



# INTERVIEW TRANSCRIPT

DISCUSSIONS WITH WORLD-LEADING EXPERTS

## **Scents, Chemicals & the Migraine Brain**

Gudrun Gossrau, MD

Professor of Neurology, Headache and Pain Specialist

Technische Universität Dresden TUD

Germany



**Introduction (00:04):** For many people with migraine, the world can feel like it's full of invisible threats. A coworker's perfume, a freshly painted room, or a simple trip down the cleaning aisle in the grocery store can be enough to trigger an attack. These reactions aren't in your head. Research is uncovering how certain smells and the tiny airborne chemicals behind them, called volatile organic compounds, or VOCs, can directly influence the brain's pain and sensory pathways.

**Introduction (cont.) (00:37):** Today we're joined by professor Gudrun Gossrau, a neurologist and migraine researcher, to help us understand why some people are so sensitive to scents, what the science says about VOCs, and how we can reduce the impact of these triggers in daily life. Dr. Gossrau, welcome to the Migraine World Summit.

**Dr. Gossrau (01:00):** Hello, and thanks for the invitation.

**Lisa Horwitz (01:03):** So to start with, can you explain what VOCs, volatile organic compounds, are, and why they're relevant to scents or odors and to people with migraine?

**Dr. Gossrau (01:16):** So, VOCs are basically ubiquitous, available in our daily life. These are organic compounds, as the name says, which are involved in many cosmetics or detergents — things of daily life that we use for cleaning or for disinfection. For instance, substances like formaldehyde. They can have really an impact on your well-being, especially on your nose, on your eyes, and also the respiratory tract.

**Gudrun Gossrau (01:53):** And they work basically with an activation of your sensory nerve fibers, so especially the trigeminal nerve is affected by them. And then they can directly have an influence on your migraine. This is a thing that some people do not think about when they use it in their daily life. But you need really to consider to change and to be very careful with your daily products.

**Lisa Horwitz (02:21):** Are VOCs only things that have odor, or can some of them be odorless?

**Dr. Gossrau (02:26):** They don't need necessarily to have a big odor. The major point of what they do is this activation of the trigeminal system. So they can have also some chemical effects, also direct effects on the central nervous system. So they can also go via the lung into the blood and in the brain.

**Dr. Gossrau (02:50):** And it's like solvents, a solution, and they can even have an impact on the balance of the neurotransmitters — dopamine, serotonin, GABA — all transmitters which are so important in balancing the central nervous system and also involved somehow in migraine disease. And of course, the effect can be a migraine headache, but of course, you can also have general effects from this like concentration problems or dizziness.

**Lisa Horwitz (03:23):** So these — either scents or sometimes not scents — chemicals that are out in our environment, can penetrate the blood-brain barrier, and they can also influence our trigeminal nerve and just cause irritation or inflammation that can trigger an attack and discomfort. Am I getting that correct?

**Dr. Gossrau (03:48):** Yeah. And the other thing is that you have often mixes of it. You can barely think about what is in this mix; there are also examples from daily life. And when you go in a room somewhere, there are different kinds of substances. And it's not easy to say this is that and this is that, but somehow all together — and then you need to be like the inspector and find out what is really the problem that matters for me. But there are also other effects of these VOCs.

**Dr. Gossrau (04:17):** They can also, when they are in a very high concentration in a room, influence your breathing. They can even lead to hypoxia — to the reduction of your O<sub>2</sub> [oxygen] intake —



which is another way they can harm you. I think for migraine, the most obvious is the effect on the trigeminal nerve. But these VOCs can go in many ways.

**Dr. Gossrau (04:41):** They can also cause an inflammatory reaction or a stress reaction and have an impact on oxidative stress in the gingiva. It's basically in the soft tissue in the mouth and throat, so they can have effects when you breathe them in; it can lead to inflammatory reactions. So it can release prostaglandins, cytokines.

