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TRAUMATIC BRAIN INJURY AND BLAST EXPOSURE CARE

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BEFORE THE

SUBCOMMITTEE ON PERSONNEL

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TRAUMATIC BRAIN INJURY AND BLAST EXPOSURE CARE

WEDNESDAY FEBRUARY 28, 2024

UNITED STATES SENATE,
SUBCOMMITTEE ON PERSONNEL,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

The Subcommittee met, pursuant to notice, at 2:59 p.m., in room 222, Russell Senate Office Building, Senator Elizabeth Warren (Chairman of the Subcommittee) presiding.

Subcommittee Members present: Senators Warren, Blumenthal, Hirono, Kaine, Ernst, Sullivan, Scott, and Budd.

OPENING STATEMENT OF SENATOR ELIZABETH WARREN

Senator WARREN.

[Technical problems.] This hearing will come to order. I am pleased to welcome you all to today's hearing to receive testimony on the Department of Defense's efforts to protect servicemembers from blast overpressure.

Servicemembers put their lives and their health on the line when they are—[technical problems]. In return, we have a profound responsibility to make sure the Nation is doing all we can to keep them safe, to prevent battlefield and training casualties—oops, thank you.

[Technical problems.]

Senator WARREN. That could be trouble. All right. Good. Did we get the other on the record? Just so, I got started here. Servicemembers put their lives and their health on the line when they put on their uniforms.

In return, we have a profound responsibility to make sure that the Nation is doing all that it can to keep them safe, to prevent battlefield and training casualties, and to provide the best possible care for those who are injured. We are holding this hearing—

[Technical problems.]

Senator WARREN. We are there? Good. We are holding this hearing because DOD is not meeting its responsibilities when it comes to traumatic brain injuries (TBI) and other injuries that result from firing weapons.

Injuries from blast overpressure, the pressure that is caused by a shock wave that exceeds normal atmospheric values, have been the signature wounds of the wars in Iraq and Afghanistan.

But there are also injuries incurred in training here at home. They are invisible, but they affect thousands of servicemembers,

causing headaches, seizures, hallucinations, and ultimately significantly increased risks of depression and suicide.

Over the course of just 3 months in 2023, DOD provided TBI treatment to servicemembers nearly 50,000 times. The more we learn, the more we come to understand that blast exposure is an ongoing threat to the health of individual servicemembers, and to the well-being, the morale, and the readiness of our entire force.

I appreciate the support I have had on this issue from Ranking Member Scott, from Senator Ernst, from Senator Tillis, and from other Members of this Committee. I secured a long term study of blast overpressure injuries in the 2018 National Defense Authorization Act, and I have worked with Senator Ernst to introduce legislation on blast overpressure and to secure additional requirements to track blast overpressure injuries in the Fiscal Year 2020 NDAA.

DOD is working to implement this legislation, but we still have significant problems. Last year, The New York Times reported on heightened brain injury risks for United States troops in Syria fighting ISIS. Four artillery batteries assigned to the region fired more weapons than any military American artillery since the Vietnam War.

The result was that each of these units had members with serious blast overpressure injuries, and each had at least one member that committed suicide. These deaths are a tragedy. Ryan, a Navy SEAL deployed to Iraq and Afghanistan, was subject to significant blasts from his own weapons over the course of his career and later died by suicide.

His father, Mr. Frank Larkin, is here today to discuss the harm that blast overpressure has caused to servicemembers and to their families. The Times also revealed that even when DOD had made policy changes to address risks, those changes were not evident on the ground. Weapons known to deliver shock waves well above safety thresholds were still widely used. Training did not involve basic safety measures, and special operations forces were not issued blast exposure gauges, the gauges that are needed to track the threats they faced.

So, DOD and Congress both have a lot to do. Here is my agenda to address this problem. First, we need to establish mitigation strategies specific to the servicemember roles that are most at risk for blast overpressure.

Second, we must require DOD to create blast exposure and traumatic brain injury logs for all servicemembers and to integrate these logs into their VA and DOD health care records. Third, the Department of Defense should partner with innovative, evidence based programs like Home Base to help servicemembers get the care they need. And I am going to have to brag here for just a minute.

Home Base is a nonprofit organization founded by Massachusetts General Hospital and the Boston Red Sox to take care of the invisible wounds of veterans, servicemembers, military families, and families of the fallen. Home Base has clinics in Massachusetts and in Florida, Ranking Member Scott's State.

Home Base has a comprehensive brain health and trauma program specifically designed for special operations veterans and

servicemembers, where it has been leading innovative treatments for veterans with co-occurring substance abuse and mental health conditions.

As we work through this year's NDAA, I want to support this program's work, and I appreciate Dr. Zafonte from Home Base joining us today. One more item.

We need to make sure that DOD sets a threshold on the maximum number of rounds that is safe—that servicemembers can safely fire, and that this includes consideration of exposure limits over an extended period of time. DOD must do its part and Congress must do our part.

So, to our witnesses, welcome and thank you for appearing. We are going to have two panels today. The first panel will consist of outside witnesses to provide their perspective on where DOD and the services are falling short on protecting servicemembers from blast overpressure.

Dr. Samantha McBirney Professor of Policy Analysis at the Pardee RAND Graduate School, Dr. Ross Zafonte, Chief of Traumatic Brain Injury and Health and Wellness Programs at Home Base, and Frank Larkin, Chief Operating Officer of Troops First Foundation and lead of the National Warrior Call Day Initiative.

The second panel will consist of officials from the Department of Defense and Walter Reed to hear how DOD is tackling this issue. We will have Dr. Lester Martinez Lopez, Assistant Secretary of Defense for Health Affairs, Kathy Lee, Director of Warfighter Brain Health Policy at DOD, and Captain Carlos Williams, Director of the National Intrepid Center of Excellence at Walter Reed National Military Medical Center.

I will now turn to Ranking Member Scott for his comments to open this hearing.

STATEMENT OF SENATOR RICK SCOTT

Senator SCOTT. First, I want to thank Senator Warren, the Chairwoman of this Committee and—our Subcommittee and thank her for caring about this issue and for taking this job so seriously. Chairwoman Warren, I want to thank you for holding this hearing on such an important topic.

Traumatic brain injury, or TBI, is one of the most common injuries sustained by American servicemembers. In 2022, more than 20,000 military personnel were diagnosed with TBI. Stop and think about that for a second. Just in 2022, there are more than 20,000, 20,000 members of military that were diagnosed with a traumatic brain injury.

That is pretty bad. The vast majority, over 84 percent, were classified as mild, which is more commonly known as a concussion. But if any of us have—when you have raised kids and they have a concussion, it scares the living daylights out of you.

Missing from this data are servicemembers who are frequently exposed to low level blasts that do not typically result in a clinically diagnosable concussion. This is concerning because repeated exposure to low level blast may cause similar symptoms as more severe cases of TBI.

We know that low level blast exposure from fire and heavy weapons systems or explosives may cause a variety of symptoms includ-

ing concentration, memory problems, irritability, headaches, and decreased hand-eye coordination. Each of these issues alone can be very serious and disrupt somebody's life.

Unfortunately, there remains a great deal about exposure to these blasts that we yet do not know. More research and better data are required so that military and health care providers can mitigate the frequency of blast exposure where possible and treat those exposed to blast where necessary.

We have actually taken action to do that. In the 2018 National Defense Authorization Act, Congress required the Department of Defense to conduct a medical study on blast pressure exposure.

Two months ago, the Committee received the Department's final report on this study. This hearing presents an opportunity to assess the quality of the Department's work. The legislation required the study, which followed specific individuals over an extended period of time, to include three specific elements.

First, the Department was to "monitor, record, and analyze data on blast pressure exposure" for any servicemember "likely to be exposed to a blast in training or combat." Second, the study was to assess the feasibility and advisability of including blast exposure history into a servicemember's medical record.

Last, the Department was to review the safety precautions of heavy weapons training in light of emerging research on blast exposure. In reviewing the final report submitted this past December, it is clear the Department still has more work to do, particularly in its ability to monitor and record blast exposures for military personnel.

Only a few hundred soldiers and marines were fitted with wearable devices that unfortunately seem to suffer from quality control issues. And while the Department's report does say that it may be feasible to record blast exposure information in a servicemember's medical record, a business case analysis is required to determine the way forward in this area. In this hearing, I would like to learn more about how the Department plans to conduct this business case analysis.

This is an important issue. I believe the Department is committed to getting this right and I believe the TBI Center of Excellence and Warfighter Brain Health Initiatives are excellent initiatives that I hope will provide the military with the information needed to better understand the effects of repetitive blast exposure.

We all must remember the exposure to low level blast will continue to be a necessary risk for many of our frontline combat troops. But if we can do better—if we can better quantify the type and number of blasts that have the potential to cause significant, perhaps permanent injuries, then we can use that information to make better decisions about how best to accomplish a particular mission.

I would like to hear from the witnesses what Congress can do to ensure the Department of Defense has the resources it needs to conduct its planned work and where we can help. Only this is about the well-being of the individuals that are willing to put on the uniform, who are closest to the front line of combat, and every servicemember that is diagnosed with TBI.

We owe it to them to ensure—and their families to ensure that when they go into harm's way, they are well-trained, have the right protective equipment, and are utilized in a manner that achieves the objective with an understanding of the risk involved.

I want to thank you to all the witnesses for being here today. I look forward to your testimony. And again, I want to thank Senator Warren for putting this together.

Senator WARREN. Thank you.

[Technical problems.]

**STATEMENT OF SAMANTHA MCBIRNEY, PROFESSOR OF
POLICY ANALYSIS, PARDEE RAND GRADUATE SCHOOL**

Dr. MCBIRNEY. Chairwoman Warren, Ranking Member Scott, and Members of the Committee, good afternoon, and thank you for the opportunity to testify today. My name is Dr. Samantha McBirney, and I am a Biomedical Engineer at the nonprofit, non-partisan RAND Corporation.

My research for the last 15 years, not only at RAND, but also at the University of California, Berkeley and the University of Southern California, has focused on traumatic brain injury, or TBI, both as the result of blunt impact and blast overpressure.

Today, I would like to speak with you about repeated exposure to low level military occupational blasts, which are low level blast exposures experienced while fulfilling military occupational duties.

Evidence suggests that servicemembers are exposed to these blasts in the form of blast overpressure, or the pressure wave that emanates from the source of an explosion. This pressure wave can cause sub-concussive injuries which are not immediately detectable and would not qualify as a TBI.

Exposure to blast overpressure can occur both in combat and in training, as has already been mentioned. During training, exposure can be due to breaching exercises and the firing of increasingly powerful weapon systems, such as the Carl Gustaf recoilless rifle and the AT4.

To provide some perspective on the level of exposure some servicemembers have, one study found that up to 32 percent of blasts experienced by breaching instructors exceeded the recommended exposure limit.

Studies have shown that the cumulative effect of repeated low level blast exposure can cause symptoms similar to TBI. While a variety of effects have been linked to low level blast exposure, as Senator Warren and Senator Scott have already mentioned, there remains a lack of scientific evidence linking repeated exposure to injury. One reason for this is the difficulty of diagnosis.

The very nature of low level blast exposure, and the fact that it is not one single event that causes an issue, but rather the cumulative effect of repeated exposure over time complicates injury recognition.

Symptoms typically do not manifest immediately, which makes it unlikely that repeated exposure to low level blast is identified as the cause. Additionally, injury is vastly underreported among servicemembers, only obfuscating the issue of proper diagnosis further.

There is also a lack of research about the military occupational specialties at greatest risk of exposure to low level blast. While there is no doubt that certain occupational specialties are more frequently exposed than others, there is little research to support these hypotheses.

So, there remains a lack of understanding of the direct impact that repeated exposure to low level blast has on the health of servicemembers in different occupational specialties. If the preventive intervention is perfectly effective but cannot be delivered in time, it is not useful.

This quote from a 2019 RAND report perfectly describes the current State and the reason many of us are here today, “as a research community, we clearly see that additional research needs to be done. However, there are steps the DOD can take now to better protect servicemembers against blast induced injury.”

I highlight four recommendations in my written testimony, and I would like to bring your attention to one of them here, the creation and maintenance of blast exposure records. These records should include number of exposures, the context of each exposure, and any physical, mental, or emotional effects resulting from that exposure.

This would allow the DOD to better track exposure frequency, assess the occurrence among high risk occupational specialties, determine the connection between exposure and health outcomes, and develop strategies to mitigate exposure in training environments.

Ultimately, these records could be used to develop an index score to gauge an individual’s combat readiness and potential health risks. As our weapon systems continue to become more advanced and increasingly powerful, low level military occupational blasts will remain an enduring challenge for servicemembers.

Addressing the issue of repeated exposure to these blasts necessitates action and collaboration between the DOD and the research community. By implementing the recommendations as outlined in my written testimony, alongside continued research efforts to close substantial knowledge gaps, the DOD can take significant strides toward better protecting the health and well-being of our servicemembers.

Thank you, and I look forward to your questions.

[The prepared statement of Dr. McBirney follows:]



Testimony

SAMANTHA MCBIRNEY

Repeated Exposure to Low- Level Military Occupational Blasts

An Overview of the Research, Critical Gaps, and
Recommendations

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*Repeated Exposure to Low-Level Military Occupational Blasts: An Overview of the Research,
Critical Gaps, and Recommendations*

Testimony of Samantha McBirney¹
RAND²

Before the Senate Armed Services Committee
Subcommittee on Military Personnel
United States Senate

February 28, 2024

Chairwoman Warren, Ranking Member Scott, and members of the committee, good afternoon, and thank you for the opportunity to testify today. My name is Dr. Samantha McBirney. I am a biomedical engineer at RAND, a nonprofit, nonpartisan research organization. My research for the past 15 years, not only at RAND but also at the University of California, Berkeley and the University of Southern California, has focused on traumatic brain injury, or TBI—both as the result of blunt impact and as the result of blast overpressure. My comments today are based on research conducted within the Personnel, Readiness, and Health Program within the RAND National Security Research Division, as well as peer-reviewed, published research that has taken place outside RAND in the broader scientific community. For the past eight years, RAND has supported the Department of Defense's (DoD's) Blast Injury Research Coordinating Office in synthesizing recent research and defining the upcoming research agenda on specific topics related to blast. A list of RAND's contributions to this space is available online.³

¹ The opinions and conclusions expressed in this testimony are the author's alone and should not be interpreted as representing those of RAND or any of the sponsors of its research.

² RAND is a research organization that develops solutions to public policy challenges to help make communities throughout the world safer and more secure, healthier and more prosperous. RAND is nonprofit, nonpartisan, and committed to the public interest. RAND's mission is enabled through its core values of quality and objectivity and its commitment to integrity and ethical behavior. RAND subjects its research publications to a robust and exacting quality-assurance process; avoids financial and other conflicts of interest through staff training, project screening, and a policy of mandatory disclosure; and pursues transparency through the open publication of research findings and recommendations, disclosure of the source of funding of published research, and policies to ensure intellectual independence. This testimony is not a research publication, but witnesses affiliated with RAND routinely draw on relevant research conducted in the organization.

³ U.S. Department of Defense Blast Injury Research Coordinating Office, "International State-of-the-Science Meeting Series," webpage, March 31, 2021, <https://blastinjuryresearch.health.mil/index.cfm/sos>.

Today, I would like to speak with you about repeated exposure to low-level military occupational blasts. These are defined as low-level blast exposures experienced while fulfilling occupational duties (both in combat and in training) that result in subconcussive injuries. These injuries are not immediately detectable and would not qualify as a TBI. I will start by introducing the injury more broadly before delving into critical gaps in the research and potential recommendations DoD could implement to move the needle forward and better protect our service members from the effects of repeated exposure to low-level blast.

