



**Defense and Veterans Brain Injury Center**  
**“Clinical Updates in Brain Injury Science Today [CUBIST]” Podcast**  
**“The Prevalence and Stability of Sleep-Wake Disturbance and Fatigue**  
**Throughout the First Year After Mild Traumatic Brain Injury”**  
**Total Run Time: 12:42**  
**Host: Dr. Donald Marion**

---

[music]

**Marion:** The views, opinions, and findings contained in this podcast are those of the host and subject matter experts. They should not be construed as official Department of Defense positions, policies, or decisions unless designated by other official documentation.

[music]

**Marion:** Hi. Welcome to Clinical Updates in Brain Injury Science Today, or “CUBIST,” a podcast for health care providers about current research on traumatic brain injury, also known as TBI. This program is produced by the Defense and Veterans Brain Injury Center, otherwise known as DVBIC. I'm your host today, Don Marion.

Today, I'll be speaking with Amanda Gano about a recently published article on traumatic brain injury. Ms. Gano is a physician assistant and subject matter expert at DVBIC. Amanda and I will discuss a study entitled “The Prevalence and Stability of Sleep-Wake Disturbance and Fatigue Throughout the First Year After Traumatic Brain Injury,” by Simen Saksvik and colleagues and published in the *Journal of Neurotrauma* in May of 2020.

**Marion:** Hi Amanda, and thanks for bringing this article to our attention today. Can you tell me a little bit about this study?

**Gano:** Hi Don, sure. This topic of sleep disturbances after mild traumatic brain injury, or mTBI, is really important, and you know, these disorders are really prevalent after mTBI and can delay recovery, and make some symptoms--like cognitive difficulties and emotional or mood disorders--worse if not adequately addressed. And this article is also really timely for us at DVBIC. As the listeners may have heard in our special episode, we have just released our newest clinical recommendation Sleep Disturbances Following Concussion/mTBI, which is a resource for primary care providers to help recognize and manage the most common sleep disturbances that occur after TBI.

So this article was a large prospective longitudinal cohort study that looked at the prevalence and the stability of sleep-wake disturbances and fatigue in three different groups. So they had an mTBI group, and then they had two control groups, they had a trauma group, and these were primarily patients with orthopedic injuries like sprains, strains, fractures, and then they had a community control group. And I thought this study was really fascinating because it used the two different control groups to help assess some common confounders that have been prevalent in other mTBI and sleep studies, like pain or prior psychiatric diagnoses. And then, this study also had a large sample size, with 378 mTBI patients and that helped create a representative sample.

**Marion:** Great. And plus as you pointed out, it's a longitudinal study rather than a retrospective study. So addressing sleep disturbances following TBI is a really important aspect of recovery. I'm interested to hear what they found. So how was this study done exactly, Amanda?

**Gano:** So like I said previously, this was a longitudinal cohort study in which patients were recruited from a primary care municipal clinic and also a trauma center emergency department in Trondheim, Norway. Both facilities see a high volume of TBI and trauma patients. The patients were between the ages of 16-60, with a mean age of 31 years and they had sustained an mTBI that met the World Health Organization criteria, which is very similar to the Department of Defense criteria that we're familiar with. So these patients had to have a witnessed loss of consciousness of less than 30 minutes. They had to have pre-or-post traumatic amnesia of less than 24 hours and then a Glasgow Coma Scale between 13-15. Patients were excluded from the study if they had severe ongoing alcohol or drug abuse, psychiatric or somatic disease, or condition that would complicate follow-up. They were excluded if they were had any prior complicated mild, moderate or severe TBI, so findings on imaging, a stroke or other acquired brain injury, or poly-trauma, such as spinal cord injury, internal bleeding or severe fractures. Lastly, they were excluded if the presented to the ED or the clinic greater than 72 hours after their injury.

So there were 82 Trauma controls with orthopedic injuries, and they were recruited from the same two hospitals and were included if they were in the same ages and they had an orthopedic injury. And they could not have an injury to the head or neck or any other poly-trauma, and the rest of the exclusion criteria was the same. And the community controls were recruited from a convenience sample, so hospital employees, family members of other participants, and both the trauma and community control groups were matched to the mTBI patients in regard to age, sex, and education level.

**Marion:** That's cool Amanda. As you pointed out, we know that sometimes outcomes or findings of these kinds of longitudinal studies are confounded because they don't have a proper control groups. But this group really payed attention to that with the two different control groups.

**Gano:** Yeah, I like that too, I wanted to point that out.

**Marion:** Yeah, so, what methods did they used to the collect for this data?

**Gano:** Sure, so patients were assessed at four different time points—first within 72 hours of their injury, and then at the two-week, three months, and then 12 months' time points after injury. These patients completed a series of structured interviews and self-report questionnaires. So participants were asked about their injury history and also asked about any pre-existing psychiatric disorders and were asked to describe those in detail. So I mentioned patients that had severe psychiatric illness were excluded, but they did allow for patients who had psychiatric diagnoses to participate and they categorized them into having a pre-injury psychiatric disorder or not—that's an important distinction because there is such an overlap between sleep disturbance and mTBI and psychiatric illness. They also separated out patients who had intracranial traumatic findings on CT scan as and labeled them as complicated mTBI or uncomplicated mTBI. And there were only 31 patients, or only nine percent of the sample, who had a complicated mTBI.

