

**Invisible Scars: How Domestic Violence Victims Have Been Left Out of the Discussion on Traumatic Brain Injuries**

by

**Heather Mongilio**

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Program in Comparative Media Studies/Writing

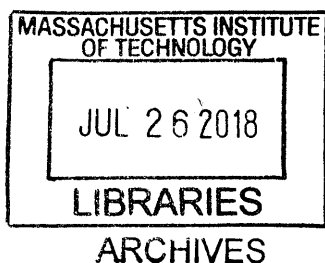
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Certified by: David Corcoran, Associate Director of the Knight Science Journalism Program

Signature redacted

Accepted by: Seth Mnookin, Associate Professor of Science Writing  
Director, Graduate Program in Science Writing



**Invisible Scars: How Domestic Violence Victims Have Been Left Out of the Discussion on Traumatic Brain Injuries**

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**Submitted to the Program in Comparative Media Studies/Writing  
on May 18, 2018 in Partial Fulfillment of the Requirements for the  
Degree of Master of Science in Science Writing**

**ABSTRACT**

Traumatic brain injuries are one of the most common injuries in domestic violence, with studies finding that approximately 75 percent of women tested report at least one TBI. These injuries leave invisible scars in the form of memory problems. But despite the large prevalence of TBIs in the population, there is a lack of research, stunted by both funding and a lack of subjects. The trouble with research extends to chronic traumatic encephalopathy, a degenerative disease caused by repetitive hits to the head. Although domestic violence researchers suggest that the population will develop CTE, which is only diagnosed post-mortem, a lack of donated brains means the disease has yet to be found among domestic violence victims.

**Thesis Supervisor: David Corcoran**

**Title: Associate Director of the Knight Science Journalism Program**

She hoped she was just sleep-deprived, but she feared she was getting early onset dementia. Perhaps that would explain all the problems with her memory.

It was 15 years ago, when Freya, then 32, started noticing difficulties with remembering words. And in recent years, the problems have gotten worse.

“I will be talking to somebody about something and part way through the conversation just all of the sudden stop dead because I don’t remember what I’m talking about and I’ll just say, ‘What was I talking about?’ I forget words all the time. I forget names of people I’ve known for years,” said Freya, who asked that her real name not be used for her safety.

It wasn’t until recently — when she saw a news piece about a study by a doctor at Massachusetts General Hospital — that she was able to put a name to what was happening: traumatic brain injury, or TBI. Almost three decades ago, when she was a young wife in an abusive relationship, Freya had probably sustained as many TBIs as an NFL player, the result of her husband repeatedly slamming her head into doorways or strangling her.

The stereotypical image of a domestic violence victim is often a woman with a swollen, black eye trying to cover up her bruises. But mild traumatic brain injuries are invisible.

They don’t leave bruises and often don’t show up on scans. And they are invisible in another way: For all the attention to mild traumatic brain injuries in male athletes, the research on TBI survivors of domestic violence hardly exists.

There are anecdotal studies that ask women if they have been hit in the head, but few look at the cognitive impairments from mild traumatic brain injuries. Fewer yet look at the effects of brain damage from strangulation, an all too common feature of domestic violence.

The lack of research is stark when compared to the rising number of studies on mild traumatic brain injuries in men and the increased attention toward chronic traumatic encephalopathy (CTE), a degenerative brain disease thought to be caused by repetitive blows to the head. The disease, which can be definitively diagnosed only by a post-mortem brain autopsy, was made famous after it was found in former NFL players and was the subject of the 2015 film “Concussion” starring Will Smith.

CTE has not been diagnosed in victims of domestic violence and there are no current studies looking for it. There are few female brains available to research, let alone ones from domestic violence victims. But researchers say it’s likely that these women will develop the disease, pointing to repetitive hits often experienced by victims, which are what lead to CTE.

But before researchers can look for CTE in the brains of these women, they need to first establish that domestic violence victims have lasting damage from TBIs. And one researcher has turned to the brains of living victims to prove that TBIs can leave permanent cognitive scars.