Background

As many of us here know, TBI has been called the “signature injury” of both Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF).⁴ Hundreds of thousands of TBI diagnoses were made between 2000 and 2015 alone,⁵ and upwards of 20 percent of service members returning from deployment suffered a TBI.⁶ Improvised explosive devices were often the cause of TBI during OEF and OIF due to widespread use of such weapons. Evidence also suggests that, apart from these injuries, service members are simultaneously exposed to low-level military occupational blasts in the form of blast overpressure (the pressure wave that emanates from the source of an explosion) in both combat and training, which can cause subconcussive injuries. Exposure during training can be due to breaching exercises and the repeated firing of increasingly powerful weapon systems—such as the Carl Gustaf recoilless rifle, the AT4, and the M72 Light Anti-Armor Weapon (LAW)—even when operating these weapons within limits presumed to be safe. To provide some perspective on the level of exposure some service members have, one study found that up to 32 percent of blasts experienced by breaching instructors exceeded the recommended exposure limit.⁷ A *New York Times* investigation found that some troops returned from Iraq and Afghanistan having fired tens of thousands of high-explosive shells each over the course of their deployment.⁸ Studies have shown that the

⁴ Lisa K. Lindquist, Holly C. Love, and Eric B. Elbogen, “Traumatic Brain Injury in Iraq and Afghanistan Veterans: New Results from a National Random Sample Study,” *Journal of Neuropsychiatry and Clinical Neurosciences*, Vol. 29, No. 3, Summer 2017.

⁵ Military Health System, “DOD TBI Worldwide Numbers,” webpage, undated, <https://health.mil/Military-Health-Topics/Centers-of-Excellence/Traumatic-Brain-Injury-Center-of-Excellence/DOD-TBI-Worldwide-Numbers>.

⁶ Terri Tanielian and Lisa H. Jaycox, eds., *Invisible Wounds of War: Psychological and Cognitive Injuries, Their Consequences, and Services to Assist Recovery*, RAND Corporation, MG-720-CCF, 2008, <https://www.rand.org/pubs/monographs/MG720.html>.

⁷ Ann Nakashima, Oshin Vartanian, Shawn Rhind, Kristen King, Catherine Tenn, and Rakesh Jetly, “Repeated Occupational Exposure to Low-Level Blast in the Canadian Armed Forces: Effects on Hearing, Balance, and Ataxia,” *Military Medicine*, Vol. 187, No. 1–2, January/February 2022.

⁸ Dave Phillips, “A Secret War, Strange New Wounds, and Silence from the Pentagon,” *New York Times*, November 5, 2023a; Dave Phillips, “U.S. Troops Still Train on Weapons With Known Risk of Brain Injury,” *New York Times*, November 26, 2023c.

cumulative effect of repeated low-level blast exposure in such environments can cause symptoms similar to TBI.⁹

Critical Gaps

A variety of effects have been linked to low-level blast exposure, some more tenuously than others. These include cognitive impairments, sleep disturbances, depression, panic attacks, and posttraumatic stress disorder.¹⁰ However, there is a lack of published, peer-reviewed, scientific evidence linking repeated low-level military occupational blast to injury. Experiments conducted in animals and observational studies of humans in certain high-risk occupations do suggest that cognitive changes can occur. However, animal studies have largely focused on rodent models, yielding results that may not readily translate to humans, and sample sizes for observational studies have remained, for the most part, exceptionally small. Only recently has the research community started conducting longitudinal studies, analyzing data from the Millennium Cohort Study; even still, much of the focus has been on high-level blast.¹¹

One reason for the lack of evidence on the relationship between low-level blast exposure and its effects is the difficulty of diagnosis. The very nature of low-level blast exposure, and the fact that it is not one single event that causes an issue but rather the cumulative effect of repeated exposure, complicates injury recognition. Symptoms typically do not manifest immediately, which makes it easy to confuse symptoms with those of other deployment-related injuries and increasingly unlikely that repeated exposure to low-level blast is identified as the cause of any symptoms.¹² Additionally, injury is vastly underreported among service members,¹³ and necessary medical care is not consistently sought out. A study conducted in 2020 assessing unreported and untreated TBI among over 5,000 soldiers concluded that, of those who reported a concussion, only 52 percent sought medical care. Of those who did not seek care, 64 percent did

⁹ Walter Carr, Elena Polejaeva, Anna Grome, Beth Crandall, Christina LaValle, Stephanie E. Eonta, and Lee Ann Young, "Relation of Repeated Low-Level Blast Exposure with Symptomology Similar to Concussion," *Journal of Head Trauma Rehabilitation*, Vol. 30, No. 1, January/February 2015.

¹⁰ Peethambaran Arun, Donna M. Wilder, Ondine Eken, Rodrigo Urioste, Andrew Batuure, Sujith Sajja, Stephen Van Albert, Ying Wang, Irene D. Gist, and Joseph B. Long, "Long-Term Effects of Blast Exposure: A Functional Study in Rats Using an Advanced Blast Simulator," *Journal of Neurotrauma*, Vol. 37, No. 4, February 2020; Jeffrey J. Bazarian, Kerry Donnelly, Derick R. Peterson, Gary C. Warner, Tong Zhu, and Jianhui Zhong, "The Relation Between Posttraumatic Stress Disorder and Mild Traumatic Brain Injury Acquired During Operations Enduring Freedom and Iraqi Freedom," *Journal of Head Trauma Rehabilitation*, Vol. 28, No. 1, January/February 2013; Lauren Fish and Paul Scharre, *Protecting Warfighters from Blast Injury*, Center for a New American Security, May 2018, <https://www.cnas.org/publications/reports/protecting-warfighters-from-blast-injury>; Phillips, 2023a.

¹¹ Jennifer N. Belding, Claire A. Kolaja, Rudolph P. Rull, and Daniel W. Trone, "Single and Repeated High-Level Blast, Low-Level Blast, and New-Onset Self-Reported Health Conditions in the U.S. Millennium Cohort Study: An Exploratory Investigation," *Frontiers in Neurology*, Vol. 14, March 20, 2023.

¹² Dave Phillips, "Five Takeaways from a Times Investigation of Artillery Blast Exposure," *New York Times*, November 5, 2023b.

¹³ Laurel Smith, Richard Westrick, Sarah Sauers, Adam Cooper, Dennis Scofield, Pedro Claro, and Bradley Warr, "Underreporting of Musculoskeletal Injuries in the US Army: Findings from an Infantry Brigade Combat Team Survey Study," *Sports Health*, Vol. 8, No. 6, November/December 2016.

not think the injury required care, while 18 percent were concerned that reporting might have negative repercussions on their careers.¹⁴ If care-seeking is this low for service members experiencing TBI, then one could safely assume that it would be even lower for service members experiencing low-level blast exposure. Lastly, the specific causal mechanism of brain injury for low-level blast remains unclear, only obfuscating the issue of proper diagnosis further.

There is also a lack of research about the military occupational specialties at greatest risk of exposure to low-level blast. While there is no doubt that certain occupational specialties are more frequently exposed to low-level blast than others (e.g., breachers, munitions range instructors), there is little to no research to support these hypotheses. So, there remains a lack of understanding of the direct impact that repeated exposure to low-level blast has on the health of service members in different military occupational specialties.¹⁵

Recommendations

“If the preventive intervention is perfectly effective but cannot be delivered in time, it is not useful.”¹⁶ This quote from a 2019 RAND report on the neurological effects of repeated exposure to military occupational blast perfectly describes the current state within DoD and the reason many of us are here today. As a research community, we clearly see that additional research needs to be done. However, there are steps DoD can take now to better protect service members against blast-induced injury. These recommendations, drawn from previously published RAND work and a 2018 report by the Center for a New American Security, are outlined below.

Expand Existing Blast Surveillance Programs

Current blast surveillance programs could be expanded through the use of devices, such as blast gauges, to monitor, record, and maintain data on service members’ blast pressure exposure, whether in training or in combat.¹⁷ Blast gauges are devices that are placed on a service member’s uniform and measure the intensity of blast waves in the vicinity. These devices are not new to DoD: In fact, over a decade ago, they were used to gather data from over 11,000 personnel deployed in Afghanistan.¹⁸ The devices produced evidence that many service members are exposed to harmful levels of low-level blast simply caused by proximity to a heavy weapon when fired. The program was ultimately discontinued, primarily due to the device’s failure to

¹⁴ Sandra M. Escolas, Margie Luton, Hamid Ferdosi, Bianca D. Chavez, and Scot D. Engel, “Traumatic Brain Injuries: Unreported and Untreated in an Army Population,” *Military Medicine*, Vol. 185, Supp. 1, January–February 2020.

¹⁵ Charles C. Engel, Emily Hoch, and Molly M. Simmons, *The Neurological Effects of Repeated Exposure to Military Occupational Blast: Implications for Prevention and Health: Proceedings, Findings, and Expert Recommendations from the Seventh Annual Department of Defense State-of-the-Science Meeting*, RAND Corporation, CF-380/1-A, 2019, https://www.rand.org/pubs/conf_proceedings/CF380z1.html.

¹⁶ Engel, Hoch, and Simmons, 2019, p. 7.

¹⁷ Fish and Scharre, 2018.

¹⁸ Defense Advanced Research Projects Agency (DARPA), “Blast Gauge,” webpage, undated, <https://www.darpa.mil/about-us/timeline/blast-gauge>.

provide reliable information on whether an individual experienced enough exposure to sustain an injury.¹⁹ However, the technology has since evolved,²⁰ meaning such devices (or similar ones) could yield useful information. The use of such devices would likely reduce the underreporting of injuries, as the responsibility of reporting would no longer be placed on the individual. Additionally, linking the device data to personnel administrative files and/or other DoD longitudinal datasets would provide much-needed information on which occupational specialties are more frequently exposed to low-level blast.

Create and Maintain Blast Exposure Records

Blast exposure records could be created and maintained as part of a member's service records. Records should include (but not be limited to) the number of previous exposures (including the number of exposures per unit of time); any residual physical, mental, or emotional effects resulting from blast exposure; and the context of the exposure (e.g., training, deployed). This would allow DoD to better track the frequency of low-level blast exposure, assess the occurrence among high-risk occupational specialties, determine the connection between exposure and health outcomes, and develop strategies to mitigate low-level blast exposure in training environments. Ultimately, in-depth blast exposure records could be used to develop an index score to gauge an individual's combat readiness and potential health risks.²¹

Update Weapon System–Specific Information to Include Blast-Related Characteristics

To properly assess blast exposure risk, more information is needed about the use of weapon systems in both training and deployed environments. A central repository of blast-related characteristics (e.g., pressure profiles, common blast loads) associated with specific systems and the environments they are used in would better inform the service members, researchers, and DoD safety programs about the risk of exposure to low-level blasts. This repository could also be used to map weapon systems and blast environments to various health risks.²²

Additionally, firing limits for shoulder-fired heavy weapons known to be blast-intensive could be reviewed and updated. According to a report published by the Center for a New American Security in 2018, "Firing limits should: be revised downward to a level such that allowable exposures are not associated with cognitive deficits after firing; cover exposures across a longer time period, on the order of 72 to 96 hours; include a minimum safe distance for observers and instructors; account for the possibility of multiple types of heavy weapons being fired in a single day; and include cumulative annual and lifetime limits for blast exposure in training."²³

¹⁹ Jon Hamilton, "Pentagon Shelves Blast Gauges Meant to Detect Battlefield Brain Injuries," *National Public Radio*, December 20, 2016, <https://www.npr.org/sections/health-shots/2016/12/20/506146595/pentagon-shelves-blast-gauges-meant-to-detect-battlefield-brain-injuries>.

²⁰ Blast Gauge System, "The Wireless Blast Gauge® System," webpage, undated, <https://blastgauge.com/>.

²¹ Engel, Hoch, and Simmons, 2019; Fish and Scharre, 2018.

²² Engel, Hoch, and Simmons, 2019.

²³ Fish and Scharre, 2018, p. 3.

Consider Embedding Researchers Within Training and Deployed Units

Embedding researchers (e.g., biomedical engineers, neuroscientists, neuropsychologists, clinician-researchers) within units could yield multiple benefits. First, researchers could improve the depth and diversity of data collected and used in studies that examine the impact of low-level blast exposure on service members.²⁴ Second, they could assist with identifying specific military occupational specialties that are more frequently exposed to low-level blast. Embedding researchers ensures that research will remain focused on real-world questions and contexts,²⁵ thereby improving the usefulness of the work being conducted while minimizing the burden placed on the members of the unit themselves.²⁶ It is important to note that none of this is accomplished by researchers merely being physically present. Embedded researchers must focus on building rapport and establishing collaborative relationships with teams.²⁷ This practice not only will guarantee the sustainability of the research being conducted but also will increase DoD's capacity to conduct research and inform policy and practice.²⁸

Conclusion

As U.S. weapon systems continue to become more advanced and increasingly powerful, low-level military occupational blasts will remain an enduring challenge for service members. Addressing the issue of repeated exposure to low-level blasts necessitates action and collaboration between DoD and the research community. DoD should consider expanding existing blast surveillance programs, creating and maintaining blast exposure records, and updating weapon system-specific information to include blast-related characteristics. Moreover, embedding researchers within training and deployed units can significantly enhance data collection and our understanding of the real-world impact that repeated low-level blast exposure has on service members. By implementing these recommendations, alongside continued research efforts to close the substantial knowledge gaps highlighted here, DoD can take significant strides toward better protecting the health and well-being of our service members.

²⁴ Valerie Jenness, "Pluto, Prisons, and Plaintiffs: Notes on Systematic Back-Translation from an Embedded Researcher," *Social Problems*, Vol. 55, No. 1, February 2008; Harriet Rowley, "Going Beyond Procedure: Engaging with the Ethical Complexities of Being an Embedded Researcher," *Management in Education*, Vol. 28, No. 1, January 2014.

²⁵ Edward J. Hackett and Diana R. Rhoten, "Engaged, Embedded, Enjoined: Science and Technology Studies in the National Science Foundation," *Science and Engineering Ethics*, Vol. 17, No. 4, December 2011.

²⁶ Engel, Hoch, and Simmons, 2019.

²⁷ Cecilia Vindrola-Padros, Tom Pape, Martin Utley, and Naomi J. Fulop, "The Role of Embedded Research in Quality Improvement: A Narrative Review," *BMJ Quality & Safety*, Vol. 26, No. 1, January 2017.

²⁸ Nicole Mockler and Susan Groundwater-Smith, "The Knowledge Building School: From the Outside In, from the Inside Out," *Change: Transformations in Education*, Vol. 5, No. 2, November 2002; Sandie Wong, "Tales from the Frontline: The Experiences of Early Childhood Practitioners Working with an 'Embedded' Research Team," *Evaluation and Program Planning*, Vol. 32, No. 2, May 2009.

Senator WARREN. Thank you.

**STATEMENT OF ROSS D. ZAFONTE, CHIEF OF TRAUMATIC
BRAIN INJURY AND HEALTH & WELLNESS PROGRAMS,
HOME BASE**

[Technical problems.]

Dr. ZAFONTE. Good afternoon, Chairwoman Warren, Ranking Member Scott, Members of the Subcommittee. My name is Dr. Ross Zafonte. I am honored to provide testimony today on traumatic brain injury care and blast exposure. My career is centered around improving the lives of people with traumatic brain injury.

I currently serve as President of Spalding, Chair of the Physical Medicine Rehabilitation Department at Harvard Medical School, Chief of the Department of Physical Medicine Rehabilitation at Mass General Hospital and Brigham and Women's Hospital, and for the past 15 years, I have served at the Home Base Program, directing its Brain Injury Program. I actually see the patients, as well as do the research.

Blast overpressure, as we just heard, is a sudden onset of a pressure wave from explosions occurring with shoulder carried artillery in training or deployment, in breaching buildings, and from improvised explosive devices. Generally, the bigger the explosion, the more damaging the pressure width.