**Dr. Gossrau (05:12):** And of course, these are all things that activate an inflammatory cascade where you get a pain reaction because it also stimulates pain receptors. And then there are these people — I think you may ask later about this — but these people with a multiple chemical sensitivity, and for those people, it's especially harmful.

**Lisa Horwitz (05:34):** Is there a threshold concentration or do some patients react to even trace amounts?

**Dr. Gossrau (05:41):** Well, I think trace amounts shouldn't be the biggest problem. I think it is, of course, depending on the amount. So more is worse. And of course, some people are more sensitive. For some people, already a small amount is really harmful and some people can stand a bit more. But after a certain concentration, it's basically for everybody a problem when you breathe it in.

**Dr. Gossrau (06:03):** And where you find it — you find it very often in [paint] when you paint the walls or when you have some glues, something to stick things together. These are the materials that release it. But it can also come from relatively new furniture or if you have a new floor somewhere. All this chemical production or the chemical interior of rooms can release it.

**Dr. Gossrau (06:38):** But another big thing I think that is even more common is really the soaps and detergents and things that you use to clean the floor or that you use to disinfect the floor.

**Lisa Horwitz (06:55):** OK, so we mentioned a lot of things right now that can cause these attacks that might be issues. So if you have a new piece of furniture or you installed new vinyl flooring in your home, is there something you can do to mitigate the compounds coming off of that? Do you need to air out? Does it diminish over time?

**Dr. Gossrau (07:17):** It diminishes over time and therefore it is the best if it's really new to let it basically breathe out and not live directly in it. Or if you have just a piece of furniture, to leave it somewhere where you can lose the higher concentration of these substances. But of course, when you have a newly established floor or something, you should avoid for some time spending long hours there.

**Dr. Gossrau (07:47):** Of course, sometimes this is not possible or sometimes it's forgotten, and then people also react. This happens. There are examples. There is work medicine, and in work medicine, often these topics are very relevant where people and employees get problems in the work environment.

**Lisa Horwitz (08:10):** In regards to things that we buy for our home, like detergents, dish soaps, body products, are there certain chemicals that we can find on the label that are good to avoid?

**Dr. Gossrau (08:26):** Well, it's individual, because if you speak really about cosmetics, there shouldn't be primarily toxic agents in it. So it should have a seal for environmental tests, something like this. You should look that you get a better product if you use it for your body or for personal belongings.



**Dr. Gossrau (08:47):** But on the other hand, even good products, if they contain, for instance, something that is activating the trigeminal nerve, don't need to be something really harmful, because it can be a kind of smell. And if you individually are very sensitive to it, it can be a problem. In reality, it's not necessarily bad, because we have been talking about VOCs so far as toxic things that are in some detergents or in some products or in inks.

**Dr. Gossrau (09:22):** But of course, VOCs, in principle — let's say a relatively harmless odor — a smell is also a VOC in a way, because they are often not very stable. But still, it can be like an organic substance that you really smell, and we also use it when we do, for instance, a smell training that we use sniffing sticks for. They are also carrier substances from this organic background.

**Dr. Gossrau (09:54):** But also this artificial smell — we use also sometimes organic substances. So I just want to say that it is not necessarily like a poison or something really problematic. It can also be a harmless odor. It is also something where you don't even think about it as a problem, and especially when you think about our patients, some of them really get problems with, let's say, high-quality products, or in general when they are more exposed to it.

**Dr. Gossrau (10:31):** I do have a patient, for instance, and when she started to work as an employee in a drugstore, there were so many different smells and things, she couldn't stand it. She had to quit this job because it was terrible. And now she has something where it has relatively less, in a bakery, it's not a problem, for instance. So this of course has an impact.

**Lisa Horwitz (10:56):** An impact, yeah, across your entire life. This makes me think of: How does osmophobia, the sensitivity to smells, differ from having odors as a migraine trigger?