## **The researcher**

Eve Valera has studied domestic violence (also known as intimate partner violence) for approximately 20 years, after volunteering in a women's shelter as a graduate student. Valera's background is in psychology and neuropsychology, and she earned her doctoral degree in 1999 from the University of Illinois-Urbana, where she wrote her dissertation on brain injuries in battered women.

Now as a Harvard Medical School professor in her late 40s, working from a small office on the Charlestown campus of Massachusetts General Hospital, she is pioneering research using brain imaging in women with TBIs from intimate partner violence. She has an academic tone as she talks about the injuries her subjects have received. But when she talks about the lack of research into the brain injuries she's seen in the women who come from pasts filled with domestic violence, she has trouble hiding her feelings. As she discussed her latest troubles getting organizations like the National Institutes of Health to fund her research, her voice rose and sharpened in frustration.

In 2003, she co-authored a study looking at the prevalence of TBIs in battered women from shelters and found a staggering number — of the 99 women studied, fully 75 percent had at least one TBI. Now, she is turning to neuroimaging to find evidence of lasting damage from the TBIs. She is one of the only researchers to use neuroimaging to look at cognitive impairments in domestic violence victims.

Valera's current research extends beyond how many victims have such numbers. She is now looking at what happens when one occurs and the lasting effects an injury will leave. Freya knew about the long-lasting effects of TBIs because she had a friend who had one following a car crash. But until she read an article about Valera's work, she "had never put two and two together" about her own symptoms, she said.

## **Freya's story**

Despite her memory problems, Freya (now 47) vividly remembers the worst attack, which landed her in the hospital with a concussion. It started when her then-husband threw her off the porch at their home in North Carolina, she said. He jumped on top of her, slamming her head into the ground and punching her. When she had a chance to escape and ran, he chased her down the street.

The next thing she remembers, they were back at home, and he jumped on her while she lay on the bed and started strangling her, Freya said. It was the early 1990s. She was 19 and had been married almost two years.

"I vividly, vividly remember seeing myself on the bed with him on top of me, floating away. And then all of the sudden I was back," she said.

They had met while she was still in high school. He was in the military, and she had moved to North Carolina to be with him after she graduated. They lived near one of the bases in the state. When his job was stressful, he took it out on her. The beatings where he slammed her head into a doorway were common. Often he'd hold her head underwater or wrap his hands around her neck to strangle her.

But this time, he strangled her until "he thought I was dead."

When she went to the hospital 28 years ago, only one person, a paramedic, asked Freya if her husband had caused her injuries. He was standing next to her, so she lied. She was diagnosed with a concussion at the hospital, she said, and then sent home with him. She was ready to leave the relationship at that time, but she said he threatened to kill her family, and she believed him.

She was dizzy and had migraines from the concussion, and while she often needed to be in a dark room or sleeping, her husband expected his dinner on the table. So the abuse, which included slamming her head into the doorway, continued while she was attempting to recover from the concussion.

That was the final straw for Freya. In the following months, while her husband was at work, she would contact her family and plan. Nine months after she left the hospital with a concussion, she was able to leave her husband. The day he left for a work trip, Freya said she kissed him goodbye and flew to her mother's house using a ticket that her grandfather bought her.

Freya has since remarried twice, most recently in 2012, and now lives with her current husband. He's retired from the military, and the two met online. She works as an office manager in a dental office west of Boston, a job that is challenging but rewarding.

Because she has trouble remembering more than two ideas at once, she often has to ask people to repeat what they said. If she has a thought, she has to share it, even if it interrupts the natural flow of the conversation. The thought is a bull in her head, charging to get out. Sometimes, she has to repeat the sentence twice so her brain realizes that she's finished her thought.

Other times when she starts a sentence, Freya suddenly cannot remember the word she needs to say next. She knows the word, she could even define it. She just doesn't remember it.