TBI can have a wide range of physical and physiologic effects. Some signs appear immediately, others take days or weeks to occur, and they may result in physical, sensory, cognitive, behavioral, or mental impacts.

According to the Department of Defense, since 2000, over 400,000 U.S. servicemembers experienced at least one brain injury and 40 percent of those later screened positive for co-morbid psychological health conditions.

Our own research has noted an elevated 10 year risk of hypertension, cardiac disease, endocrine or hormonal dysfunction, and behavioral concerns such as depression even among the youngest of patients.

Home Base is located in Charlestown, Massachusetts, with, I am proud to say, as a native Floridian, satellite locations in Florida and Arizona, and operates one of the oldest and most impactful private sector programs in the Nation.

For 15 years, we have served as an incubator for innovative clinical care models and research, and the program is nested within Mass General Hospital, allowing us to leverage the faculty in Mass General Brigham Health System. Home Base bridges the gap between research and clinical care.

Now, in 2018, Home Base was approached by the Navy Special Warfare with a complex set of problems facing Navy SEALs. We quickly developed a comprehensive brain injury and polytrauma program. This program is named COMBAT, or the Comprehensive Brain Health and Treatment Program.

It is modeled after existing programs that we developed for elite athletes and provides integrated, multi-disciplinary, specialist treatments, evaluation and care coordination for veteran and Active Duty operators. Home Base has treated nearly 1,000 special operators through our intensive programs, 71.9 percent of combat participants are Active Duty and the overwhelming majority return to duty, so we are keeping the fighting force active. We currently have 178 Active Duty special operators waiting to be screened and scheduled for COMBAT Program, and COMBAT has cared for operators in 47 States, the District of Columbia, Guam, Puerto Rico, including 53 patients from Massachusetts, 60 from Florida, 6 from Connecticut, 22 from Hawaii, 278 from Virginia, 4 from Illinois, 1 from Alaska, and 54 from North Carolina.

The COMBAT program is highly efficient, agile, and compressed into a 5-day model of care. Patients see a minimum of nine pro-

viders, and this may expand grossly related to pertinent diagnostic imaging or other studies.

So, in summary, we are very grateful for the support of Congress, especially Chairwoman Warren, has shown this program, and for the partnership and financial support provided by SOCOM.

The program is successful and the demand for care is growing at a steady pace. Based on my experience in this field and treating patients at Home Base, I would recommend the Department of Defense consider the following options. Invest in and develop tools to measure——

[Technical problems.]

Dr. ZAFONTE. Increase funding for partnerships with academic medical centers. Ensure all servicemembers with traumatic brain injury can easily access care. And as has been said, that data needs to be linked to blast exposure.

Develop novel methods to define and understand the impacts of declining health spans and develop treatment interventions. I also recommend that DOD partner with Home Base to develop a long term, longitudinal health span study on the multi-system injury of blast and traumatic brain injury.

And invest in research that evaluates and treats the long term sequelae of repeated brain injuries of blast exposure. Thank you for the opportunity to testify on this very important topic, and for your commitment to supporting members of the military. I am happy to answer questions the Committee may have.

[The prepared statement of Dr. Ross D. Zafonte follows:]



Hearing Testimony
Senate Armed Services Personnel Subcommittee
February 28, 2024

Ross D. Zafonte, D.O.
Chief of the Traumatic Brain Injury and Health and Wellness Programs, Home Base
President, Spaulding Rehabilitation
Earle P. and Ida S. Charlton Professor and Chair
Department of Physical Medicine and Rehabilitation, Harvard Medical School
Chief, Physical Medicine and Rehabilitation, Massachusetts General Hospital and Brigham and Women's Hospital

Good afternoon, Chairwoman Warren, Ranking Member Scott, and members of the Subcommittee. My name is Dr. Ross Zafonte, and I am the honored to provide testimony today on traumatic brain injury and blast exposure care for members of the armed services.

My career has centered around improving the lives of people with traumatic brain injury, spinal cord injury, and other catastrophic illnesses. I currently serve as the President of Spaulding Rehabilitation, Chair of the Department of Physical Medicine and Rehabilitation (PM&R) at Harvard Medical School, and Chief of the Department of PM&R at Massachusetts General Hospital and Brigham and Women's Hospital. For the past 15 years, I have also served as Chief of Traumatic Brain Injury at Massachusetts General Hospital's Home Base program, where I developed and oversee a comprehensive brain injury and polytrauma program uniquely designed for service members and veterans, including a groundbreaking model launched five years ago that focuses on members of the Special Operations community. This program treats Special Operators who often experience the highest level of blast and extreme environmental exposures.

Throughout my career, I have published more than 400 peer-reviewed journals, articles, abstracts, and book chapters on traumatic brain injury, spasticity, and other neurological disorders. My textbook, *Brain Injury Medicine*, is regarded highly in the field of brain injury care. My current work involves several large clinical trials and has been funded by the National Institutes of Health (NIH), the U.S. Department of Defense (DOD), and the National Institute on Disability and Rehabilitation Research (NIDRR). I am also the Principal Investigator for the Football Players Health Study at Harvard University, a comprehensive research program examining the multifactorial causes that impact the health and well-being of former NFL players.¹

¹ <https://footballplayershealth.harvard.edu/team/ross-zafonte/>

Blast Overpressure

Known as BOP, blast overpressure is the sudden onset of a pressure wave from explosions occurring with the use of shoulder-carried artillery and heavy armor in both training and deployment, in breaching buildings, and from improvised explosive devices. Generally, the bigger the explosion, the more damaging the pressure wave. Blast waves are often reflected off surfaces resulting in a double hit of more. For example – a blast wave can reflect from a surface such as the ground and result in a reflected pressure between two and eight times the incident pressure.² Recent development of blast exposure measures are helpful, recent research has suggested that the severity of the exposure may have a greater impact on brain volume. Several survey tools have been developed and a single measure may be most helpful in linking exposure to long term health concerns. Some investigators have demonstrated evidence of neuroinflammation with exposure and standard cognitive testing measures may be less sensitive to changes early in the time course after exposure.³

Impact of BOP on the Warfighter

Traumatic brain injury (TBI) is one of the invisible wounds of war and one of the signature injuries of troops wounded in Afghanistan and Iraq.⁴ TBI can have wide-ranging physical and psychological effects. Some signs or symptoms may appear immediately after the traumatic event, while others may appear days or weeks later. Researchers and care providers classify injury into three levels of severity, although these are considered controversial and no injury should truly be considered mild—mild, moderate, and severe. These categories are based on loss of consciousness, length of memory loss and confusion and responsiveness after the injury.

Mild TBI can have long term physical, sensory, and cognitive, behavioral, or mental symptoms, including headaches, difficulty with balance fatigue, loss of balance, blurred vision, ringing in the ears, memory or concentration problems, mood changes, and difficulty sleeping. We now know that many do not recover for months.

Even after surviving a moderate or severe TBI and receiving inpatient rehabilitation services, a person's life expectancy is 9 years shorter.⁵ TBI increases the risk of dying from several causes. Compared to people without TBI, people with TBI are more likely to die from seizures, infections, and pneumonia.⁶ People with moderate-to-severe TBI typically face a variety of chronic health problems. Among those still alive five years after injury:

- 57% are moderately or severely disabled.
- 55% do not have a job (but were employed at the same time of their injury)
- 50% return to a hospital at least once
- 33% rely on others for help with everyday activities

² Magnuson, J., Leonessa, F. & Ling, G.S.F. Neuropathology of Explosive Blast Traumatic Brain Injury. *Curr Neurol Neurosci Rep* 12, 570–579 (2012). <https://doi.org/10.1007/s11910-012-0303-6>

³ Stone, J. R., Avants, B. B., Tustison, N. J., Gill, J., Wilde, E. A., Neumann, K. D., Gladney, L. A., Kilgore, M. O., Bowling, F., Wilson, C. M., Detro, J. F., Belanger, H. G., Deary, K., Linsenbardt, H., & Ahlers, S. T. (2024). Neurological Effects of Repeated Blast Exposure in Special Operations Personnel. *Journal of neurotrauma*, 10.1089/neu.2023.0309. Advance online publication. <https://doi.org/10.1089/neu.2023.0309>

⁴ https://dod.defense.gov/News/Special-Reports/0315_tbi/

⁵ https://www.cdc.gov/traumaticbraininjury/pdf/moderate_to_severe_tbi_lifelong-a.pdf

⁶ *Ibid.*

- 29% are not satisfied with life
- 9% use illicit drugs or misuse alcohol
- 12% reside in nursing homes or other institutions

Service members experience repeated blast exposures frequently due to operating heavy weaponry including artillery and mortar firing, grenades, flash bang devices, shoulder-fired weapons, and command breaching.

According to the Department of Defense, since 2000, over 413,000 US service members experienced at least one TBI, and 40% of those with in-theater TBIs later screened positive for comorbid psychological health conditions, including post-traumatic stress disorder (PTSD), depression, and anxiety.⁷

In military settings, 4psi (~27kPa) is the current safety standard based on human tympanic membrane rupture. Studies have reported, however, that this limit can be exceeded in real world scenarios where 2-13psi (14-90kPa) has been measured.⁸ The truth is that members of the Special Forces often exceed suspected safe levels of serial exposure.

Recent models suggest the cumulative effect of repeated low-level blasts (rLLB) may cause neurological deficits that develop over months. For instance, personnel who are exposed to rLLB may not show obvious symptoms right away and continue with their work which leads to further exposures and increasing the risk of injury.⁹ Such repeated injury may result in axonal injury and chronic neuroinflammation, cycle that may facilitate long term dysfunction.

Long-term health issues associated with BOP exposure.

While the exact long-term effects of blast are still to be characterized, repeated brain injury has been associated with neurodegenerative disease, and recent reports suggest a specific astroglia pathology. My own research with TBI has noted an elevated 10-year risk of hypertension, endocrine and hormonal dysfunction, cardiac disease, and behavioral concerns such as depression, anxiety, and even bipolar disorder. Such work on cardiovascular risk has recently been corroborated by a military study group¹⁰. These findings suggest that TBI of any severity is associated with a higher risk of chronic cardiovascular, endocrine, and neurological comorbidities in patients without baseline diagnoses. Medical comorbidities were observed in relatively young patients with TBI, not just older people¹¹. Recent reports have also suggested links to other neurologic illness.

⁷ DeGraba, T. J., Williams, K., Koffman, R., Bell, J. L., Pettit, W., Kelly, J. P., Dittmer, T. A., Nussbaum, G., Grammer, G., Bleiberg, J., French, L. M., & Pickett, T. C. (2021). Efficacy of an Interdisciplinary Intensive Outpatient Program in Treating Combat-Related Traumatic Brain Injury and Psychological Health Conditions. *Frontiers in neurology*, 11, 580182. <https://doi.org/10.3389/fneur.2020.580182>

⁸ Ravula, A. R., Das, T., Gosain, A., Dolalas, T., Padhi, S., Chandra, N., & Pfister, B. J. (2022). An update on repeated blast traumatic brain injury. *Current Opinion in Biomedical Engineering*, 24, Article 100409. <https://doi.org/10.1016/j.cobme.2022.100409>

⁹ Ibid.

¹⁰ Stewart, I. J., Amuan, M. E., Wang, C. P., Kennedy, E., Kenney, K., Werner, J. K., Carlson, K. F., Tate, D. F., Pogoda, T. K., Dismuke-Greer, C. E., Wright, W. S., Wilde, E. A., & Pugh, M. J. (2022). Association Between Traumatic Brain Injury and Subsequent Cardiovascular Disease Among Post-9/11-Era Veterans. *JAMA neurology*, 79(11), 1122–1131. <https://doi.org/10.1001/jamaneurol.2022.2682>

¹¹ Izzy, S., Chen, P. M., Tahir, Z., Grashow, R., Radmanesh, F., Cote, D. J., Yahya, T., Dhand, A., Taylor, H., Shih, S. L., Albastaki, O., Rovito, C., Snider, S. B., Whalen, M., Nathan, D. M., Miller, K. K., Speizer, F. E., Baggish, A., Weisskopf, M. G., & Zafonte, R. (2022). Association of Traumatic Brain Injury with the Risk of Developing Chronic

In addition, we should consider in this special population the long-term sequelae of sleep dysfunction and the chronic musculoskeletal pain that can result from multiple parachuting jumps and injuries in theatre. All of which have an impact on the service members force readiness and long-term health.

Home Base Model of Care

Home Base -- located in Charlestown, Massachusetts, with satellite locations in Florida and Arizona -- operates one of the oldest and most impactful private-sector programs in the nation dedicated to delivering lifesaving clinical care and support for the treatment of invisible wounds, including post-traumatic stress, traumatic brain injury, anxiety, depression, co-occurring substance use disorder, family relationship challenges, and other issues associated with military service.¹² Since its inception, Home Base has provided care and support to more than 35,000 veterans, service members, their families, and families of the fallen from all 50 states, 5 territories, and 13 countries—all at no out-of-pocket cost to the patient, thanks to a grateful nation of supporters.

For nearly 15 years, Home Base has been an incubator for innovative clinical care models and research. Home Base is nested within the world-renowned Massachusetts General Hospital, and our National Center of Excellence leverages the extensive resources and faculty of the Massachusetts General Hospital, Harvard Medical School, Spaulding Rehabilitation Hospital, the Massachusetts Eye & Ear Hospital, and other elements of the Mass General Brigham integrated healthcare system to deliver evidence-based care. Moreover, this incredible ecosystem we operate within provides us with insight into the latest research and clinical care opportunities and daily access to world-leading researchers and clinicians who work on the forefront of mental health and brain injury care. This ensures that our efforts to treat these invisible wounds are synchronized, not siloed.

Our research provides crucial insights into the complex interplay between single and repeated TBIs, chronic diseases, and premature aging – guiding evidence-based interventions and advancing clinical care standards. We bridge the gap between research and practice, ensuring that cutting-edge findings translate into tangible benefits for those we serve.

Home Base's Comprehensive Brain Health and Treatment Program (ComBHAT Program) and 2-Week Intensive Clinical Program (ICP)

At the end of 2018, Home Base was approached by Naval Special Warfare, a subset of USSOCOM, with a complex set of challenges facing Navy SEALs. We immediately developed a comprehensive brain injury and polytrauma program that matched the up-tempo time constraints and complex medical needs of Special Operations Forces personnel (SOF personnel).

Launched in 2019, the five-day Comprehensive Brain Health and Treatment Program (ComBHAT program) is modeled after existing programs for elite athletes, including NFL players. ComBHAT provides integrated, multidisciplinary specialist evaluation, treatment initiation, and care coordination for active-duty and veteran SOF personnel with mild and moderate TBI, leveraging the depth and breadth of specialists across the Mass General Brigham integrated healthcare system.

Cardiovascular, Endocrine, Neurological, and Psychiatric Disorders. JAMA network open, 5(4), e229478.

<https://doi.org/10.1001/jamanetworkopen.2022.9478>

¹² Home Base is in 3 communities in Florida in partnership with FGCU, David Lawrence Center, and Tampa General Hospital, with plans to expand to the Florida panhandle in partnership with Lifeview Health. Home Base also expanded to Arizona in 2024, in partnership with Arizona State University.

Patients receive evaluations from brain injury medicine, neuropsychology, clinical psychology, psychiatry, neuroendocrinology, sports medicine, and musculoskeletal and vestibular physical therapy. Other evaluations and services are provided on an as-needed basis. Accompanying diagnostic tests include neuroimaging, hormone evaluation, metabolic testing, other laboratory testing, and cardiovascular and cerebrovascular function testing. Treatments are recommended based on evaluations and can include, but are not limited to rehabilitation, physical therapy, headache treatment, sleep interventions, medication or injection-based therapies, and home exercise programs. Each participant leaves with a comprehensive and personalized treatment and rehabilitation plan to implement in their home community.