Patients were then asked to compare their sleep need and sleep quality to the way it was before their TBI. They completed a series of validated self-report measures, such as the Insomnia Severity Index, the Epworth Sleepiness Scale, the Fatigue Severity Scale, and a numeric rating scale for pain. Again, those were assessed at the different time intervals for the patients in the treatment and control groups.

**Marion:** Great. One problem that I think plagues a lot of these kinds of longitudinal studies is a relatively high dropout rate, especially when they try to follow them up as long as one year after. What was the dropout rate for this study, Amanda?

**Gano:** Yeah, it's a good question Don. So for this study, the attrition rate was actually pretty low. So even at 12 months, there was only a 15 percent dropout rate, so only 56 patients in the mTBI group, 11 patients in the trauma control group, so 13 percent, and 15 patients community control group, so 18 percent, were lost to follow-up. So this may have been because when the study was designed, they gave a gift certificate for each participant that followed up. And so they each got 54 euros for returning to the hospital for their follow up visit. So that may have contributed.

**Marion:** So there was an incentive, what you're saying, to return. That always seems to work. I know that some of the studies we do at Walter Reed, for example, they provide an incentive as well, and that improves their follow-up. So what were the results of this study then, Amanda?

**Gano:** Sure. So among the 378 mTBI patients enrolled in the study, a very small percentage, had complicated mild TBI, or any kind of intracranial lesions on CT, and less than five percent had a LOC greater than five minutes. So this cohort of TBI patients truly had, for the most part, what the DoD would consider a mild TBI. Patients with both complicated and uncomplicated TBI had significantly higher prevalence of increased sleep need, poor sleep quality, excessive daytime sleepiness, and fatigue than both the trauma and community controls.

They also found that both trauma groups, so the mTBI and orthopedic trauma controls, had a reduction of sleep-wake disorder and fatigue problems during the first year after injury, but the trauma controls, so the people that had the orthopedic trauma had returned to levels similar to community controls by about three months after injury. And almost 53 percent of the mTBI patients who experienced these symptoms at two weeks after injury had persisting problems that lasted three months or longer. The results showed that most patients did get better over time, with 55 percent of mTBI patients and 77 percent of trauma control patients that either didn't even experience sleep disturbances or had symptoms that resolved within the first three months. But a large proportion of patients with mTBI that had sleep disturbances at three months had persistent symptoms that still present at one year mark.

Also important to point out regarding history of psychiatric illness. This study found that reporting a prior psychiatric disorder was generally associated with poor sleep quality and fatigue across all the groups. But there was no evidence that this relationship differed between patients with mTBI and the control groups. So that was fascinating.

**Marion:** So Amanda, the authors pointed specifically that, at 12 months, it was unusual for the symptomatic mTBI patients to have a cluster or grouping of post-traumatic sleep and fatigue symptoms. Can you comment on that and how was that different than at two weeks?

**Gano:** Yeah Don, so I thought that was interesting too. In the sample at two weeks, there was a lot of overlap between the different sleep symptoms. But at the one year mark, it seemed as if one problem emerged as the predominant problem. And so this may be helpful for primary care providers to keep in mind or watch out for that typically if the symptoms do become chronic, it may be in one specific complaint cluster. So the ones that this study addressed were increased sleep need, excessive daytime sleepiness, poor sleep quality, or fatigue.

**Marion:** Finally Amanda, what were the limitations of the study?

**Gano:** So all of the information gathered was a patient self-report, which can be inherently inaccurate, as you know. Objective measures, like polysomnography and actigraphy, could have been effective in measuring things like total sleep time or sleep efficiency, but they weren't evaluated in this study. The research also didn't have direct information about shift work, social jet lag, sleep rhythms, and other things that could also impact sleep-wake outcomes.

For the two-week, three month, and one year follow-ups, they indicate that a subgroup of patients with mTBI did not meet at the hospital for their follow-up assessments, but they instead answered the interviews over the phone or sent in their completed questionnaires via mail or email. And we know that in-person interviews are more accurate.

**Marion:** So what do you want our listeners to take away from this study?

**Gano:** Well, you know with a high prevalence of sleep disturbances following mTBI, it's really important for providers to just be cognizant of the potential for these sleep problems to become chronic and try to address them as soon as possible. Most sleep disturbances in mTBI patients will resolve over time, but using clinical tools like the DVBC sleep clinical recommendation to help primary care providers recognize and treat some of these symptoms early on might help to mitigate some of the chronic mTBI symptoms that we're seeing.

**Marion:** Alright, well thanks Amanda. Unfortunately, that's all we have time for today. You can find a link to this article and to the DVBC clinical recommendation on sleep disturbances following mTBI in the description of this episode. You

can stay up-to-date on future episodes by subscribing to “CUBIST” on iTunes, Sound Cloud, Stitcher, or wherever you listen to podcasts, where you can also find links to the articles we discuss and other relevant resources.

[music]

“CUBIST” is produced and edited by Vinnie White and was hosted today by me, Don Marion. It is a product of the Defense and Veterans Brain Injury Center, led by Division Chief Captain Scott Pyne, Medical Corps, United States Navy.

Thank you for listening to this episode. Next time, we will discuss TBI research getting attention in the mainstream press.

[music]