She likes to sing and crochet, hoping to keep her brain busy. She calls herself "the Post-it Note queen," because she has to write everything down before she forgets. Her cognitive impairments aren't noticeable from one or two conversations, and anyone who stopped to ask her a couple of questions probably couldn't tell that she is dealing with a brain injury. And she's made adjustments to account for any troubles from her brain. She's "the little engine that could," she said.

## **Damaged connections**

But what causes women like Freya to have lasting cognitive impairments from injuries sustained decades ago? That's what Valera is aiming to learn. She is expanding on the research that has determined that victims do have TBIs, and is using neuroimaging to see what damage their injuries left. She is the author of two imaging studies, one published in October 2016 and one soon to be published.

“And so that's all the research out there on imaging and TBI in these women. That's it. That's all I know of,” Valera said.

Each brain injury is different. The force of the hit matters, as does the spot where it lands. When the head is jarred, as in a hit or bump, and there is acceleration or deceleration, the brain will rattle against the skull. Eight strong bones fused together to protect one of the body's most valuable organs, the skull is so strong that a man couldn't crush it if he stood on it. (He would have to weigh more than 1,000 pounds to fracture it.) Inside, the skull floats the brain, tethered to the rest of the body by veins, arteries and the spinal cord.

The brain is not a solidified organ like the liver or heart. Instead, it has a consistency more like jello or a chunky pudding, which means the brain can easily slosh around in the skull. And so the skull, which is meant to protect the brain from the outside world, can quickly become its enemy.

Even more important is what happens on the cellular level. The brain is made up of two different types of material. There's the grey fatty matter made up of the bodies of neurons and supporting brain cells. Then there's the white matter, which is made up of axons, which project like arms extending from the cell's main body and help neurons communicate with each other.

When the brain is jarred, axons are stretched. They can heal, like a tendon or an elastic band stretched past its limit. But stretch the band too many times and it cannot go back to its original shape — it cannot heal. Damage to the white matter is likely the cause of the memory issues following a TBI, Valera said.

Severity is determined by a battery of tests. How long was a person unconscious? Less than 30 minutes means a mild brain injury. It also comes down to a score on the Glasgow Coma Scale, a measurement used by doctors and emergency personnel that evaluates a person's eye, motor and verbal responses following a head injury.

Many experience confusion or disorientation and might see stars or spots. Mild TBIs are often accompanied by headaches, a period of cognitive difficulties and psychological symptoms, such as anxiety, depression and irritability.

Depending on the severity, most brains recover from mild TBIs, and symptoms can resolve in a week to three months, especially for the first concussion. But Valera said that sometimes symptoms don't ever go away. Furthermore, every subsequent concussion will take longer to

heal, and once someone has one concussion, the chance of getting another goes up due to the initial damage from the TBI. And if the brain doesn't have time to recover, another injury could easily occur.

To study the damage left by a blow to the head, Valera employs diffusion tensor imaging, a type of neuroimaging that uses an MRI to look at the white matter made up of axons in the brain. Neurotransmitters, the chemical messengers in the brain, travel along the axons of one neuron to the next. But like limbs on a tree, the axons can break or be damaged. Diffusion tensor imaging, unlike a typical MRI scan, can see the breakage in the white matter tracts. Cognitive impairments, like memory and attention problems, are thought to be caused by widespread lesions in the white matter, according to Valera's 2016 study.

The study looked at 20 women, whom Valera found at shelters or by word of mouth. She performed the diffusion tensor imaging while the women were in resting state — lying in the MRI machine without being given a specific cognitive task. Looking at the whole brain when the women were in the scanner, she examined functional connectivity, the correlation between activity in separate brain areas.

Different parts of the brain work together to form networks and perform functions. It's as if each part was a member of a relay team trying to win a race. The default mode network is the largest network, running from about the middle of the brain to the front. It includes areas associated with the brain's control center, memory and thinking about oneself or others. Valera found damage associated with TBIs in that network and the salience network, which is linked to prepping the brain to act.