Home Base also provides personalized needs assessment, TBI education, and support services to military family members and caregivers. Participants can matriculate into other treatment programs within Home Base or best-in-class programs in other parts of the country, as clinically indicated. Many have sufficient health problems that they are deemed eligible for our 2-week Intensive Clinical Program (ICP), which cares for all era service members and veterans from all 50 states. This outpatient program provides evidence-based therapy with complimentary holistic care to address invisible wounds of war. This innovative model of care has a 95% completion rate with treatment tracks in brain injury, mental health (PTSD, anxiety, depression) and substance use disorder. Since inception, Home Base has treated nearly 1,000 SOF through the ComBHaT program and ICP.

The ComBHaT program has cared for patients from 47 states, the District of Columbia, Guam, and Puerto Rico, including 53 patients from Massachusetts, 60 from Florida, 6 from Connecticut, 22 from Hawaii, 278 from Virginia, 4 from Illinois, 1 from Alaska, 54 from North Carolina. 71.9% of ComBHaT program participants are active duty and 178 Special Forces personnel are currently waiting to be screened and scheduled.

Benefits of the ComBHaT Program

- **Agility** – The consistent flow of patients from SOF enables us to extrapolate findings and adjust programing in real time as services are needed. The ComBHaT program serves as an incubator for brain health innovation e.g., such as the rate of cancer diagnosis we have seen in our SOF patient population has led to collaboration with the Massachusetts General Hospital Cancer Center to include cancer screening as standard protocol of the evaluation process.¹³
- **Meeting the Demand** - The program was initially piloted with Naval Special Warfare but has now expanded to serve all SOF. As of February 2024, nearly 500 SOF personnel, of which 71.9% are active-duty, have completed this unique program and 178 currently waiting to be screened and scheduled.
- **Compressed and Efficient Model of Care** – The ComBHaT program is a highly efficient, compressed 5-day care model that limits the time away from service, work, and family. Patients see a minimum of 9 medical specialists, and this number is generally higher as additional interactions occur as they pertain to diagnostic studies/imaging and specific labs. In other healthcare settings, the complex

¹³ Stewart, I. J., Howard, J. T., Poltavskiy, E., Dore, M., Amuan, M. E., Ocier, K., Walker, L. E., Alcover, K. C., & Pugh, M. J. (2024). Traumatic Brain Injury and Subsequent Risk of Brain Cancer in US Veterans of the Iraq and Afghanistan Wars. *JAMA network open*, 7(2), e2354588. <https://doi.org/10.1001/jamanetworkopen.2023.54588>

- Central to our mission is understanding that polytrauma injuries, especially those impacting brain health, have profound and far-reaching consequences. We're actively investigating the long-term effects of these injuries, which encompass a spectrum of physical and psychological ailments ranging from neurodegenerative diseases to behavioral health disorders and even cancer. Through my research and collaboration with specialists, we're uncovering critical insights that inform evidence-based interventions and elevate standards of clinical care.

Our commitment to comprehensive evaluation has unearthed cases of serious illnesses such as myasthenia, Parkinson's, and tumors affecting the head and neck region among SOF personnel. By swiftly identifying and addressing these life-threatening conditions, we ensure that our beneficiaries receive world-class care from a multidisciplinary team of experts. This integrated approach not only saves lives but also underscores our dedication to delivering tangible benefits to those we serve.

¹⁴ Special Operations Forces Wounded Warriors receive specialized brain-health care (socom.mil)

¹⁵ Grashow, R., Shaffer-Panczyk, T. V., Dai, L., Lee, H., Marengi, D., Jr, Baker, J., Weisskopf, M. G., Speizer, F. E., Whittington, A. J., Taylor, H. A., Jr, Keating, D., Tenforde, A., Guseh, J. S., Wasfy, M. M., Zafonte, R., & Baggish, A. (2022). Healthspan and chronic disease burden among young adult and middle-aged male former American-style professional football players. *British Journal of Sports Medicine*, 57(3), 166–171. Advance online publication. <https://doi.org/10.1136/bjsports-2022-106021>

The ComBHAT program serves as a cornerstone in our pursuit of extending healthspan and improving overall well-being. By elucidating the complex interplay between TBIs, chronic diseases, and premature aging, we're driving forward evidence-based interventions that bridge the gap between research and practice. Through our unwavering commitment to excellence, we're not just prolonging lives but enhancing the quality of life for service members and veterans alike.

Summary and Recommendations

We are grateful for the support Congress, especially Chairwoman Warren, has shown for this program, and for the partnership and financial support provided by SOCOM. The program has been successful. Patients have shown a reduction in TBI symptoms, improved cognitive function, improvements in psychiatric symptoms, specifically depression and trauma-related symptoms, and enhanced resiliency.

The ComBHAT program provides crucial insights into the complex interplay between single and repeated TBIs, chronic diseases, and premature aging, guiding evidence-based interventions and advancing clinical care standards. We bridge the gap between research and practice, ensuring that cutting-edge findings translate into tangible benefits for those we serve.

Based on my experience in this field and treating patients at Home Base, I recommend the Department of Defense:

1. Invest resources and develop a series of consistent physiological and non-physiologic tools to measure blast exposure.
2. Continue to support and increase funding for public-private partnerships with academic medical centers for programs like ComBHAT and the 2-week Intensive Clinical Program to enable access to world-class treatment without barriers.
3. Ensure all active-duty service members with blast overpressure exposure and TBI can easily access high-quality care to address the full spectrum of injuries, no matter where they are deployed.
4. Develop novel methods to define and understand the impacts of declining healthspan in active-duty service members and develop a tool to measure intervention over a longitudinal period of time.

I also recommend the Department of Defense partner with Home Base to:

1. Develop a long-term longitudinal healthspan study¹⁶ to capture the impact of multisystem injury from repeated brain injury and blast exposure.
2. Invest in research that evaluates and treats the long-term sequelae of repeated brain injuries and blast exposure.

Thank you for the opportunity to testify on this very important topic.

¹⁶ Grashow, R., Shaffer-Panczyk, T. V., Dairi, I., Lee, H., Marengi, D., Jr, Baker, J., Weisskopf, M. G., Speizer, F. E., Whittington, A. J., Taylor, H. A., Jr, Keating, D., Tenforde, A., Guseh, J. S., Wasfy, M. M., Zafonte, R., & Baggish, A. (2022). Healthspan and chronic disease burden among young adult and middle-aged male former American-style professional football players. *British Journal of Sports Medicine*, 57(3), 166–171. Advance online publication. <https://doi.org/10.1136/bjsports-2022-106021>

Senator WARREN. Thank you, Dr. Zafonte. Mr. Larkin, would you like to make an opening statement?

STATEMENT OF FRANK J. LARKIN, CHIEF OPERATING OFFICER, TROOPS FIRST FOUNDATION, LEAD OF NATIONAL WARRIOR CALL DAY INITIATIVE

Mr. LARKIN. Thank you to the Committee for the opportunity to speak. My formal testimony is submitted for the record.

As a former Navy SEAL, I am here today to be a voice for all those that have worn our Nation's uniform and are currently struggling everyday with both visible and invisible wounds. Wounds that transcend mental, physical, and spiritual domains. Wounds that transcend—I am sorry, wounds that have influenced an epidemic

level of suicides amongst our Active Duty force and veteran populations.

My intent today is not to pounce on the Department of Defense or the Veterans Administration, but to help them succeed. I would not be here if it was not for my son Ryan, U.S. Navy SEAL Special Operator 1st Class Ryan F. Larkin. My son would be 36 years old today if he had not taken his life on the morning of April 23d, 2017.

He had been suffering from what we have come to characterize as invisible wounds, a complex rubric of post-traumatic stress disorder, moral injury, and substance use disorder that was complicated by undiagnosed traumatic brain injury from blast exposure, the signature injury of the past 20 plus years fighting the global War on Terror.

Ryan was a highly decorated and accomplished Navy SEAL, trained as a special operations medic, sniper, and explosives breacher. He loved being a SEAL, furthered by the love and loyalty for his teammates that was cemented on the battlefield.

Following four heavy combat tours in Iraq and Afghanistan, Ryan, like many others who have worn the uniform of our Nation in combat, began experiencing uncharacteristic changes that manifested in difficulty sleeping, nightmares, anxiety, hypervigilance, loss of memory and declining cognitive functions. He stopped smiling. He sought help, but the help that was offered was not aligned with what he needed.

When his condition became more complicated, and their proposed solutions didn't work, the system weaponized his pleas for help against him and pushed him out of the SEAL team and out of the Navy.

This abrupt separation created another deep weeping wound. He felt that he had let his teammates down, abandoning them. The system he trusted hung labels on him to justify their assessments and their actions. A year after he honorably separated from the Navy, Ryan ended his life. Ryan repeatedly said, something is wrong with my head, nobody is listening, they keep telling me I'm crazy.

This was reinforced by the endless stream of medications prescribed by both defense health and VA clinicians to address his behavioral symptoms, not the root cause of his challenges. Everything defaulted to psychiatric and mental health illness, with very little mention of TBI, despite his operational profile and repeated exposures to blast overpressures from our weapons systems and enemy IEDs.

Over the course of 2 years between defense health and the VA, he was prescribed over 40 different medications, everything from potions, lotions, and creams to high end psychotropic and mood stabilizing drugs. He never received a clinical diagnosis. He was a walking experiment.

One night prior to his death, he said that he wasn't going to live very long, that he was broken up inside. He made me promise that if anything ever happened to him, that he wanted his body donated for TBI-Breacher's Syndrome research. Then he turned to me and said, you know dad, it is going to take guys killing themselves before the system wakes up to the fact that it has a problem.

The guys are hurt. Ryan's brain was donated to a DOD research effort at Walter Reed National Military Medical Center. Two months later, we learned that Ryan had a severe case of undiagnosed microscopic brain injury uniquely related to repeated blast exposure. Ryan was hurt, not crazy.

He was right all along. Unfortunately, our medical enterprises could not and still cannot see this level of microscopic injury in a living warfighter or veteran. My son died from his injuries suffered both in training for combat and combat operations.

He just didn't die right away. These warriors with invisible wounds, they are hurt. They are not broken. They break when they are cut away from their teammates, their tribes, and are betrayed by the institutions where they have given their all. It has been 23 years since 9/11. DOD has spent almost \$3 billion in mental—on mental health, substance abuse, suicide prevention, PTSD, TBI, and other warfighter assistance programs.

I give them a D plus, C minus at best, for the lack of measurable impact for those who need answers. Those are the deck plate, dirt level warfighters we promised to take care of and not leave behind.

Blast exposure is a key threat to warrior brain health and potentially represents a significant national security threat to our force, readiness, and resiliency. However, whatever solutions we come up with, it can't impact our operational effectiveness or lethality on the battlefield.

We need to do this smarter and by down the risk on the front end. Thank you for the opportunity to be the voice for others like Ryan. Subject to your questions.

[The prepared statement of Mr. Frank J. Larkin follows:]

PREPARED STATEMENT BY MR. FRANK J. LARKIN

INTRODUCTION & BACKGROUND

... We know that losing someone with traumatic brain injury (TBI) to suicide isn't the worst part. There are 500,000 other Ryan's currently out there with TBI trying to stay alive, despite being four times as likely to attempt suicide. Military TBI and suicide scientist Dr. Jayna Mocer-Brooks' husband, a career Armor officer with TBI, is just one of them. We know the worst parts are when you get the call about another. And another. And another.

We know no one is immune, not even colleagues like Dr. Kate Rocklein, whose husband Michael Froede was Special Operations (SOF), had TBI, and died shortly after Ryan as she was conducting research on factors inducing suicide in SOF. Always canaries in the coal mine, we know Special Operations' projected incidence of TBI exceeds 52 percent, three times that of other combatant commands, with corresponding suicides in these elite units outpacing the larger military at estimated rates of 2.5 to 1.

Ryan, Michael, nearly half of Michael's chalk from the Special Forces Q course, and countless others have died from TBI while inspectors general found last year the entire US Central Command failed to assess and treat brain injuries in its combat troops. Or DOD assigning no oversight authority for TBI initiatives force wide. Or DOD spending three billion taxpayer dollars on quote-unquote the best neurological care possible, like \$3.7 million reading Greek classics to soldiers, or \$2.7 million producing a Sesame Street vignette about death.

Or DOD spending \$76 million annually for Preservation of the Force and Family, an unsuccessful non-clinical fitness program posing as brain and mental healthcare for Special Operators still disproportionately dying from TBI-related suicide. Unfortunately, that human performance program is the foundation of the Warfighter Brain Health Initiative.

Without this Committee exercising the considerable power endowed by its mandate to ensure our common defense, holding leadership accountable for treating TBI and preventing related suicides will remain aspirational, to the horror of families

imagining more survivors bearing the costs of these wars, and to a generation of potential recruits again witnessing our military abandon the very troops it has unsuccessfully enticed them to become.

We are elevating these threats to servicemembers (SM) lives to congressional levels based on alarms raised by impartial clinicians and scientists analyzing 20+ years of DOD's TBI initiatives. We are elevating these threats because DOD's reports to Congress now globally exclude mention of TBI and, on their face, are overtly disingenuous and have over-capitalized Congress' patience and goodwill.

We know DOD hyperfocus on capturing blast overpressure data is a ruse because DOD has had exposure thresholds for a decade. Warfighter Brain is a 5-year-long exercise in regurgitative rebranding of previously ignored recommendations made by myself and others years ago. We know experts predict Warfighter Brain is more likely to induce TBI-related suicides than prevent them.

We know the Longitudinal Blast Overpressure Study was neither longitudinal nor an actual research study. Despite unfettered access to DOD-created and approved sensors, investigators used untested, faulty sensors while exposing SMs to dangerous ex-urban blast overpressures without informed consent or right to refuse. Were it legitimate research, it never would have passed review by a qualified ethics board. And if it had produced any tangible results, those data would be dismissed as biased, problematic, and unacceptable.

We know that pillars of Warfighter Brain have no basis in medical evidence, nor can such human performance programs treat brain trauma in any way advised by clinical medicine. We've known since 2006 that athletic training cannot improve TBI cellular pathologies. We know DOD's current plan is to treat TBI primarily by accelerating SMs' cognitive processing speeds—an infinitesimally small aspect of TBI—but not by providing cutting-edge TBI assessment and treatment available to civilian citizens.

In the words of one Operator with TBI, "HPO just means we're in the best shape of our lives when we kill ourselves."

We know DOD has weaponized science to avoid acting decisively on TBI: they will again try to convince you that nothing can be done without snipe hunting for more data. We know TBI from blasts with pressures as low as 30psi—about the force of a bicycle tire exploding—scrambles DNA signaling, causing hosts of chronic clinical syndromes and neurological disorders, from Parkinson's to mood disorders to suicide. Yet in November 2022, ASD guidance was that overpressures of 4psi were plenty dangerous enough. Again: we know that DOD knows the overpressures and thresholds.

We know that SOF's superior fitness and resilience does not repair anatomical damage from blast exposures and treating TBI with human performance optimization is like prescribing CrossFit for Alzheimer's. We know the past 10 years of DOD pushing athletic wellness programs for neurological injuries has done much to gaslight SMs with TBI into believing they could heal if they weren't so weak, further incenting their suicides.

We know DOD is publicly moving toward force wide assessment of cognitive processing deficits from TBI to remove injured SMs and their families from career military service with immediacy—"med-boarding" them is far more economically appealing than expenditures toward healing and retaining our Nations' most experienced and sophisticated SMs during a time when we can recruit neither into our armed forces.