**Dr. Gossrau (11:08):** It is basically here that the migraine attack — some people have an aura, some patients like up to 25%. And then you have here photophobia and phonophobia, but also osmophobia. And this is what we are really talking about or what we are really interested in.

**Dr. Gossrau (11:27):** And this is a study that we did in migraine patients where we asked them basically when they do have their osmophobia: whether it's just before the migraine attack, during the migraine attack, or also in between the attacks. And we asked also how many of them would have really a smell or odor triggered migraine attack. And there were like 30% of patients saying that really a smell can trigger an attack.

**Dr. Gossrau (11:54):** And we saw that just right before the attack comes, 38% have already osmophobia. During the attack, it's like 62%, or almost two-thirds. But also in between the migraine attack. So normally when everything is peaceful, let's say, also almost one-third of the patients do show osmophobia. So this means that even in between the attacks, their life is not really normal, [from] what we know.

**Dr. Gossrau (12:20):** But also in terms of senses, in terms of reactions to odors in their daily life, it is influencing a lot. And we asked our patients which type of odors would be especially nasty for them. The highest percentage, or the most unpleasant odor, was basically sweet perfumes — which you have in daily life a lot. If you have somebody crossing the street just next to you with a very sweet perfume, perfume can be a problem. But the other thing is also a food smell.

**Dr. Gossrau (12:57):** So basically, you have a piece of meat — a roasted piece of meat — something like this is nasty. Cigarettes. Of course from cars, [the exhaust]. In general, also rooms with bad air quality — but even flowers. Of course, the [paint] when used to color some car or something, this is a problem. Or even nail polish, which also is very chemical; gas; and some other things.

**Dr. Gossrau (13:33):** Yeah, but you wanted to know the difference between the osmophobia and really the odor-triggered migraine attack. So basically, there is a difference, but somehow [they] go



into each other, so it's a continuum basically. So some patients are especially heavily affected — you really give them a smell and they get their migraine attack. We saw it in our studies. They basically could see that migraine attack would start like 120 minutes on average after the patient got this special odor.

**Dr. Gossrau (14:06):** So it took like two hours to induce it. And it was especially seen in about one-third of migraine patients who got a migraine triggered by the odor. And then in this study, they also investigated patients with tension-type headaches, with other primary headaches. And there, none of them would get a headache attack induced by the smell. So it was something specific to migraine, obviously.

**Lisa Horwitz (14:33):** So we covered a lot in that question, and I don't want this to slide by; is the fact that when you were doing the research, that people with headache but not migraine did not have pain induced from odors?

**Dr. Gossrau (14:53):** This was actually a study from Spain, and they could clearly show that it is something relatively specific for migraine that you can really trigger in about one-third of patients.

**Lisa Horwitz (15:04):** Could VOCs hitting the area postrema [a structure in the brain that serves as a toxin sensor] be causing some of these issues? One of our community members asked this question.

**Dr. Gossrau (15:11):** The connection on an anatomical level between the olfactory and the trigeminal system — they are very close with each other, interacting almost. So there is already in the periphery of the body, in the nose, a direct connection between the trigeminal nerve and the olfactory nerve. So there is a very close intermingling between these two senses basically, on the peripheral level but also on the central level. And this is where we expect a lot of this work.

**Dr. Gossrau (15:46):** What we mainly want to shape, we see in the clinic of the osmophobia, because we do also have a big outpatient clinic for children and adolescents. And we see clearly from the olfactory side a difference between migraine patients who are young and who are older. What we investigated is the so-called smell test; so basically the olfactory function in patients. And we could clearly see that patients with migraine have lower olfactory function than patients without, as in healthy patients.

**Dr. Gossrau (16:24):** Everybody expected it differently, but it was like this. And interestingly, patients who have migraine with aura are even less well able to really distinguish different smells. Here was investigated the olfactory bulb, the organ of smell where also the neurons are located. And there was a measurement of the volume.

