

## Medical News &amp; Perspectives

# More Questions Raised by Concussion-like Symptoms Found in US Diplomats Who Served in Havana

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**M**embers of the US diplomatic community in Havana began visiting the embassy's medical unit in late December 2016 with symptoms, such as headache and ear pain, that they said began after they encountered strange sounds or sensations.

For months, speculation swirled around the etiology and extent of their ailments, but a new report in *JAMA* provides the most detailed picture yet of their condition. Clinical evaluation of 21 of the 24 US government personnel suspected as having been targeted by the mysterious "health attacks"—as the State Department calls them—found that most experienced persistent cognitive, balance, hearing, oculomotor dysfunction, or all 4, as well as sleep impairment and headaches, according to the report.

Specialists in physical medicine and rehabilitation, occupational medicine, neurology, neuroradiology, and neurosurgery independently obtained clinical histories and conducted unblinded clinical assessments of the cohort at the University of Pennsylvania's Perelman School of Medicine in Philadelphia. Clinical assessments included objective and subjective standardized measures of cognition, mood, balance and vestibular function, and vision and oculomotor function. To maintain the patients' privacy, limited demographic information was disclosed, including only average age and sex (10 men, average age of 39 years; 11 women, average age of 47 years).

On average, 203 days had elapsed from the time they experienced a so-called attack to the time they were evaluated. Virtually all of them reported that symptoms persisted for more than 3 months. At the time of their evaluation, 14 of the 21 had still not returned to work. With comprehensive outpatient rehabilitation, half of the 14 were able to resume

working, albeit with restrictions such as reduced hours.

## Concussion-like Symptoms

Of the 21 individuals assessed at Penn, 17 reported cognitive or behavioral problems such as difficulty remembering, concentrating, or both. "It's not that any patient can't do a given task, but it requires way more effort," said coauthor Randel Swanson, DO, PhD, a brain injury rehabilitation specialist at the University of Pennsylvania's Center for Brain Injury and Repair. "They don't have as much cognitive reserve."

Other common symptoms and objective findings included balance problems in 15 of the patients, convergence insufficiency—in which the eyes can't work together to focus on nearby objects—in 11, sleep impairment in 18, and headaches in 16. Thirteen were referred to cognitive rehabilitation, 17 to rehabilitation to improve their balance, and 14 to rehabilitation to improve their eye function. Three received hearing aids for sensorineural hearing loss.

"If you took any one of these patients and put them into a brain injury clinic, and you didn't know their background, you would think that they had a traumatic brain injury from being in a car accident or a blast

in the military," Swanson said. "It's like a concussion without a concussion."

In other words, he said, although they had symptoms similar to those seen in patients with a concussion, none of the 21 had a history of blunt trauma that could cause concussion or traumatic brain injury. The absence of blunt trauma, plus numerous news reports that most of the affected individuals noticed strange sounds or sensations before the onset of their symptoms, fueled speculation that these patients were targeted by an unknown sonic weapon.

According to the new study, 18 of the 21 patients said they heard a strange localized sound, described by almost all of them as high-pitched, while 12 said they felt an odd sensation, described as pressure or a vibration, before their symptoms began. Only 1 person in the group reported neither hearing nor feeling anything unusual before becoming ill.

"We actually don't think it was the audible sound that was the problem," said coauthor Douglas Smith, MD, a neurology professor at the University of Pennsylvania who directs the Center for Brain Injury and Repair. "We think the audible sound was a consequence of the exposure,

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because audible sound is not known to cause brain injury." What caused the symptoms was not the focus of the article, Smith said, although he noted that experiments in animals have found that ultrasound, infrasound, and microwaves can cause brain damage. For example, Chinese researchers [found](#) that infrasound can damage the hippocampus in rats.

However, covertly targeting people with sound above (ultrasonic) or below (infrasonic) the hearing range would be virtually impossible, said Toby Heys, PhD, an acoustics researcher at Manchester Metropolitan University in the United Kingdom. It would be difficult to target individuals with ultrasonic waves, which would be deflected by walls or closed windows, or with infrasonic waves, which would require a massive speaker to produce, he explained.

### Alternative Explanations

Although not systematically excluded, a virus or chemical agent was not a readily apparent explanation for the symptoms, according to Smith and his coauthors. No signs of a viral illness, such as preceding fever, were identified, and it is unlikely that a chemical agent could produce neurological symptoms without affecting other organs, they wrote.

Over the last several months, some skeptics have suggested that the symptoms reported by the embassy personnel can be attributed to mass psychogenic illness (MPI).

"The most plausible explanation is mass psychogenic illness triggered by a group of close-knit staff working for the same department in an anxiety-fueled, hostile, foreign environment in a country with a long and well-known history of targeting US embassy personnel," said Robert Bartholomew, PhD, a US-born medical sociologist on the faculty of Botany College in Auckland, New Zealand, who recently wrote a [commentary](#) about the incident in Havana. "We have an array of vague somatic complaints, most of which have no known association with exposure to acoustical waves, but are common in cases of MPI."