We know from Dr. Mocerri-Brooks' pioneering work that receiving the Purple Heart for brain injuries would reduce suicides, one of precious few tangible solutions available to us. We also know that without consent of Congress, DOD adjusted criteria for the Purple Heart and TBI. Awards branches now misapply regulations in denying multitudes of eligible SMs Purple Hearts for combat related TBI: officially denying this injury's existence and further incenting their suicides.

We know from Dr. Rocklein's influential work that Special Operators have been stripped of tabs and tridents and separated from their teams en masse for exhibiting uncontrollable symptoms of TBI and suicidal behaviors. We know such institutional betrayals precede suicide in Special Operations more often than not. And tomorrow these unsanctioned practices can be easily reversed—with the stroke of a pen—at no cost to taxpayers.

We know Warfighter Brain is another slick, opaque strategy full of battlefield buzzwords without clear paths to success. Since we also know DOD is only selling tickets to another circus, my second recommendation is to transfer TBI care to vetted, agile private industry and academic health sciences partnerships equipped to immediately assess and initiate approved emerging treatments with basis in evidence and efficacy.

Last, and especially poignant given my presence here because of Ryan's death, and Dr. Rocklein's discoveries because of Michael's death: we know comprehensive reforms are the only viable path forward. Therefore, I recommend immediately implementing the Froede-Larkin Reform Act, also submitted prior to testifying, into this year's NDAA. It is evidence-based and signals sincere course correction to disenfranchised SMs with TBI, and their families suffering with them, reverses nearly 20 years of TBI mismanagement and confusion, and ensures upcoming generations of SMs never again experience such cruelties of bureaucratic inertia toward their health, welfare, and survivability.

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Senator WARREN. Thank you, Mr. Larkin. I appreciate your being here and sharing this story. I am sorry for your loss, and I am sorry for the treatment your son Ryan received. I think you said it right, traumatic brain injuries are considered “the signature wound” of our wars in Iraq and Afghanistan.

While improvised explosive devices, IEDs, may have caused some of these medical injuries, a military medical research study found that for troops with mild traumatic brain injury, “the most important cause of brain injury was the long term exposure to explosive weapons.”

In 2011, the Defense Advanced Research Projects Agency determined that 75 percent of the troops’ blast exposure in Afghanistan was coming from their own weapons. The effects of blast overpressure are terrible, including memory loss, increased risk of dementia, and substance abuse problems.

But despite the severity of these impacts on servicemembers’ health, when these problems are diagnosed, blast exposure is rarely identified as a potential cause. Dr. McBirney, you have studied this issue for 15 years now. Why is it so difficult to detect when blast overpressure is causing the types of symptoms that we are talking about here in our servicemembers?

Dr. MCBIRNEY. That is a great question, Senator Warren, and a question that so many people within the research community are committed to answering. It really comes back to the nature of the injury itself.

We are not looking at an injury that is caused by one isolated event. The fact that it is caused by repeated exposure to very low level blasts that perhaps might happen throughout the course of an entire military career really complicates injury recognition.

Add to that the fact that symptoms typically don't manifest immediately, as was mentioned, and it becomes increasingly difficult to link symptoms to repeated exposure.

Senator WARREN. So, yes, I just want to say, I want to pick up on this, because I think this is a really important point about the challenge in trying to diagnose because of the very nature of what the injury looks like. It is not a single moment in time where this happens. And so, I just want to pick up and let's see if we can take this forward.

We need to know how often, I take it from your testimony—we need to know how often a servicemember has been exposed to blast overpressure, to give medical personnel the information that they need to identify and treat the underlying cause of their symptoms. Now, so far, the DOD only has blast exposure data for a total of 500 servicemembers.

We are missing data, obviously, for a whole lot more. Tracking this information through blast exposure and traumatic brain injury logs for all servicemembers would be a good start, but we also need to pay special attention to servicemembers that are at especially high risk for blast exposure.

Some military occupational specialties, MOSs, such as training instructors, are significantly more likely to be exposed to blast during training or operations. The Marine Corps found that the artillery community is also at particularly high risk and that high rates of exposure could lead them, "to suffering injuries faster than combat replacements can be trained to replace them."

So, Dr. McBirney, I wanted to give you another chance in this is we are trying to push this forward, does DOD currently have the strategies it needs to mitigate the risks from blast overpressure that are specific to each of the military occupational specialties that are most likely to be exposed?

Dr. MCBIRNEY. I can't say I am aware of any of those strategies. And in addition to that, a lot of the folks with whom I interact on a very regular basis with boots on the ground in these communities that are at risk of significant exposure are additionally unaware of such strategies.

Senator WARREN. Okay. So, anything more do you want to say about what DOD should be doing in this space? I want to make sure I have given you a chance here.

Dr. MCBIRNEY. No. Thank you, Senator. I think really Mr. Larkin and I were discussing prior to this. I think if my—if I could choose the key takeaway for today, it would be to not let perfection interfere with progress. I think everyone here is looking for the right solution. And what we really want to be sure of is that we don't wait too long to implement what we think is a perfect solution.

There is a lot of research that still needs to be done. Coming from the research community, I am always a supporter of more research. That being said, we can also be looking to implement solu-

tions, study said solutions, while they are being implemented at the same time.

Senator WARREN. So, let's focus on that for just a second, just a little bit more, about the idea of collecting the data as we go along, so at least it is a first step in getting the information that we need.

I understand this is a gap that DOD needs to fill, and I understand that it is more challenging to limit servicemember blast exposure during combat, but there is no excuse for DOD to continue to expose servicemembers to unnecessary levels of blast overpressure during training. This is obviously an area where we could make change, and it is clear that there is a lot we need to do to protect our servicemembers from blast exposure.

But DOD, it goes to your point Dr. McBirney, DOD constantly says we need more research, we need more research. And I am a data nerd. I always want more research, but I am very concerned about the idea that we are going to put off treatment.

So, let me put the question more specifically to you, and that is, do you think we know enough now about the risks of blast overpressure to servicemembers' health to start taking action now?

Dr. MCBIRNEY. In short, absolutely. Yes.

Senator WARREN. All right. So, we do know enough. So, there are number of steps DOD could take to help us get more data so that we can understand this over time, but more importantly, a number of steps they could take right now in terms of treatment.

I have talked long enough so I will come back to you later on this, Dr. Zafonte and Mr. Larkin. Senator Scott.

Senator SCOTT. Yes. Well, first, Mr. Larkin, I can't imagine—having kids and grandkids, I can't imagine lose one. So, thank you for your service, your son service and just hope as a result, you know, something good happens out of it. Somebody—it prevents something else from happening.

Dr. Zafonte, can you explain what the—the blast, what does it do to the brain like this? Like let's say, you know, I go shoot a shotgun or doing this stuff, what does it do—each one of them, how does it impact my brain?

Dr. ZAFONTE. Well, I think, to my colleagues' good point, perfection is the enemy of the good. You can criticize all of the models, but we know that these sub-concussive injuries do a number of different things.

They probably disproportionately impact areas of the brain at gray matter, white matter interfaces. They probably have a vascular effect. More likely long term, there is possibly a premature aging effect to the brain itself with multiple repetitive blast exposures or certainly with traumatic brain injury.

So, lifelong exposure, getting that quantification that Senator Warren talked about is critically important because we need to know one thing. We need to know in who, how much, what were they doing, and then what was the actual phenotype or what actually happened to the symptoms of the person, and track that very carefully.

Senator SCOTT. So, right now, you can get a glucose monitor and put all your data in there, and pretty fast you can get a correlation, right? So have you had any opportunity to take—because we know, if you joined the service, we know what blast you are going to have

in boot camp if you are enlisting—you know, enlisted. Is there anybody that is doing anything to just say that when you just put all this data on something and then just look at the model over a period of time?

Dr. ZAFONTE. I think there are a number of groups, including our own, looking at blood based biomarkers for people, neuroimaging. All of those are critical as we understand the exposure and the diagnosis.

But we also want to know how those things and specific lifelong exposures impact the symptoms of the person. Because there is not a 1 to 1 relationship. There's a relative relationship.

Senator SCOTT. If every servicemember, if you had the data of—you know, just start today. Just anybody new that joins boot camp and starts going through infantry training. If you just have the data and you had that in front of you, then over time you could do predictive analysis of, you know, where the problems are, right?

Dr. ZAFONTE. Right, and I think that—but to the point that was just raised, I think there are action steps now and that we have—we are compelled very much so to make this a living learning environment and continue to collect data and perhaps change policy, change programs, change how we treat people as we understand more over time.

Senator SCOTT. So, you don't have enough information today exactly what happens as all these blasts happen. What you have is, you know, you see the result. You see over a period of time that this is what happens. That is what you have so far, right?

Dr. ZAFONTE. I think that is right. I think, Senator, what we have, and thank you for the excellent question, is a series of smaller studies that show changes in your imaging, changes in blood based biomarkers, representative of injury of the brain. But how it is going to behave in a large population of people is one thing. How it is going to behave in Bobby or Sue is a very different thing.

Senator SCOTT. Right. Okay, and how—so, Dr. McBirney, how hard it would be to just put up a program? It wouldn't be that hard, would it?

Dr. MCBIRNEY. That is a great question. Unfortunately, one that I find myself unqualified to answer.

Senator SCOTT. But we do it in a whole bunch of other stuff. We do it like with glucose monitors, right. And if you gave servicemembers just—you know, just say, here—they all have cell phones, right? You just had an app that said, okay, so every time you have exposure okay, you put this in. You put in exactly what you did and what you shot.

Some people are not going to do it well, just like no one follows their health—you know, they didn't take their medicine. But that wouldn't be that hard to do, right? I mean, we have all this stuff from sugar levels.

Why don't we do—I mean, why don't we—why wouldn't that be the simplest thing to start doing and then you could start seeing that, like—if you could—if you had all that data, you could pretty quickly do a predictive analysis of even short term problems. Not, you know, it take a long time to say what is my 20 year problem, right.

Dr. ZAFONTE. Yes, I think following people over decade will be valuable. I think we will see certain markers and certain things change early on, but we have to remember that it is not an uncomplicated story.

Even the blood based biomarkers or other entities such as imaging have a lot of variation within. You know, the brain, I think my colleagues would support me, is an incredible structure, but it is also a bit of a black box still within science, and understanding how different networks relationships, how these nodes connect, and an injury in one space affects an injury another, that is a challenge.

Senator SCOTT. But you would actually know the result. I mean, you even though you don't know exactly why, you could over time predict what is going to happen.

Dr. ZAFONTE. If you are looking for symptomatic, senator, prediction I think with a large enough data set, you certainly could draw some strong relationships.

Senator SCOTT. Right, and then very quickly come back and say, okay, we know this. We know that if you have this much, you know—the, you know, the odds are like you can go get a blood test for cancer now and it is very predictive of whether you are going to end up with cancer. Is it perfect? No. I mean it depends on the cancer. So, it seems like this would be pretty easy to do and it shouldn't be that hard.

Dr. ZAFONTE. So, Senator, I would agree with you, but I would bring up the issue that we are all individual and different people, and these types of injuries affect individuals in a different way.

So, a series of years? worth of exposure is affected by who you were beforehand, the kinds of exposures, and then the treatment you had afterwards. That produces this result, and the fact that it is not so easy to put in a box.

Senator SCOTT. Right. Okay. Senator Hirono.

[Technical problems.]

Senator HIRONO. I call myself for 5 minutes—[technical problems]. There are a lot of our servicemembers who were exposed to IEDs during the tenure in Afghanistan and Iraq. So, are you tracking these servicemembers? Most of them probably are in veteran status. Are you tracking them for exposure to blasts and what is happening to them? Anybody?

Mr. LARKIN. So, I used to be a senior leader within the Department of Defense running the Joint IED Field Organization, JIEDO. I can tell you that it was a concern as far back as 2008, 2009, that these blast exposures were creating a unique health risk to our warriors.

We had gotten to the point where we had up armored and created new armored vehicles that were surviving the blast, but what got in that vehicle and what came out of that vehicle were two different states, and it alerted us to the fact that there were things—that blast effect was having an effect on the human body that needed to be studied and researched.

So, as far as you know, having a handle on—unless there was a catastrophic injury and usually one that was visible, at the time, if they—a lot of these folks came out of these vehicles, and they looked fairly normal.

Senator HIRONO. Yes.

Mr. LARKIN. It wasn't until time evolved that we started to see the behavioral changes, cognitive dysfunction, and so forth. I have no knowledge of whether anybody attempted to formally collect on that data and do anything with it.

Senator HIRONO. I think that is an important kind of followup as we try to understand what the impact of these blasts are long term. Also, I would think that—I mean, it is bad enough that there is traumatic brain injury that needs to be followed up on, but I would think that a lot of them may develop conditions such as ringing in the ears. Yes, so, Dr. Zafonte.

Mr. LARKIN. Thank you very much, Senator, for the excellent point. I think we have long term sequelae for people such as tinnitus or ringing in the ear, chronic headaches.

Senator HIRONO. Yes.

Dr. ZAFONTE. Pain is a big driver that drives not only a headache or one's immediate perception, but it also invades behavior. People who are in pain don't behave the same way, and they don't cognitively perform the same way.

So, what I am saying is that blast has a multi-system effect. Of course, the brain is our principal and driving concern, but it has effects in things that are linked to the brain, linked to the behavior that we need to know more about.

Senator HIRONO. Well, for example, tinnitus—that doesn't cause pain, but it is severely annoying. It can be debilitating. I don't know whether you are—it sounds as though you are also tracking the incidence of these kinds of issues, and it is something I am very familiar with, and there seems to be no cure for these conditions.

I am very interested to know what kind of breakthroughs there are in treatment—I know that tinnitus is the disease, and tinnitus is a ringing that's not related to any problem with the ears. So, is that something that you all are also studying, tracking?

Mr. LARKIN. Senator, all I can tell you is that I have it from the use of explosives and weapons.

Senator HIRONO. You have it?

Mr. LARKIN. It doesn't go away.

Senator HIRONO. I know.

Mr. LARKIN. It is just—I have to live with it.

Senator HIRONO. Me too. It is very annoying. Sometimes it is so loud that it interferes with sleeping. So that is—I think that there are a lot more of our servicemembers who have endured or are enduring those conditions that we have to pay attention to. One more question.

A 2023 RAND report noted that there is a critical gap in effective PPE in that most models represent the average human male. So is that—and this is for Dr. McBirney. It is certainly important that we protect—provide protective equipment to all of our servicemembers.

So how can we make sure that this kind of protective equipment is also—is appropriate for women. Is that happening?

Dr. MCBIRNEY. That is a great question, a very important topic, and it is happening. So those findings were from the last State of the science meeting that we had on blast induced injury, and we were happy to learn that there is quite a bit of research being done

in the community to make sure that the average male, and specifically in many instances the average Caucasian male, is not the only subject that is being used to test equipment.

Senator HIRONO. Yes. That is very important. Thank you. Thank you, Madam Chair.

Senator WARREN. Thank you. Senator Ernst.

Senator ERNST. Thank you very much, and good afternoon. I would like to thank you, Chairwoman, for the invitation to participate in this Subcommittee today. It is a very important discussion that we are having about the impact on our servicemembers and their families.

Traumatic brain injuries can arise not only from the combat deployments, but also from those routine training exercises that our men and women go through every single day. Even when they are adhering to safety standards and established safety guidelines, the act of firing heavy weapons, just as you stated, Mr. Larkin, can create those long term effects.

Other types of training sessions in preparation for combat deployments, many of these things can potentially lead to cognitive impairments affecting our function. Mr. Larkin, I understand that you shared the story about your son, Ryan.

I want to thank you so much for your service as a Navy SEAL and your son's service as a Navy SEAL. It was through Mr. Larkin, through Frank sharing his son's story with me many years ago that I finally understood the need to be involved with traumatic brain injuries.