**Dr. Gossrau (16:52):** And you would also think that somebody who is extremely sensitive to smell and also therefore osmophobic like a migraine patient would have a huge olfactory bulb because it is so sensitive. And in fact, in the study, it was the opposite — those patients who are very sensitive to smell had a much smaller olfactory bulb than the others. And they had also a less good olfactory function.

**Dr. Gossrau (17:21):** And this goes along with the fact [that] if you are afraid that a smell can trigger your migraine attack, you avoid it. And when you avoid smells in general, which happens then often, also your olfactory function becomes less good. And this is the important way that we see. It is like almost a behavioral thing also, because when I know a smell can induce my migraine, I avoid smells. But this means that in general, I avoid smells and I do not have such a good olfactory function anymore.

**Lisa Horwitz (17:56):** The studies have found, which is kind of crazy, that the olfactory bulb in people with osmophobia and migraine patients is actually smaller than in people without it, which



seems counterintuitive because we would think if you're more sensitive, that means you're receiving more stimulus and data and information. But that's not the cause.

**Dr. Gossrau (18:21):** Yeah, but for this, I need to go back to what I started to say about the children and the adolescents, because we did study olfactory function in children and adolescents. And there we saw that they are actually very normal in their function. So this means this process of osmophobia, and fear of a smell seems to really change the behavior towards smells. And as a reaction or as a result of this, you avoid smells and you lose a part of your ability to smell things.

**Dr. Gossrau (18:57):** We have patients who lose, [among] other things, their smell, their olfactory potential. And you give them, every day for like three to six months, things to smell and they really improve, like a training. And this means that the threshold that they start to smell things is becoming higher and higher in a way that — let me say it now correctly — that they can smell better and better higher solutions of the odor. So over time, they increase their ability.

**Dr. Gossrau (19:32):** And we do in migraine basically the opposite. We avoid more and more of the smell and it needs to have then finally more and more concentrated smells to really smell something because we always avoid. We make sure by learning. But what we saw in our patients — because we did with them, also with migraine patients, a smell training. And in the smell training, they could really choose only smells which they really liked and which they were also feeling comfortable with.

**Dr. Gossrau (20:04):** And with this, over three months, we could see they could improve their ability to smell and none of the patients got a migraine attack. So there is a lot of taking [in] the right smell. So it means taking a smell and odor which activates mainly or almost only the olfactory nerve, because we have many odors which activate the olfactory nerve, but also the trigeminal nerve. Many of these — peppermint, whatever — there's always a little bit of a trigeminal component.

**Dr. Gossrau (20:36):** And when you activate this a little bit, this plays into your migraine. And therefore, the patients, when they take something that is, let's say, harmless, like white chocolate or something, then they don't induce the migraine attack. What we found is also that basically, age together with disease duration has an impact — patients who have a longer disease duration have more of osmophobia in percentage also. And also chronic migraine patients have also higher amounts.

**Dr. Gossrau (21:04):** So more disease load. So it leads you to even more of this osmophobia, which comes together with this behavior of avoidance of smells. And we did not really discover everything yet [from] this. We have to continue. But we know for sure that this interplay between the olfactory and trigeminal system is very important.

**Dr. Gossrau (21:25):** And there exists one animal study even on this. So a researcher from Heidelberg did it with mice. And what they did is they put mice in different cages. They had in one cage a very, let's say, nice smell; one unusual; and in one a very aversive smell. And then afterwards, they were giving them during this time little pain stimuli. And then it was a bit hard because they investigated later what happened in the trigeminal nuclei in the brain stem of these mice.

**Dr. Gossrau (22:03):** But they could see that these mice who had been in the cage with a very positive smell had less of a pain reaction on the cellular biological level. So this is another thing we can, with a pleasant smell, obviously influence. But I think we really need to put [in] more research to get to really the right time point. Obviously, in childhood, the osmophobia behavior is not yet so dramatically expressed, [from] what we see.