### **'Too many to count'**

While Valera is pioneering research using DTI, she still has to rely on some flawed tools. She interviewed the women using questions based on the diagnostic criteria for a traumatic brain injury, but even asking women about TBIs has problems. For one, she couldn't depend on medical records because abused women, in general, often do not go to the hospital after an attack, according to the study.

She also couldn't ask women if they'd ever sustained a mild traumatic brain injury because it's an unfamiliar term to many. For women in abusive relationships, a knock on the head may not seem as serious as an injury that leaves a mark like a bad bruise or broken bone, Valera said.

“When I say, ‘After anything your partner ever did to you, did you ever see stars or spots? After anything your partner did, did you lose consciousness? Or after anything your partner ever did to you, did you ever not remember a certain period of time around that incident?’” Valera said. “And that's what will get them to say, ‘Yeah, one time we were arguing and he hit me and the next thing I remember I was in the other room.’”

When she asked the women about times they saw spots or lost consciousness, she said about half of the women studied said it happened anywhere between one to eight times because “they can actually count them,” she said.

“But then a lot of the women were saying, ‘Oh it happened like a couple times a week for years.’ We put it in the too many to count category. So it’s well over 16, well over 25, and at that point, we don’t even try to count after that,” she said.

The study also counted times that a woman had been strangled, asking if they had experienced an altered state of consciousness, like dizziness or being dazed (because strangulation can also damage the brain).

According to the study, all women reported one mild TBI, with 75 percent reporting multiple.

“The bottom line is the women are sustaining brain injuries, and a lot of them are sustaining them at alarmingly high rates. So that is what I see as a big problem,” Valera said. “Women don’t necessarily realize these are potentially problematic.”

### **When a woman is strangled**

There’s a subset of TBIs that are even more invisible — the ones caused by strangulation. Most definitions of TBI say it is caused by a blow to the head, but strangulation can also cause brain damage through anoxia (oxygen supply to the brain is cut off) or hypoxia (decreased oxygen supply).

About half the time, strangulation often leaves no bruises. But it often leaves a sign in the eyes — broken blood vessels called petechiae. In severe cases, they can make the eyes look bloody. (Freya said her eyes’ alarming appearance was the reason her husband let her go to the hospital after he strangled her.)

Petechiae in the eyes are one of the common signs that a person has been strangled, and intimate partner violence advocacy experts often teach first responders to look for petechiae.

“One of the scariest things about it, it only takes a little more pressure for the person to be killed by being strangled,” said Jacquelyn Campbell, a nurse and professor at the Johns Hopkins University School of Nursing and a leading expert in domestic violence and strangulation.

Even if it isn’t fatal, strangulation can still cause a brain injury, she said. And it can happen in one of two ways.

The first, a chokehold, puts pressure on the carotid arteries in the front of the neck, preventing oxygenated blood from getting to the brain. The second, a forearm to the sides of the neck, puts pressure on the jugular veins, preventing blood from coming out of the brain. Besides killing brain cells, either kind of strangulation can cause a stroke, Campbell said.



Gael Strack, the executive director of the Training Institute on Strangulation Prevention, said that when victims do go to the hospital or talk to police, they might not always remember that they've been strangled due to the lack of oxygen to their brain. That means their recollection of events may be inconsistent or jumbled, and especially for police, it might appear as if they are unreliable witnesses. The training institute works with emergency personnel to train them to look for signs of strangulation, Strack said.

"It's almost like [you should] assume someone's been strangled unless they say otherwise," Strack said.

Research on strangulation and TBIs is complicated because most intimate partner violence victims report physical blows to the head and strangulation, so it's not easy to separate what damage is from a hit and which is from the lack of oxygen, Campbell said. (One key difference is that strangulation does not cause the breakage of axons that leads to CTE.)

The research used to be segregated, but researchers like Campbell and Valera are now looking at strangulation as a cause of TBI.