So, thank you so much for sharing what is a very difficult story to tell, but one that is incredibly important for every young man and woman that puts on the uniform of our Nation. So, thank you for that. Mr. Larkin, did you share with the Subcommittee then how it was discovered that your son Ryan had traumatic brain injury?

Mr. LARKIN. Thank you for the question, Senator, and thank you for your comments. Ryan had expressed his desire that if anything ever happened to him, he wanted his body and his brain donated for traumatic brain injury breacher syndrome research.

That subsequently was done, and his brain was donated to an activity at Bethesda, Walter Reed that postmortem analysis revealed that he had an undiagnosed microscopic level of brain injury that was uniquely aligned with blast exposure. They only see this pattern of injury with blast exposure.

If we had not gotten that finding, the narrative that the Navy had built around Ryan and his struggle, and his subsequent passing would have continued on—would continue to have damaged his reputation. But this finding was indisputable that he was injured. He was not, in his terms, crazy.

Senator ERNST. Exactly, Mr. Larkin, and I just want everyone to understand that so many of these injuries go undetected through CAT scans, through MRI's, PET scans.

As a followup to that then, and I am very grateful that Ryan had chosen to do that because you would not have known about those injuries otherwise, but then for you, and Dr. Zafonte—is that right?

I want to make sure I get it correct, Dr. Zafonte, is the automated neuropsychological assessment metrics, the ANAM test that

is used by the DOD, an accurate method of detecting those changes in cognition that can lead to a TBI diagnosis?

Dr. ZAFONTE. Senator, thank you for the excellent question. I think we are searching for a gold standard. A number of these measures, including the ANAM, have significant flaws in them.

Everything from the way they are administered, to challenges on their consistency and internal behavior within an individual and external to other individuals. So, while it is an interesting screening tool, it is far from perfect.

Senator ERNST. Yes, and that is why I hope we continue to work toward alternatives or ways that we find that gold standard. That is something that this Subcommittee is working on. You have spoken a little bit about wearable devices as well that might be able to diagnose a TBI or blast exposure.

All of these things require research, development, recommendations. Are you confident that we can get to a point where you are able to make recommendations to Congress, to DOD, that will provide us a path forward in protecting these men and women. Any thoughts—yes, Dr. Zafonte.

Dr. ZAFONTE. Thank you, Senator, for your excellent question. I would say, and I think my good colleague said this before, perfection is the enemy of the good. There are things we know to do now, and as we learn more, we should do better.

I think if we act and think our responsibilities to make this a dynamic, learning, positive environment for our servicemembers, we can do things now while evaluating data and really making positive change in the future.

I think we are going to learn that there is a lot more of that microscopic injury than we had ever believed, and then in certain people, that is going to have some significant sequelae over time.

Senator ERNST. Thank you, Dr. Zafonte, and I believe you are absolutely correct. I think there are a lot more servicemembers out there that have sustained various micro tears or injuries to their brain. I was reminded of this quote not too long ago, and it's an old one, so forgive me, but if the human brain were so simple, we could understand it, we would be so simple we couldn't.

Just let that sink in, because I think we are always going to be striving to find the answer that we need when it comes to traumatic brain injury. We may never reach that 100 percent solution just because of the dynamics of this incredible organ, but it doesn't mean we should just let it go. There are absolute, disruptions to families, just as we have heard from Mr. Larkin.

It is incredibly important that we pursue not only ways to prevent traumatic brain injury, but that we also find ways if it does occur and we won't be able to prevent it in 100 percent of cases, but if it is to occur, we need to find ways to treat it and mitigate the impact to our families.

So, thank you again, Chairwoman. I really appreciate the opportunity to be here today.

Senator WARREN. So, I just want to say a very special thank you to you. Senator Ernst, Senator Ernst is not on this Subcommittee.

Like many in the Senate, she has an absolutely packed schedule, but she has been engaged for years now on the issues around traumatic brain injury and working toward changes in the law, both for

the documentation that will lead us to better diagnoses and also for the resources to begin treatment now for those who need it.

She wanted to be here with us today, and I appreciate your coming and doing this. Thank you. Thank you, Senator Kaine.

Senator KAINE. Thank you, Chair Warren, and to the Subcommittee for having this hearing. It is really important, and I am just going to ask the same question of both panels. So, I just have one question and I would love to get your take, and I will ask the same question to the second panel.

We are not the only country that employs weapons that can have these effects on servicemembers' brain health. So, what have we learned or what can we learn from the experience of other nations and their militaries, either about strategies to prevent or strategies to treat?

Mr. LARKIN. Senator, again, in my role as a senior leader of the Joint IED Defeat Organization at DOD, back during the height of Iraq and Afghanistan, this was not a United States only problem.

You know, we were very much in the trenches with our NATO allies, Five Eyes partners, who were all experiencing the same challenges with maneuvering on the battlefield because the IED had paralyzed our movement and the IED was the weapon system the enemy used against us that literally brought home all the casualties and fatalities of those two conflicts and Africa.

If we don't bridge communications with those countries as we try to solve this problem, we are missing a big part of it. They have a great data. They are as concerned about what we are talking about as we are.

I think that really we need unsolicited—we need a gyro like task force to bring together the Government, industry, academia, and our foreign partners for a unity of effort to match the data, the intellectual capability, and our technology to solve this.

We can solve it. It is just that we have different ad hoc efforts going on right now. They are not coordinated. We are handicapped by a lack of data sharing, and like I said, we got to get everybody on—in the same—

Senator KAINE. Even within our own family. I know this panel too has DOD, but not VA. I mean, I am I know in the Richmond, VA, this is a very high priority. So, sharing within our family certainly, but with our allies who have the same experience is really important. Dr. McBirney or Dr. Zafonte, do you want to add to that at all?

Dr. MCBIRNEY. Sure. No, thank you for the question, Senator, and it is an excellent one. One consideration that I know some of our allies are considering at this time, and it was published in a report in 2018 by the Center for a New American Security, is reviewing and updating firing limits for a lot of these weapon systems.

Those firing limits haven't necessarily been revisited in some time. In my written testimony, there is a direct quotation from that CNS report in 2018 that details exactly what information to revisit in these weapon systems manuals, and perhaps consider updating to really get at mitigating exposure that our servicemembers experience in training in particular.

Senator KAINE. Dr. Zafonte.

Dr. ZAFONTE. Senator, thank you for the great question, and I agree with the comments of my esteemed colleagues. I would add just one other thing, you are completely right. There is power in numbers. There is power in togetherness. There is power in the opportunity to discover and serve our allies throughout the world.

I would advocate for common data elements, common data sets that go across our allies as we think about these kinds of exposures and the kind of long term sequelae, both immediate, what does somebody feel now, and then what do they experience years later. Those kinds of things would be incredibly important and doable in many other health systems.

Senator KAINE. Thank you very much. I yield back.

Senator WARREN. Thank you. Very important. Senator Sullivan.

Senator SULLIVAN. Thank you, Madam Chair, and thank you and Senator Scott for holding this hearing. I think it is a really important one, and I want to thank the witnesses for their attention to these really important issues for our military.

So, I got here a little bit late, so if this has already been discussed, bear with me, but I want to dig into this New York Times article from November 2023 entitled, A Secret Strange—Secret War, Strange New Wounds, and Silence from the Pentagon. This was about the marines in Syria deployed in Syria in 2016 and 2017.

They returned and really struggled with PTSD issues and health issues, and it wasn't from direct combat. I mean, they were in combat, but it was primarily from there, it appears, really significant amount of firing howitzer rounds.

Kind of to Senator Kaine's point, we have had military members in different wars, Vietnam, Korea, WWII, of course, fire thousands and thousands of howitzer rounds. But so, we have seen this before, but these marines seem to really have struggled. Have you—either of you read this report or this story? Okay.

Senators Warren, and Ernst, and Tillis on January 18th, letter to Secretary Austin asked him a lot of specific questions relating to this and other issues that relate to TBI. But this is a kind of a different TBI.

So, sometimes I worry, you know, I just retired from the Marine Corps myself, and I love the Marine Corps. But, you know, like all big organizations, they can be bureaucratic, and I am not sure these marines are treated very well. I am wondering, from your experience, maybe we will start with you, Dr. Zafonte, what is your assessment of that report? Was well done reporting, in my view, from the New York Times.

What do you think the next steps should be? Obviously, we will ask the Government witnesses in the next panel on this topic but would just like to get your assessment from this particular episode. A lot of my constituents in Alaska wrote—read this article and were quite disturbed by it.

We don't even have a big Marine Corps presence in my State, but big Army and Air Force presence. So, can—I would like all of you to just comment on what your thoughts were and then what we can do—you know, if the marines haven't seen this, you can see how they could overlook it, but we—I think this needs a much deeper dive than the military has given it.

To the Chairman's credit and some other senators are already pressing Secretary Austin on it. So, what are your thoughts on it?

Dr. ZAFONTE. Senator, thank you for the excellent point and question. From my perspective, I think that the piece brought up a series of issues. It really took the cover off of some things and made them more public in some ways.

It talked about many of the long term sequelae, near term and long term, that are being seen clinically in this population of people. Now, these are extreme individuals, many of them. They are the 1 percent of the 1 percent. They are the fittest, the swiftest, and yet they are seeing clinically apparent problems. There are also, in many ways, the most resilient. They are selected many times.

So that raises for me some real concerns. It may be related to the density of the exposure. It may be related to the lifelong exposure, and it may be related to a global elements of the life in that kind of stress for a significant period of time.

So, I think we need to learn a lot more about the long term issues here and the short term ones, and I think part of the way we do that is better quantifying the exposure and the person over time.

Senator SULLIVAN. Great. Doctor McBirney, do you have a view on this?

Dr. MCBIRNEY. Absolutely. No, and thank you for raising this. I thought that New York Times article was very well written and well investigated and reported. I think—

Senator SULLIVAN. By the way, just for the record, I don't believe everything at the New York Times writes.

[Laughter.]

Dr. MCBIRNEY. Certainly.

Senator SULLIVAN. So, Senator Warren might—no, I am just kidding. But so, I am sure the marines had some points in there that probably weren't reported, or I am not saying it was a perfect piece, but it raised an important issue. These young men, to Dr. Zafonte's point, these are, my view, the best of what we have in America. We certainly, you know, we need to take care of them.

Dr. MCBIRNEY. Absolutely, agreed. I think the one of the main takeaways for me when I read that article was the fact that there is a culture that is pervasive across the DOD, unfortunately, that really contributes to this underreporting that we see of injuries. I think the way that these men were treated is indicative of this culture and the fear that a lot of servicemembers have when it comes to reporting injuries.

There have been many studies done on the underreporting of traumatic brain injury. There are a variety of reasons that servicemembers don't report injuries. But fear of negative repercussions on their military career is certainly a huge one. So, I think when I read that New York Times article in the series of articles, that is really what came to my mind, is a culture that needs changing if we hope to improve this.

Senator SULLIVAN. Yes, and, Mr. Larkin, real quick. Sorry, Madam Chair. You know, there—and I don't know if you have a view on this, but we have had many wars with many thousands

and thousands of artillery rounds fired. I had an 81 millimeter mortar platoon for 2 years on Active Duty, my marines.

We fired, you know, all kinds of 81 millimeter mortar. That is not as big as these howitzers, but it is a big mortar, and, you know, you feel it when you are firing those, and your ears hurt when you don't have your ear protection on because it is so loud.

But what is your sense on how we need to look at this, that article, but compare it to other wars where we have shot thousands and thousands and thousands of rounds.

Mr. LARKIN. So, you know, if I am going to put my money, it is going to be on the preventative end as much as we can to by down these injuries. But I completely agree with Dr. McBirney, the issue here is about trust.

You know, you are not going to get in reporting unless there is trust that is built between that operator or that warrior and the system. We have collected blast data on—in a variety of different efforts—

Senator SULLIVAN. On artillery too?

Mr. LARKIN. Just in, you know, a variety of different settings where blast gauges and so forth have been worn by our warriors. We have no idea where that data has gone. So again, it never comes back to the warfighter like a dosimeter would for radiation.

So, they say, well, you know, we wear these things, but we don't hear anything back. One of the things, and it might be a novel idea I offer, is, you know, when we procure and acquire weapons systems and munitions, why don't we ask those manufacturers to provide us with blast overpressure data according to strict criteria that they all have to follow, that ultimately will allow us to craft training protocols and potentially surveillance programs for the more high risk occupation.

But again, we have been calling this by a different name coming off the battlefield since WWI, and it all has rested in psychiatric mental health diagnosis, and we are now starting to realize this is a biological injury caused by blast overpressure.

Senator SULLIVAN. Thank you. Thank you, Madam Chair.

Senator WARREN. Thank you. I have another round of questions that I want to do. I know Senator Scott does. If anyone else does, we are glad to do it. But I want to pick up on what Mr. Larkin was just talking about, and that is trust. That servicemembers who have been affected by blast overpressure aren't getting the help they need.

The question is, why not? I will go back to The New York Times article because it does give us some on the ground anecdotes that people are experiencing. So, a Marine Corps officer who is leading an artillery unit was quoted in this story saying that he was experiencing severe headaches and small seizures but, "was worried that his injuries would not be acknowledged because there was no documentation that he was exposed to anything serious."

Now, we have talked some about the importance of record keeping and how that could fundamentally change what happens in this area, but I want to talk about where we are right now and the consequences of the failure to diagnose early and what that means. Mr. Larkin, you are the one who has focused on this more than anyone.

I think you said in your written testimony that you estimate that about 80 percent of your son's exposure occurred during training. Is that right? That is what I understood.

Mr. LARKIN. Yes, Senator. If you talk to other veterans that have trained for combat, been in combat, they will pretty much confirm that the majority of their exposures is in the training environment, an environment that we can control.

Senator WARREN. So, if I can ask you, we know about what happened to Ryan because he donated his brain postmortem, and they were able to do an analysis. But can you speak to what happened when Ryan was still alive, and whether you and your family got the appropriate support that Ryan needed, as he clearly demonstrated that he was in increasing trouble?

Mr. LARKIN. So, one thing I didn't share about Ryan is that after he passed, what we found on his computer were—he downloaded numerous studies on blast exposure and TBI and also was researching the medications that he got. So, he was locked on this. I didn't like what he did. I didn't support what he did. But I have grown to understand why he did it. It was for his teammates. He was going to prove that something was wrong. Now, when he went to get help, he did it more for his teammates than himself.

But again, you know, we didn't know what we didn't know. I think a lot of people were trying to do their best for him, the best that they could, but maybe all the wrong way, and because we lacked the science, we lacked the knowledge. TBI was not mentioned—I mean, very little. It was not taken seriously because they couldn't see it.

We still can't see this level of injury in a living operator or living warfighter, which is—again within the medical enterprise, if you don't have a blood marker that alerts you, you know, just like a, you know, heart attack, we look at heart, you know, enzymes and so forth, that alert us that, hey, there is muscle damage and we see an EKG that tells us that, you know, things are going wrong.

But then when the heart—we don't have that right now, and it handicaps our ability to triage these folks early on in the evolution, to your point. The opportunity here, and I don't know if my colleagues would agree with me, but the opportunity that we have here is to get it at this early, not wait till it gets to a catastrophic, you know, point, you know, this disease process, the injury process where things have gone too far.

Senator WARREN. So let me just pick up on this. I understand that this is hard to diagnose and that it is—we collect data that will be one way to make it easier to diagnose. I understand we would like to start as early in the process as we can. But there is another feature of this that we have some control over right now, that when someone has any concern, who is the advocate to make sure they get the help they need?

My sense of this is it is just a patchwork. You go here, you get sent there, then you end up someplace else, and the patient is put in the position of having to advocate for a diagnosis, that it is not the patient's responsibility or expertise to have to make. I am grateful that Ryan did what he did in order to help his teammates. But ultimately, we have a bigger responsibility here.