**Dr. Gossrau (22:38):** And it comes then, I think, over a lifetime. So we need somehow to do something to change our behavior, but also to find out more about what really triggers, then, about the smell to really have it more as a therapy.



**Lisa Horwitz (22:57):** Is it that children don't have as much negative reaction to it because they don't associate certain smells yet with pain? Is this part of neuroplasticity — that people need to do some sort of brain retraining so that they can feel safe around scents again?

**Dr. Gossrau (23:14):** In part, but only in part, because there is a lot of real biological messaging between the trigeminal and olfactory system. And in terms of children, you need to know that the olfactory ability is increasing with age. Basically, when children are something like 14 or 15 years, they have a very well developed sense of olfaction. But for instance, children of 5 years of age or 7 years, they are still basically improving year by year.

**Dr. Gossrau (23:49):** It's also about — they need to learn the different smells and train. But then when they are 15, they have really reached a good quality of assessment of smells and abilities of olfaction. But this means also, the younger the children, the less they can already allocate a smell by knowing to realize the smell is that. And the other thing is also the olfactory threshold is still improving.

**Dr. Gossrau (24:24):** So there is a development — and for sure it is neuroplasticity — because you see also in the olfactory bulb that I showed you, this is pure neuroplasticity because the olfactory bulb is this region in the adult brain that is able to still increase; normally we don't have this so much. But the olfactory bulb is, of course, that place of regeneration, basically. So I think that we need to do certainly more research. But this is extremely interesting.

**Dr. Gossrau (24:53):** And of course, it has an effect for daily life that we need to tell our patients, “Yes, you need to be careful because it can trigger.” But if you do not lose so much of your olfactory ability, it is probably better and it probably prevents this vicious circle that we have.

**Lisa Horwitz (25:16):** So how do you advise patients who are walking that fine line between not wanting to lose olfactory presence, skill — I guess you could call it a skill — but also don't want to have an attack triggered every time they leave their house? How do you navigate that?

**Dr. Gossrau (25:35):** Now, first of all, you need to find out whether the patient belongs to this up to 30% who really has a very solid attack answer to a certain smell, because if you have a patient who always gets an attack after a certain mixture with, let's say, peppermint and something else, you cannot convince these patients to take a training with peppermint. This doesn't make sense.

**Dr. Gossrau (26:03):** But we need to have other patients who are, of course, afraid, but who see if they have harmless smells like pure olfactory or almost pure olfactory, that they can have it. This is an important thing because this phobic aspect is a psychological aspect that comes with it, this fear — we need to address that. But we need to do a fine phenotyping of patients because, as you know, everybody's individual. We cannot treat one group the same as others. So there will be a group that can go relatively more normal through life. But one group needs to be a bit more careful.

**Lisa Horwitz (26:46):** Would you advise people to wear a mask in public if they have issues with running into people with perfume or if they have problems, maybe, if they are visiting someone in the hospital? There's a lot of chemical smells and cleaning products there. Is that something you advise or something we want to avoid?

**Dr. Gossrau (27:05):** So if you are in this high-risk group, then you'll be a bit more careful. And then we would advise that you avoid certain kinds of chemicals. But if you belong to the two-thirds of the other group, then we can tell you, yes, it is, of course, that you are osmophobic in the attack.

**Dr. Gossrau (27:23):** But if you continue to expose yourself to rather harmless smells, you will in the end have a better outcome and you will have less of a chance to increase more and more osmophobia. But this is something that I discuss with my patients. This is something that we need also to study in



bigger prospective studies now that we really have this grouping. I believe it is like this, but we need to do more research on this. But I think it's relevant.

**Dr. Gossrau (27:55):** And there are also patients from the work environment who really get triggered migraines and headaches just because they change a certain detergent in the clinical environment. We have lots of nurses with migraine and this is, of course, a risk factor for them.

**Lisa Horwitz (28:15):** We do know that the migraine brain loves stability. So anytime you change an odor that you use in your daily life, you can mess up your whole system. People in our community were also asking, is there a chemical that is similar in all of these triggers?