It's also a warning sign of the relationship turning fatal. Women who are strangled by partners are 750 times more likely to be killed by their abuser than other battered women, Strack said. And as with hits to the head, women often don't go to the hospital or call the police when they are strangled. That means they aren't getting assessed by a doctor or nurse for injuries to their neck or brain.

While Strack deals specifically with strangulation, she frequently speaks to women who have symptoms or diagnoses of mild traumatic brain injuries, many of whom have difficulty getting the treatment or resources that they need. Victims call the organization happy that they can put a diagnosis to their symptoms, Strack said.

"They think they're going crazy. They know there's something wrong with them. They're having difficulty paying attention, remembering things, they're getting put on probation [at work], they are being fired and they should be put on long-term disability," Strack said. "Well, you can't get all these things in place unless you get a specialist to diagnose you that you have suffered a traumatic brain injury."

### **Many victims, few studies**

Freya is far from alone. The National Domestic Violence Hotline estimates that one in four women, and one in seven men, have been a victim of severe physical violence by a romantic partner. Approximately 15 percent of women have been injured as a result of a domestic violence incident that involved rape, a physical attack or stalking, according to the Hotline.

One of those women is Audrey Mabrey, who separated from her husband in 2009. The two got along well, with Mabrey sharing the house with him immediately after their divorce, she said in

an interview. And even though she ended up getting her own place, her ex-husband, Christopher Hanney, convinced her that her new home wasn't safe, so she started spending the nights at his.

In November 2009, Mabrey stopped by her ex-husband's place in between her work and school. She went for a jog, and when she returned, her ex-husband was naked in her garage and holding a butcher's knife, she said. He then charged at her. During the attack, Hanney attempted to sexually assault her and bludgeoned her with a hammer. He then doused her in gasoline and threw a lit candle at her. She was 26.

Hanney was sentenced to life in prison, but Mabrey, who now lives in Florida, still carries the scars from his attack. She spent six weeks in a coma and had burns to 80 percent of her body. Now in her mid-30s, she does not have a full range of motion in her arms and neck. This past year, she was diagnosed with a traumatic brain injury from the hammer attack.

Like Freya, Mabrey has memory issues. "It's almost like an old person when you go to do something, and as soon as you get there you're like, 'Why am I in this room? What did I come in here for?' But it doesn't happen sporadically. It was happening all the time," Mabrey said.

Although Mabrey said her memory problems started immediately after Hanney's attack, she wasn't diagnosed with a traumatic brain injury. She didn't receive treatment, and the problem persisted. But this past year, she was diagnosed with a TBI.

Mabrey has shared her story through different outlets, including public speaking, and her memory problems accompany her onstage. She is the CEO and founder of the advocacy organization Ignite the Fires Within, through which she gives talks on healthy relationships, domestic violence and her own experience. When she forgets her thought or a word, she uses it to demonstrate the memory problems associated with a mild TBI.

"I can be in the middle of a conversation and be very passionate about it, and just completely lose my train of thought. And that is very frustrating," Mabrey said.

She is also part of Break the Silence, an organization founded by Kristen Paruginog.

From ages 18-22, Paruginog, who lives in California, was in an abusive relationship. After getting a restraining order against her ex-boyfriend, she decided to share her story on Facebook by posting a picture of the document. Then she started Break the Silence, which over the past seven years has grown into a nationwide organization that has helped more than 10,000 women, she said.

"I know if I shared my story someone would say, 'Me, too,'" Paruginog said.

Unlike Freya or Mabrey, Paruginog has not been diagnosed with a TBI, although she said she has experienced similar symptoms. She has headaches, blurred vision. "I'm incredibly forgetful," she said.

Most of the organization's board members have lasting effects from TBIs, said current President Cassi Cain. But while survivors of intimate partner violence are growing more open about their memory problems and domestic abuse, many remain invisible. And that makes research on the population more difficult.