So, I just want to know if you can speak just a little bit to the notion that starting now, before we have perfect information, that we need a single way for people to go into this system, to be able to raise a hand, say, I have problems like the Marine that is quoted in The New York Times piece. I have problems and know there will be one person there who will advocate and at least get them to the best possible treatment that we can. Can you speak to that, Mr. Larkin?

Mr. LARKIN. Yes, and I think the No. 1 word that I would pick out is listen. The system needs to listen to these folks as they step forward.

You know, and we need to understand this is a leadership problem, and we need to educate leadership as to what is going on here so that they can properly usher these folks down the right paths, so that we can stop their injury process and that we can start a level of treatment that one size fits one, not one size fits all, you know, which is precision medicine. I think as the science develops, as our medical capabilities develop, we are going to get better and better at doing that.

But again, Ryan became disenfranchised. He became, you know, adversarial because the system turned on him, a system that he depended on, a system I depended on. This was my community, too, and so, this is why I am here today, and I realize this isn't in a perfect world, but you know, the ultimate grader of what we do or not do are the veterans, the warfighters, and their families. Are we doing the right thing for them?

Senator WARREN. Yes. Yes. I very much appreciate that and appreciate your comments here. If I can, I want to go to the treatment part of this. Dr. Zafonte, you work at Home Base, and Home Base tries to be the one place that brings people in and gives a response.

That is on the side of our servicemember, not hostile to our servicemember. You are on the front lines. You see people with TBI every day. Can you talk just a little bit about how Home Base has organized itself, and what you are seeing, and what kind of needs you have?

Dr. ZAFONTE. Well, Senator, thank you for the excellent question. I think we see ourselves as a partner with DOD, and that we are auxiliary in an important and differential way.

That we take a look at the whole person, and what we try to understand is that, you know, I think Mr. Larkin captured it brilliantly, somebody is not just a psychological illness, but we bring multiple specialists to bear on this person for a very intense evaluation that might take, as I said, months or years in a standard environment, and try to emerge them in a team based behavior where we listen to the patients and we develop a programmatic plan to treat.

If we can't treat the microscopic injury right away, let's treat their symptoms and get them relatively well.

Senator WARREN. I am so proud of the work that Home Base does, and I really want to underscore the importance—there is help. There are things we can do, and I take it, if I can just have you underscore it again, Dr. Zafonte, you actually return people to

Active Duty military service. Can you say just a little more about that?

Dr. ZAFONTE. I am happy to. Thank you, Senator. I think one of the most extraordinary things, especially for our special operators, is the very high degree of return to duty, return to the force, return to fighting. Because if you think about it as a person, that is what they want to do.

They want to be well and go back to their teammates and contribute at a very high level, and indeed, that is the goal. The goal is being able to give people agency over their own health again, and that is what we do.

Very high rates of return. Large numbers of people still waiting for service, which we hope to provide. I think that we see this as a means of enhancing programmatic excellence and serving as that bridge for mid-career, early career people who really need a bolus of help.

Senator WARREN. Early and accurate intervention, which I think is the point you make as well, Mr. Larkin and Dr. McBirney. I appreciate the work you do. Thank you. Senator Scott.

Senator SCOTT. Thank you, Chairwoman. Dr. Zafonte, NFL players are wearing—some of them are wearing the Q collar.

Dr. ZAFONTE. Yes, sir.

Senator SCOTT. Okay, can you tell me how it works and what you think of it?

Dr. ZAFONTE. Thank you very much, Senator, for that excellent question. It is an area of debate that is certainly of interest in the field of traumatic brain injury. The theory behind the Q collar is that a compression here at the neck, slight compression, would result in less force shaking within the brain.

Its role in blast related injury, I believe, unless Dr. McBirney has more data, is unclear. In sport related injury, it has received preliminary approval, although the enthusiasm in many investigators is modest.

Senator SCOTT. Okay. All right. Knowing what you all know now, knowing the service is the service—so if you had a child or grandchild that was 18 years old, wants to be a warfighter, enlist in the, whatever, what would your advice be to him? You want to start, Dr. McBirney?

Dr. MCBIRNEY. Is not enlisting an option? I mean that as a serious question. Traumatic brain injury is such—there is such a huge risk of getting this injury. As we have heard today, detection of this injury, treatment of this injury is not guaranteed.

I would—in sitting here, I now have a 14 month old daughter, so this question is very relevant. I would strongly urge her to reconsider her decision. Unfortunately, that is a decision that I know many veterans that I personally know have asked their children to reconsider as well.

Senator SCOTT. Mr. Larkin.

Mr. LARKIN. So, Ryan is with me here today in spirit, and much of what I am saying is actually him talking through me. He would tell you he loved being a SEAL and he wouldn't trade anything. It is just that we got to do it better.

I will say that my own Naval Special Warfare community, the SEAL community, Ryan's story has deeply affected them, and they

have moved aggressively to try to make a difference, along with the parent Command, USSOCOM, right up to the Commanding General. They are leading the way, in my opinion, within the Department of Defense.

Very often, you know, what Special Operations does, the conventional forces follow. So, thanks, Ryan.

Senator SCOTT. Dr. Zafonte.

Dr. ZAFONTE. Certainly, I think this is a point of great debate. But I guess what I would say, and we see this in contact sport, we see it in the military. The first we can do is know what we know to do now, which is eliminate unnecessary exposure. Rules changes in sports have made a big difference.

I believe we can eliminate unnecessary exposure in this population of people where there isn't a lot of return on investment, either to their training or for their long term health, or for their team members. That would be an awfully good place to start in enhancing force health.

Senator SCOTT. Thank all of you. I mean, I don't think—if we care about our freedoms, we actually don't have a choice. We don't have a choice. We have to thank God every day somebody is willing to put on the uniform, because if we get to a point where people say there is too much risk, then say goodbye to all of our liberties.

So, I hope we get to the point where, you know, nobody would say you shouldn't go in because of the risk. So, thank you.

Senator WARREN. Senator King.

Senator KING. Just a closing comment on that question, Senator Scott, you know, thinking about what you would say to your kid. One of my three kids is a Marine who was an 8-year infantry commander, now a Marine reservist, and keep thinking about him and how he might answer that question.

But as I think about the question, let me just recount an amazing story that I heard not long ago from Doug Wilder, who is the former Governor of Virginia, first African American elected Governor.

He was drafted into the military in the Korean War, and the military, like society at that time, was still dealing with an awful lot of racial prejudice. He was in a unit where there were many African Americans, many Caucasians, and others. And Doug is a guy who is going to stand up for himself.

He had a commanding officer that said, I want everybody here to be treated fairly, and he believed, as did others in his unit, in the middle of some really difficult battle circumstances—the African Americans in the unit were not being treated well and they all agreed they were going to talk to their CO and pass that on. When they all stood up to do it, they all just said to Doug, okay, now you do it, and so, he laid out his concerns about the way they were being treated.

His commanding officer said, you have done what I asked you to do. Now you all go back to work and let me do what I need to do, and things didn't change for about 3 or 4 weeks, and then all of a sudden 1 day everything changed because he did what he was supposed to do. He stood up and he said, this isn't right, and we are a unit, and if we make some changes, things can be better.

I would hope that people grappling with the decision, maybe your daughter might be in this position 17.5 years from now, but people grappling with the decision will realize things don't just get better, you know, by themselves. Things don't just change by osmosis. It takes people at all levels from the, you know, private first class all the way up to a four star standing up and saying, we will be better if we make these changes.

I think an awful lot of our young people, or people at all ages, but I think a lot of our young people have a lot of wisdom to offer. I would hope that they might still say, yes, I am doing this, and I am also going to be committed to speaking up if I see areas where we can be better. Thank you.

Senator WARREN. Thank you, Senator Kaine. I will be calling on you, as we are doing the NDAA, both to tighten up the rules on reporting and get more resources into treatment. That surely has to come out of a hearing like this.

So, thank you. Thank you all for being with us today. I would like to call up the second panel. Thank you. All right, are we ready? Secretary Martinez Lopez, if you can give us an opening statement, please.

JOINT STATEMENT OF HON. LESTER MARTINEZ-LOPEZ, ASSISTANT SECRETARY OF DEFENSE FOR HEALTH AFFAIRS, DEPARTMENT OF DEFENSE; KATHY M. LEE, DIRECTOR, WARFIGHTER BRAIN HEALTH POLICY, DEPARTMENT OF DEFENSE; AND CAPTAIN CARLOS D. WILLIAMS, USN, DIRECTOR, NATIONAL INTREPID CENTER OF EXCELLENCE

Dr. MARTINEZ LOPEZ. Chairwoman Warren, Ranking Member Scott, distinguished Members of the Senate Armed Services Committee, we are pleased to represent the Office of the Secretary of Defense to discuss the Department of Defense's commitment to address warfighter brain health issues and initiatives.

We are honored to represent the dedicated military and civilian medical professionals and the military health system providing support to our combatant commanders and delivering or arranging health care for our 9.6 million beneficiaries.

We will inform the Committee about the Department's initiatives to understand the causes and impact of brain injuries and blast exposures, support ongoing training of medical professionals, inform the development of treatment protocols, and improve the cognitive and physical performance of our servicemembers.

The Department of Defense's primary mission is to defend the Nation. Fulfilling this mission means warfighters need the ability to make expedient and effective decisions on the battlefield.

Promoting brain health enables our effectiveness as a fighting force operationally, and mitigating the impact of traumatic brain injury in all its form is a top priority of DOD as we focus on near and long term health care of our servicemembers.

In support of these priorities, the DOD established a joint effort between the operational and medical forces called the Warfighter Brain Health Initiative. This initiative was finalized in 2022 to codify a policy and direction in support of unified efforts across the military to address TBI and blast overpressure.

The Warfighter Brain Health Initiative focuses on cognitive and physical performance, identification of known and emerging brain threats in military environments, and methods to immediately detect and treat brain injury. The WBHI Initiative is an important organizing function for our Department wide efforts to address brain injury and related diagnosis, such as PTSD and suicide.

Between 2000 and 2023, 485,553 servicemembers were diagnosed with TBI. The annual members of TBI grew from just above 10,000 per year in 2000, to a peak of 33,000 per year in 2011. The DOD responded to this increasing rate of TBI in combat during Operation Iraqi Freedom and Operation Enduring Freedom through rapid expansion of TBI clinical care and research to support military forces around the globe.

We recognize, however, that more research and insight is needed in both the care and research dimensions to better understand the risk, how to protect the warfighters, and how to treat brain injuries more effectively.

Our strategic approach to this issue is an iterative one involving policy to coordinate clinical changes and gap driven research investment. When policies work, we look at how to refine for broader effectiveness. When they do not work as expected, we review why and modify them to invest in research to advance alternative solutions.

With that overarching policy mindset, we hope to discuss that we see as pivotal actions, research findings and their impact on our current approach as implemented within the WBHI. We communicate these insights not because we believe they are foolproof solution. Rather, enable collective action through shared knowledge.

We know there is still much to learn about the brain and not everybody responds in the same way to similar exposures or injuries. We seek to integrate solutions for the future as we provide recommendations to inform and affect change to safety, doctrine, and policy. This mission is more both personal and professional.

As providers, researchers, and military leaders, we are committed to mitigating the risk of and improving the treatment for BOP exposures and TBI. We appreciate your continued support of military medicine, and for inviting us to be here with you today to discuss the important issues surrounding the brain health of our warfighters.

We thank Senator Warren, Senator Scott, and the members of the Subcommittee for leading continued congressional attention on blast exposures and brain injuries, and we look forward to your questions.

[The prepared joint statement of Dr. Martinez Lopez, Ms. Lee, and Mr. Williams follows:]

Not for publication until released by the Committee

Prepared Statement
of
Dr. Lester Martínez-López
Assistant Secretary of Defense (Health Affairs)
Ms. Katherine Lee
Director, Warfighter Brain Health
Captain Carlos Williams
Director, National Intrepid Center of Excellence
Regarding
Traumatic Brain Injury and Blast Exposure Care
Before the
Senate Armed Services Committee
February 28, 2024

Not for publication until released by the Committee

Chairwoman Warren, Ranking Member Scott, distinguished Members of the Senate Armed Services Committee, I am pleased to represent the Office of the Secretary of Defense to discuss the Department of Defense's commitment to address Warfighter Brain Health issues and initiatives. We are honored to represent the dedicated military and civilian medical professionals in the Military Health System (MHS), providing direct support to our combatant commanders and delivering or arranging health care for our 9.6 million beneficiaries.

We will inform the Committee about the Department's initiatives to understand the causes and impact of brain injuries, support ongoing training of medical professionals, inform the development of treatment protocols, and improve cognitive and physical performance of the warfighter.

The Department of Defense's (DoD's) primary mission is to defend the Nation. Fulfilling this mission means warfighters need the ability to make expedient and effective decisions on the battlefield. Promoting brain health and mitigating the impact of traumatic brain injury (TBI), in all its forms, is a top priority for DoD. In support of this priority, the DoD established a joint effort between operational and medical forces called the Warfighter Brain Health Initiative (WBHI). Warfighter brain health represents the physical, psychological, and cognitive status that affect a warfighter's capacity to function adaptively in any environment and impacts readiness, operational capability, and mission effectiveness.

The mission of the MHS is to enable the DoD to provide medically ready personnel and ready medical forces by improving the health of all those entrusted to our care. Taking care of our people is a sacred trust, one that we are devoted to earning every day. The MHS brings together advanced research capability, doctors, nurses, other health care professionals such as combat medics and other enlisted staff, medical education, and health care administration,

creating one of the world's largest health care systems, serving more than 9.6 million people. Add to that our critical research partnerships with other federal agencies, major universities, and industry leaders, and we have tremendous capability.

As the Assistant Secretary of Defense for Health Affairs, my focus is on the health of Service members and their families. My office develops the policies and budgetary priorities for the Defense Health Agency (DHA) and the Military Departments to optimize force health protection and clinical care. I oversee the DHA and the Uniformed Services University of the Health Sciences (USU), and work closely with medical and operational leaders across the Military Departments and DoD. I take this responsibility seriously having worked as an Army doctor, and later as a health care executive in the private sector and have seen first-hand the value of effective policy. This mission is both personal and professional, and I am committed to mitigating the risks of and improving the treatments for Blast Overpressure (BOP) and TBI. I look forward to sharing our approaches to these issues with you.

Between 2000-2023, 485,553 Service members were diagnosed with TBIs. The annual number of TBIs grew from just above 10,000 per year in 2000 to a peak just shy of 33,000 per year by 2011. The DoD responded to this increasing rate of TBI in combat during Operation Iraqi Freedom/Operation Enduring Freedom through rapid expansion of TBI clinical care and research to support military forces around the globe. We recognized, however, that more research and insight was needed in both the care and research dimensions to better understand the risks, better protect warfighters, and treat brain injuries more effectively.

The WBHI was created in 2022 to codify policy and provide direction in support of unified efforts across the military to address TBI and BOP. The WBHI brings together brain health-related efforts and stakeholders throughout DoD to enhance information sharing and

collaboration. The WBHI focuses on cognitive and physical performance, identification of known and emerging brain threats in military environments (*e.g.*, BOP and Anomalous Health Incidents), and development of methods to immediately detect brain injury.

Let me first address our work related to cognitive and physical performance. The future security environment and expected battlespaces are becoming more and more complex. DoD is building on our research investments in TBI and over 20 years of delivering care in unique combat and training environments. We are expanding pre-deployment neurocognitive testing to a broader program for the whole of DoD to identify, monitor, and manage warfighters who suffer cognitive effects from brain exposures or injuries. The expansion of the cognitive monitoring program will improve DoD's ability to manage and excel the total health of the warfighter and impact overall readiness.