**Dr. Gossrau (28:32):** We are not yet there that we [can] say there is this one. I think it is quite individual, but for sure, usually there is a trigeminal activation by it. One other thing — it is also interesting that migraine patients with aura and without aura seem to differentially elaborate on smell.

**Dr. Gossrau (28:55):** So basically when we activated them with different trigeminal and especially olfactory stimuli, they showed a different pattern in the high-resolution EEG (electroencephalography). So meaning that a patient who has migraine without aura showed different brain potentials after stimulus than somebody with a migraine with aura. And this already tells us that these two groups should be treated differently. And this is also something you need to consider whether in general, when you have a migraine with aura, that you need to be more careful than if you have migraine without aura.

**Lisa Horwitz (29:42):** So I want to make sure that I absorbed this correctly. Your studies are finding that patients who have aura may have more sensitivities than patients without aura.

**Dr. Gossrau (29:56):** What we did in this study is to see that there is a different way how the brain of patients with migraine with aura reacts to, let's say, a chocolate stimulus compared to a patient with migraine without aura. And this is already telling us that there are obviously differences. I mean, there are some works about it that this is not really a distinct disease, but there are some clear differences, of course.

**Dr. Gossrau (30:27):** But also this is for the future; we need to consider this when we have to counsel patients or we have to give some advice. So this is obviously important that with aura, you should be a bit more careful with odors.

**Lisa Horwitz (30:47):** That's really good to know, because I think sometimes people who have aura may feel that way, but without concrete scientific evidence, they might not feel comfortable enough to advocate for those extra steps for themselves, whether it's extra medicines or whether it's being more assertive in the workplace and asking for extra protections. So I'm really glad you brought that up. So we've mentioned that smell test several times, and I want to make sure I'm understanding correctly.

**Lisa Horwitz (31:18):** It's important, especially for people who have scents as triggers, to continue to have exposure to scents, because you don't want to lose your ability to differentiate between odors. It's almost like when we had COVID and people lost their smell, you made them smell a bunch of things to bring back [their sense of smell]. Is that similar to what's going on?

**Dr. Gossrau (31:43):** This is similar with the one point that in migraine patients who know their triggering odors, sometimes you need to be careful that in your training you involve more odors which are mainly olfactory stimulating. So this is like chocolate or rose. I would start really with pure, single smells. Also, when we did the smell trainings in the study, the patients had 10 different smells that they could choose.



**Dr. Gossrau (32:21):** And they have chosen a lot of rose, but coffee also; they liked it a lot. And what we could also see [is] that over time, there is more of an acceptance of the citrus smells. You activate the trigeminal system with it, and there is over time more acceptance. And these are the things where you asked me for neuroplasticity; yes, there must be something.

**Dr. Gossrau (32:48):** And I think it is also more like a steady state between these two. There is the olfaction on the one side and the trigeminal activation on the other, and one goes up [*makes balance gesture*]. So you need to balance them well, because otherwise, if the olfaction goes too low, you have too much trigeminal [activation], too much migraine. And when you have some balance, it's better for you.

**Lisa Horwitz (33:08):** That's so interesting.

**Dr. Gossrau (33:09):** If you understand what I want to say, hopefully.

**Lisa Horwitz (33:10):** Yeah. So if you're not getting enough olfactory input, it can affect the trigeminal nerve.

**Dr. Gossrau (33:19):** Yes. It makes them more sensitive, actually.

**Lisa Horwitz (33:22):** That's wild.

**Dr. Gossrau (33:24):** Yeah. But the point is that for this, this is what we think from our studies and how we build our hypothesis. In principle, we would need to do now studies showing that really with olfaction you can clearly influence certain brain areas that are responsible for the trigeminal or migraine. I mean, this would be good if you would have olfactory input and with this you can silence a certain pathway.