Abused women often don't go to emergency rooms following attacks for a host of reasons. They might not think their injuries are hospital worthy, they might not be able to go due to threats from their abusive partner or they might not want to leave children, to name a few. In the academic world, this population can be purposefully left out, with some studies using intimate partner violence as an exclusionary factor because it is so complicated, Dr. David Okonkwo, the clinical director of the Brain Trauma Research Center at the University of Pittsburgh.

"This is a patient population that is very frequently overlooked," Okonkwo said in an interview.

### **Obstacles to research**

Although the lack of research subjects presents a large challenge to those trying to study TBI in domestic violence, it is far from the only one. Researchers have to be familiar with the population, neuroscience or neuropsychology and the types of neuroimaging available, Valera said.

Dr. Glynnis Zieman is a neurologist at the Barrow Clinic in Arizona who recently was part of a team studying brain injuries in women referred to the clinic from the local shelters. Of the 150 women, 81 percent had so many brain injuries they could not keep count. But Zieman ran into one of the problems facing many researchers with domestic violence victims.

"The challenging part about doing research with this population is most of them don't have prior medical records because many of them have not had medical care," Zieman said.

Without records, the subjects have to divulge the information. That means researchers have to rely on patient accounts and make sure questions are understandable. Zieman, like Valera, asks about times the victims have lost consciousness even though that does not always happen with mild traumatic brain injuries. But for the women, it's something they can understand.

They also have to be in a position in their lives where they can participate in a study, Valera said. That means the women are likely not in current abusive relationships.

Once researchers have found women, they have to secure funding, an issue Valera knows well. She has applied for funding from the National Institutes of Health and was told in an early review that she didn't need funding for her neuroimaging research because she had already done a study on it.

"There's two studies in all this world that we know of, and the reviewer said, 'well, she's already done the work so why does she need funding to do more,'" she said.

It's ironic, she said, because millions of dollars are funneled into studies on NFL athletes or military members so researchers can do multiple imaging studies. But after completing a study with a relatively low sample size and no control group, the reviewer thought Valera's proposal for a larger, cleaner study was repetitive.

"The logic there is mind-boggling," Valera said.

Part of the funding issue is tied to a misunderstanding about the importance of studying domestic violence victims, and there is also some victim blaming, Valera said.

"And now there is an apparent misconception that we don't necessarily need to research these women because there's all this other research in athletes and the military, so why do we have to study these women at all. Which actually makes no sense to me," Valera said.

In a [January 2018 editorial](#), Valera suggested that domestic violence victims experience far more TBIs than military members or athletes, despite the lack of focus in research.

"Despite this alarmingly high rate of repetitive partner-related TBIs, there are almost no systematic studies examining health outcomes of brain injuries in these women. As such, a large segment of our society is being afflicted with unstudied, unaddressed, and untreated TBIs," she wrote.

When it comes to traumatic brain injuries in women, there is some research done on female athletes or military members, although it pales in comparison to the amount conducted on men.

"So much attention has gone into athletes and military, ... those are clearly high risk populations as well, but athletes and military have access to resources. They have access to medical care...." Zieman said. "Whereas these women have never seen a doctor for their injuries, let alone their brain injuries. And they've never had someone explain what can happen after a brain injury or multiple injuries."

### **The hunt for CTE**

Chronic Encephalopathy was first discovered in the late 1920s when a doctor saw post-mortem signs in boxers. (At this time, sufferers were labeled "punch drunk.") It was brought into the spotlight in 2002 by [Dr. Bennet Omalu](#), a forensic pathologist in Pittsburgh who diagnosed the disease in former Steelers players and called it CTE. CTE comes from the [breakage of axons](#) that results from repetitive hits to the head. When the axons and the cellular components that make up axons break, a protein called Tau is released. Tau, which is also a likely a factor in Alzheimer's, clumps in the brain tissue, causing a discoloration that looks almost like rust on the brain and probably some of the dementia seen in CTE.

