelling]. Our audio team here JAMA includes Daniel Morrow, Jesse McQuarters and Mike Berkowitz [assumed spellings], the deputy editor for electronic media here at the JAMA Network. Listen to the entire array of JAMA Clinical Reviews and Education podcasts. They include JAMA Clinical Reviews, JAMA Performance Improvement, and JAMA Professionalism. Once again, I'm Ed Livingston, deputy editor of clinical reviews and education for JAMA. Thanks for listening.