**Dr. Gossrau (33:54):** So this would be really cool. I don't know whether we will get it, but this would be definitely very helpful to prove this. Because for our point now, we are on a more hypothesis level — here and there we have a little mosaic piece that tells us, yes, it's probably right. But it's like a universe of itself and you can definitely work more on it. But of course, you need also to take the important messages to the clinic for the patients.

**Lisa Horwitz (34:25):** Is this where you think the research needs to move towards?

**Dr. Gossrau (34:27):** There are not many people doing research with olfaction and migraine, actually, because I think in general olfaction is not a very common thing. It just pops up like this. You said the pandemic time and many people were affected. But in reality, if you look a bit closer to olfaction, it affects so many parts of our life, from so many psychological things. People who are depressed, they also lose their olfaction, or the other way around. If you cannot smell anymore, you also get quite sad. You cannot enjoy your food anymore and so on.

**Dr. Gossrau (35:02):** So it is a very complex thing. It's a very old sense. But of course, other things are maybe more pronounced often. But I think it's important, especially for migraine, because migraine is a disease of senses. So you should not neglect one of the oldest, archaic senses.

**Lisa Horwitz (35:24):** Is there anything else you want our audience to know that we have not covered today?

**Dr. Gossrau (35:30):** Well, I would maybe encourage patients, if they face an increase in their migraine frequency by changing work or changing situations at work, that they try to check several levels. What could be the reason?



**Dr. Gossrau (35:54):** But they should not forget to check also this side, as I told you from these nurses who increased their problems because they changed the substances in the soap that they used there. You should be open-minded in this direction and consider that there could be a problem, for instance.

**Lisa Horwitz (36:16):** And could something that you used in the past become a problem in the future? Like, "I always use this brand of soap and it hasn't changed." Should I consider that even as a possible trigger?

**Dr. Gossrau (36:28):** Patients who are more and more chronified towards chronic migraine become more and more osmophobic. And at the same point, they lose their olfactory ability. So, of course, the whole thing has an impact. And of course, time and treatments. But I can also imagine that nowadays with better available therapies, we face hopefully less chronic migraine patients. This would be the ideal situation. Also, with this, you would need to make sure that everybody who needs it gets it at the right time.

**Dr. Gossrau (37:01):** And this is also a topic that we face here in Germany, because, of course, there is always the financial aspect. But one should not underestimate the fact of this chronification and the brain plasticity that comes with it.

**Lisa Horwitz (37:17):** Are there any resources you'd like to recommend or offer to our audience?

**Dr. Gossrau (37:21):** We have a big awareness campaign running. It's called Attack! Together Against Headache and Migraine. So we are working on that. And I can see that slowly things are changing because it's a lot of work that you need to do in different levels of society, among colleagues and in the medical field, but especially in society and in schools for children.

**Dr. Gossrau (37:45):** This is maybe my other major message that I would give you, that one really should take care of children and adolescents with migraine. This evening before I came here, I had just this interdisciplinary treatment group that we established for adolescents with headache and migraine. And you see how many young girls especially are facing chronic migraine at the age of 16 or 17. And then I see them some years later and I see how much it impacts their life and their education. And this is where I say you need really early on to take care of these young patients.

**Lisa Horwitz (38:25):** I could not agree more. In relation specifically to smells or volatile organic compounds, are there certain protections we should be asking for in the workplace?

**Dr. Gossrau (38:38):** It's an important question because, in reality, somebody who is very sensitive should have possibilities not to work in areas that are mainly polluted with smells or things that could trigger the migraine. And there should also be a possibility for an employee to change the workplace directly or to [take] breaks and so on. But in principle, if the workplace is a bit contaminated, it's probably best to choose a different place. Because even if you go outside and have your breaks, if this is possible, you still come back. And this is usually not the best.

**Lisa Horwitz (39:19):** I want to thank you so much for your time today. We have explored so much and my brain is still reeling from how much information you've given us. But yeah, this was great. Thank you so much.