And the possible connection to domestic violence is worrisome. "It's really repetitive little traumas" that lead to CTE, said Dr. Ann McKee, one of the leading researchers on chronic

traumatic encephalopathy (CTE). McKee, a professor of neurology and pathology at Boston University, is known for studying the brains of deceased NFL players like Aaron Hernandez, who committed suicide at 27 after being convicted of murder. The disease continues to be found in football players, with McKee diagnosing more than 100 brains of former NFL players as having CTE, according to The New York Times.

McKee's research is mostly done post-mortem on men who have died, because more male brains have been donated. To look for CTE from domestic violence, McKee needs female brains — and the brains have to be from women who are known victims of domestic violence.

But currently the lack of brains means that victims of domestic violence are left out of the diagnosis. There is one possible case of a domestic violence victim who might have had CTE, McKee said. Among CTE researchers, she's known as the "punch-drunk wife." She was 76 years old when she died, and researchers found widespread brain damage post-mortem, according to a 1990 article in The Lancet.

A group called PINK Concussions is trying to address the need for donated brains, said founder Katherine Snedaker. PINK Concussions has partnered with the National PTSD Brain Bank to encourage women to leave their brains to science when they die. While the organization brings awareness to TBIs that women have sustained from sports, military service and accidents, they also make sure to include women with domestic violence. Freya recently spoke on one of the panels they held at NIH.

"No one really wants to talk about domestic violence, let alone TBI in domestic violence," Snedaker said.

McKee said women are likely more prone to concussions, which makes the lack of research on women, including domestic violence victims, athletes and military members, more puzzling. It also takes them longer to recover. But why this happens is not as clear.

"We really don't understand the gender aspect of it all," McKee said.

But to Valera, it "just seems obvious" that there must be CTE in victims of domestic violence. "I mean if it's really there in the NFL, how it couldn't be... in women as they age and have been abused like this would be shocking to me," Valera said.

### **Looking to the future**

With its brain donation pledge, PINK Concussion is trying to provide resources for researchers to understand the gender gap. The advocacy group also holds panels at which women can talk about their experiences following their TBI. The NIH panel at which Freya talked also included an athlete and military member. Zieman has also spoken at panels held by PINK.

Although Valera was not on the PINK panel, she was at the NIH workshop on female brain injury at which it took place. Valera presented her own research there, and she has her own page on the PINK Concussions sites as one of the experts on TBIs from domestic violence.

She has considered starting a brain bank to help address some of the research gaps, and despite problems early on in funding, she said her grant application is still being considered and she's hopeful. Valera said it's a positive sign that the NIH created a workshop to address female TBIs. "So there's definitely growing awareness now that this is what we need to worry about," she said.

Valera said she is trying to create a body of research that will allow experts to say, "Yes, this is what we know, this is what's going on here when women have these brain injuries and this is what we still need to know."

In the 28 years since Freya first received a TBI diagnosis, things have changed for domestic violence. She said she's seen more awareness and more resources for women leaving abusive relationships. But she wishes more were done to protect victims, including more stringent laws against abusers and a database that would track restraining orders.

For those in abusive relationships, she wants them to know that there is a way out and there are support systems in place. "You're stronger than you think. He's weaker than you think," Freya said. "There's help out there, and it's OK to ask for it. It's scary to leave, but fear of the unknown is a hell of a lot better than fear of him. Take a leap of faith in yourself and get out. You can do this."

As a member of PINK Concussions, Freya signed its donation pledge so that upon her death, her brain can be studied. For now, she shares her experiences on their panels. She said she'll be taking her story internationally and will join one of the PINK panels in Scotland.

She has not yet gone to a doctor for her brain injury, but she plans to see one. Knowing that her cognitive problems stemmed from her TBIs gave her some relief and empowered her. Now that her symptoms had a name, she could research and control it.

"It's something you can do something about it," Freya said. "It's something you can say, 'OK, I've got ahold of you now. Your name is traumatic brain injury, and I'm going to find out what I can do about you. I may be able to do nothing, but you're mine and I'm going to own you.'"

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