A panel of Cuban scientists convened by the Cuban government also concluded that MPI caused the US staffers' symptoms, the journal *Science* [reported](#) in early December. The panel, which did not have

access to the diplomats or their medical records, received recordings from US officials of the high-pitched sound that some in the diplomatic community had reported hearing. Based on the frequency of the sound in the recordings, Cuban scientists concluded that it could have been produced by the [Jamaican field cricket](#).

However, Smith said it's unlikely that MPI is at play, because not every person in the cohort knew everyone else. "There were cases where some individuals had no idea that anyone else was affected."

"Furthermore," wrote Smith and his coauthors, "MPI is often associated with transient, benign symptoms with rapid onset and recovery often beginning with older individuals."

Christopher Muth, MD, an assistant professor in the Department of Neurological Sciences at Rush University Medical Center in Chicago and an associate editor at *JAMA* who coauthored an accompanying [editorial](#), noted that the reported symptoms are associated with a variety of neurological illnesses.

"Not all of the symptoms reported by these 21 patients are necessarily seen in any 1 condition, but many of [them] overlap to various degrees with other conditions," Muth said. Besides concussion or postconcussion syndrome, the symptoms are seen in such conditions as vestibular migraine and persistent postural-perceptual dizziness, he explained.

What's more, the conventional neuroimaging data from most of the cohort appear to be normal or have nonspecific findings, suggesting either no structural injury or injury that can only be seen on a molecular level or with more advanced imaging techniques, according to S. Andrew Josephson, MD, chairman of neurology at the University of California, San Francisco, School of Medicine, who was not involved in evaluating the patients.

"There's not something on the conventional MRI [magnetic resonance imaging] that you can point to and definitively say there is a common issue."

### Study Limitations

Steven Lewis, MD, coauthor of the editorial accompanying the study, noted that none of the patients underwent similar testing before they arrived in Havana, making it difficult to pinpoint when their problems began. Without reporting the age of each

patient or having prior baseline test results, it's also impossible to exclude the likelihood that the neurological findings could simply be due to aging, explained Lewis, chief of neurology at the Lehigh Valley Health Network in Pennsylvania.

For example, he said, age could be a factor in the 3 people who needed hearing aids after they left Havana. "We don't know if they were 38 or 58. If they were 38 and had hearing loss, maybe that would potentially be a little more significant." Given the lack of baseline testing, it would be helpful to have blinded evaluators compare the cohort to age- and sex-matched controls, Lewis said.

The State Department is now recommending that government personnel undergo baseline testing before going to Havana, according to [testimony](#) by Charles Rosenfarb, MD, at a January 9 [hearing](#) convened by the Senate Committee on Foreign Relations. "All government personnel who travel to Havana on official duty now receive a detailed medical briefing and are encouraged to undergo predeployment screening, including baseline audiograms and neurocognitive testing," Rosenfarb, medical director of the State Department's Bureau of Medical Services, told committee members.

### Next Steps

Swanson and Smith said their team is continuing to monitor the cohort's progress. They plan to use diffusion tensor imaging, an MRI-based technique, to assess the patients' white matter tracts and to compare them to what is seen in the brains of patients with concussion. They also plan to conduct neuropsychological testing on 6 remaining individuals who have not yet had such testing at Penn but for whom it was indicated.

"This does look like a [disease] cluster, which has gotten interest from the CDC [Centers for Disease Control and Prevention]," Smith said. "We've been speaking with them and will continue working with them as things progress."

Smith said he and his coauthors signed a nondisclosure agreement with the State Department, so they cannot discuss whether they know more about what happened in Havana than has already been made public.

"We still do not have definitive answers on the source or cause of the attacks,"

said a State Department spokesperson who did not wish to be identified. "The State Department continues to be deeply concerned about the safety and security of our personnel." The embassy is operating with "emergency personnel" who "are carrying out core diplomatic and consular functions, including providing emergency assistance to US citizens in Cuba."

Whether current personnel are at risk is not known. "We can't speculate on

the true incidence or prevalence of this," Swanson said.

Meanwhile, the State Department on January 10 issued a "level 3" advisory about travel to Cuba, which recommends that Americans "reconsider travel" there "due to health attacks directed at US Embassy Havana employees." Because the source of the attacks has not been identified, the advisory continues, "we believe US citizens may also be at risk."

As for the former Havana embassy personnel in his cohort, Smith said, "the really important news is that everyone has shown improvement." Even though his team's findings are preliminary, they "will help provide some sort of a sketch of what [physicians] might have to look for for.... If any new cases come, we can employ that [information] to make the diagnosis." ■

**Note:** Source references are available through embedded hyperlinks in the article text online.