Second, regarding the threats in our current military operating environments to brain health, I am grateful for the provisions championed by this committee supporting a longitudinal study on the impact of BOP, including a review of safety precautions to protect Service members. The results and recommendations were recently summarized in a Report to Congress, dated December 19, 2023, and we are determining our approach to implementing the recommendations into the tactics techniques and procedures that guide how we train and fight. We thank Senator Warren, Senator Scott, and the Members of the Subcommittee for leading continued Congressional attention on blast exposures and brain injuries.

Third, I will highlight how the Department is moving from clinical and research insights to continuously updating policy and guidance as more information is gained to enhance WBH. One example is DoD interim guidance, issued November 4, 2022, to raise BOP risk awareness and manage exposure across the force. It provides leaders with guidance on immediate actions

they can take to limit the impact of blast exposure on Service members. We know there is still much to learn about the brain, and that not everyone responds in the same way to similar exposures or injuries. In the clinical domains not yet scientifically mature enough for universal intervention, our policy efforts focus on funding research breakthroughs. We are creating accurate and reliable data sets to document identified injuries, evaluating contributing causes and thresholds for concern, and assessing response to treatment, to optimize care and enable use of that data to inform gap-research investments and treatments.

The Department has codified through policy and programming numerous clinical advances from our research portfolios, as well as real world evidence from the experience of military practitioners across the MHS continuum of care (including combat operations).

Existing efforts include:

- **Acute Concussion Care Pathway:** To ensure standardized comprehensive acute concussion assessment and care across the MHS, the DoD established the Acute Concussion Care Pathway. This care pathway, tailored to each Service member, was established with the goal of improving recovery times and outcomes by utilizing a multi-modal assessment tool at the time of injury—the Military Acute Concussion Evaluation (MACE) 2—to ensure brain health deficits were identified even if only detectable in a subset of clinical domains. These tools also help ensure timely access to repeat evaluations with personalized treatment protocols that are demonstrated to accelerate injury recovery through individualized progressive return to activity processes. This pathway resulted in the clinical screening of approximately 20,000 first time TBI diagnosed Service members across the Military Services in Fiscal Year 2023.

- **MACE 2:** The 2018 MACE 2 is an acute screening and assessment tool for all medically trained personnel who evaluate Service members involved in a potentially concussive event. The clinical tool, which takes about 10 to 15 minutes to administer, incorporates current state-of-the-science traumatic brain injury assessment, including balance, eye movements and cognitive screening. The screening does not require any equipment and can be done in austere environments. This clinical advance was driven by the DoD, first through research to clarify what was needed, and then through early adoption.
- **Defense Intrepid Network:** DoD operates a network of TBI specialty clinics and comprehensive interdisciplinary centers of excellence called the Defense Intrepid Network for Brain Health and TBI, which supports Service members diagnosed with brain injury related injury or illness. This network delivers a holistic patient centered interdisciplinary TBI model of care. Behavioral health services draw upon the disciplines of psychiatry, psychology, and social work. Additional services may draw from neurology, sleep medicine, pain management, and rehabilitation services such as balance and vision therapy to name a few. From 2010 to the present, across the network, there have been over 94,000 patients treated and over 1.3 million clinical encounters. In Calendar Year 2023, there were over 17,000 patients with over 180,000 medical encounters within this network. Our patients have responded favorably to these services – with a patient satisfaction rate of 97.5% for those who have participated in the Intensive Outpatient Programs.
- **Warfighter Brain Health Hub:** Established in December 2023, at health.mil/brain, the Hub serves as a constantly updated single source of information on brain health topics, news and updates, resources, and common questions and answers. Our goal is to make the latest brain

health information easy to access for our Service members, providers, families, and the public.

The MHS sees an estimated 14,000 to 17,000 visits per month for TBI, emphasizing the critical need to standardize tools and invest in research to identify, control, and mitigate TBI. We must and will augment existing work in advanced diagnostics, breakthrough therapies, and long-term monitoring to better identify, care for, and treat Service members and Veterans who are affected by TBI. We are committed to a holistic view of brain health and brain injuries—before, during, and after any blast exposure or injury.

Although there have been critical advances in brain research with many of these advances coming from DoD funded research, such as in the areas of biomarkers, brain imaging, and genome mapping, much remains to be learned about the brain, not only in military medicine, but in the global medical community. Historically, military medical research and experience have benefitted the civilian health care community, academia, and industry partners and we fully intend to maintain that tradition, sharing what we learn.

Partnerships with the operational, safety, outreach, training, education, clinical, and research communities internal and external to the Department are critical, and we are grateful for the participation and support of these entities. Continued engagement with multiple communities of interest will help us achieve our goals and measures of success. The DoD is committed to prioritizing these efforts to evaluate and advocate for technology solutions and provide recommendations to inform and affect change to safety, doctrine, and policy.

Thank you for your continued support of military medicine and for inviting me to be here with you today to discuss the important issues surrounding the brain health of our warfighters. I look forward to your questions.

Senator WARREN. Thank you very much. I appreciate it, Dr. Martinez. So, I appreciate that DOD has begun to take steps toward mitigating the risks associated with traumatic brain injury.

Starting this year, new troops will be given regular cognitive assessments to help monitor potential impacts from blast exposure on their brain health. This will help medical providers recognize brain injuries and changes in cognitive function more quickly, and it will help servicemembers get the clinical help that they need. I am glad

that DOD is taking this critical step, but it is important that we do this right.

Captain Williams, your organization, the National Intrepid Center of Excellence, works with servicemembers with TBIs and other invisible wounds of war. As you know, one of the—and we have discussed here repeatedly today, one of the most significant ways that troops are exposed to blast overpressure is through training.

To ensure that we are accurately monitoring the impact of blast exposure on servicemembers' brain health, would it be helpful to give a cognitive test before the servicemember begins training and firing weapons?

Captain WILLIAMS. Thanks, Senator, for the question, and thank you for the opportunity to talk about this important issue. Absolutely, yes. Let me start out by saying yes, it is critically important.

Baselining is something that we utilize in all aspects of medicine for surveillance. We utilize it prior to treatment, utilize prior to modals that we know cause risk. So, we have moved to now—this year, we hope to move to, all members, once they join the military and before they start the initial military training, they get cognitive testing.

They get cognitive testing, because we know that the highest risk of TBIs in the military are in the training environment, and so, it would be valuable. We wanted to use the same precision medicine we have been using in the past for other modalities, that we do with TBI.

Senator WARREN. Okay. So, if the baseline assessment is not starting until after training, that is not an accurate measure of the servicemember's brain health changes over time. We are going to miss the front end of this, and as we have talked about the importance of isolating the problem early is absolutely critical.

So, to make sure that we are able to detect signs of cognitive decline due to blast exposure, we have got to do this assessment before the training starts. Second thing, we also need to do regular tests of servicemembers' cognitive health after the baseline assessment. While Special Operations Command will conduct these tests every 3 years, DOD is currently planning to retest troops only every 5 years.

Dr. Martinez, you are responsible for assessing the effects of and improving how DOD tracks blast pressure exposure. Would annual cognitive testing for servicemembers help increase the chance that we detect changes in cognitive function and detect them earlier when intervention would be more effective?

Dr. MARTINEZ LOPEZ. Ma'am, the—as the Department, we are looking into this. I think if there is value into doing it every year, we don't know. So, maybe 3 years, maybe 5 years. There is more data and more science that we need to look into. I am not looking at 10 year research.

I am looking at short term research to figure out what would be the best frequency of doing the test. Not only that, but what kind of other testing we should add to the battery to assess the condition of the soldiers—the servicemembers.

Senator WARREN. So, I just want to say I feel a little bit frustrated here that Special Operations Command already clearly says 5 years is not enough. They are at three. Frankly, until we have

better data, I don't know why we wouldn't be saying, let's do an annual test and see what we can detect.

If the data show us that 3 years is often enough interval to be able to detect changes, that is fine. But it seems to me, given what else we know, and given how catastrophic the implications of untreated TBI can be, that we ought to be erring on the side at least of collecting these data annually. So, I really want to push on this, waiting 5 years to test is just not often enough.

Another way that DOD needs to show that it is serious about protecting servicemembers from blast overpressure is by establishing effective weapon use safety limits. We had some conversation about this earlier. In 2022, DOD directed the services to establish a maximum allowable number of rounds for servicemembers to fire to mitigate blast overpressure injury risk.

Now good start, but I see two problems with this. First, the limits don't include brain injury risk. Blast pressure experts have raised concerns that this means that our current safety thresholds are built on things like whether or not it is likely to cause your eardrum to burst. They are very old guidelines, and they are not about traumatic brain injury.

Ms. Lee, you are in charge of overseeing DOD's warfighter brain health policy. Why is it important that DOD establish a maximum allowable number of rounds for servicemembers to fire that takes into account brain injury as well as injury just to the ears?

Ms. LEE. Senator Warren, thank you so much for the question, and thanks for having us here today to be able to talk about warfighter brain health, blast overpressure, and traumatic brain injury.

This is an excellent question. We absolutely—it is imperative that we have allowable number of rounds for all the weapon systems that are commonly used so that we can avoid unnecessary blast exposure in our servicemembers. We believe that this also gives us an opportunity to be able to ensure the usage is correct, the position, crew position, proximity, and all those pieces can come together.

Our policies are moving in that direction to be able to look at the brain. As you mentioned, historically, it has been through ear and lung. However, we are looking at what the brain effects are, and we will follow suit with our policies as such.

Senator WARREN. So again, I want to say I feel a little bit of frustration here. I appreciate that you are working on establishing these limits, but we are going to get this off the ground now.

We know enough to start moving in the right direction. My office has heard stories of servicemembers having to take their own initiative in setting limitations for their troops. We have got training instructors who just say, I have decided that is enough, and that is not enough to get this job done.

So again, I urge you better to make your best estimate and get started on forcing these weapons manufacturers to start collecting these data so that they will be able to give us limits on how they can be used.

One more concern here. It is how we measure these weapons use safety limits. DOD's own studies found that it took 70 to 96 hours to resolve servicemembers cognitive deficits after firing heavy

weapons. So that is about how long it appears before people are back to their original steady State. But DOD guidelines say they are only going to test for the first 24 hours.

Ms. Lee, could servicemembers benefit from establishing weapons use safety limits for longer periods of time, like 72 hours?

Ms. LEE. Yes, ma'am. We are looking to expand that timeframe so that we allow for those differences that are coming up with blast overpressure. So that is again where our policies, the direction that our policies are headed so that we can cover that time period. We are firmly committed to early detection, provides the opportunity to treat, and that maximizes our outcome.

Senator WARREN. Well, I hope you do this soon. The Department of Defense's Inspector General has raised concerns that military health system providers are not consistently providing a 72 hour followup appointment for patients with mild TBIs, so clearly, a longer timeframe is something that DOD itself recognizes is important and that we need to get done.

Look, I get it, this is hard, and I am grateful that you are doing the work you are doing. I want to be a partner, but a partner that urges you to move faster and deliver more for our servicemembers as quickly as possible. We need to do better for our troops, and we need to do it right now. Senator Scott.

Senator SCOTT. Thank you, Chair. So, I will ask you the same question, what would you tell your son or daughter who was going to go in and be a warfighter, 18 years old, go enlist—what would you tell them today, based on what you know?

Dr. MARTINEZ-LOPEZ. Sir, I have three boys. Two of them served in the military. One is still in the reserves. So, I am very proud of their service just like, you know, and I will tell my grandkids, I have eight of them—so, that there is a great opportunity in the services.

I think there is some value as a human being that we develop, that service to country is very important. Even if you do it for a short time, it makes a big difference as you as a person.

I don't care how you—where you serve or how you serve, is it critical now? They need to understand that this is a risky business, and what—so they need to come out with their eyes wide open, right.

So, my kids knew that .I very, very—I made it very clear and—but I am still very proud. I will tell my grandkids, if they really think about, there is something that triggers them to serve, go fetch.

Senator SCOTT. Captain.

Captain WILLIAMS. Thank you for the question, sir. I have no children at this point, but I have many—nephews, nieces, and friends of the family who I have encouraged to join the military. This has been the greatest honor in my lifetime to serve in uniform.

I wouldn't change that requirement for anyone or request to anyone. I would tell them to follow their heart, and I would encourage them to know that there are inherent risks to the job, and our job is to make sure that the people who you are entrusting your life to, they have a responsibility—a responsibility to care for you. So, no different, and the reason why I am here today is saying we want

to make sure that our men and women in uniform know that we are caring for them in every possible way.

Senator SCOTT. Thank you. Ms. Lee.

Ms. LEE. Yes. So, I have five children and one grandchild, and I would absolutely say to support and defend our homeland, to join the military and join the armed services. One of them is a Marine.

Through that service, it is about the trust, and I have seen working in this environment for the last 20 years, especially around the traumatic brain injury realm, that you really do need to be credible and have integrity based on that trust and ensuring that we are going to do right by you.

We are a family, and we are going to take care of you. Mr. Larkin is part of our team. We are all in this together with the same mission to take care of our people and take care of servicemembers that make the sacrifice.

Senator SCOTT. Thanks. Secretary Martinez, the Department's report to Congress on the longitudinal blast study says the Department plans to conduct a business case analysis and review lessons learned to inform its way forward with blast monitoring.

So, who is conducting the business case analysis? When do you expect the analysis to be completed? What factors is the Department including in its analysis?

Dr. MARTINEZ-LOPEZ. Sir, do you mind if I defer to Ms. Lee.

Ms. LEE. So, the business case analysis kickoff meeting was the 14th of February. It is being conducted by a contract service. We are expecting the results in September 2024. We looked at—we are looking—we have extensively involved military departments in this so that the outcome that comes, the outcome and recommendations will be able to be implemented by the military departments.

Both the service communities and the operational communities are heavily invested in this business case analysis so that we can review the necessary resources, the—and look at how to establish a standardized monitoring program throughout the force.

Senator SCOTT. When do you think you will be completed?

Ms. LEE. The business case analysis will be completed in September.

Senator SCOTT. September? Okay. Right. The 2023, the Fiscal Year 2023 NDAA also authorized but didn't require the Director of the Defense Health Agency to conduct a pilot program to monitor blast exposure to the use of commercially available, off the shelf wearable sensors. Do you all plan to do it, and do you have any sensors in mind that you think are working?

Ms. LEE. So, yes, sir. So, we are awaiting the BCA results, the business case analysis results in September, to make a decision on whether or not that pilot that could be the segue from our Section 734 work into a full blown standard monitoring blast program throughout the Department.

So, again, those decisions, we will probably make in the in the September 2024 time period. In terms of blast sensors, we have various communities to include the Special Operations Command that have been looking at the—right now, the three available, commercially available products.

Those decisions are, right now, living in the acquisition world as they are doing suitability and fielding exercises, and based on the requirements of each individual community.

Senator SCOTT. Good. Also, the Fiscal Year 2023 NDAA required a report describing the strategy and implementation plan for the Warfighter Brain Health Initiative. I guess this was due at the end of last year or so. Is that different than the others?

Ms. LEE. That is the strategy and action plan that has five lines of effort. I believe that is headed over your way right now.

Senator SCOTT. Oh, okay. All right. Thank you.

Senator WARREN. So can I just ask one more question. It is 7 months before the business case analysis. What are you going to do over the next 7 months?

Ms. LEE. So, in the original memo that was produced before we had finished Section 734, the Assistant Secretary of Defense for Readiness put out this interim guidance memo. Before we had completed all of the information, all the data, we felt it was imperative to try to get brain health guidance out at that time.

So, we sent the memo out. Included in that four PSA memo are six actions to try to avoid unnecessary blast exposures. So, what we are doing in the meantime is updating that memo with more data that we have from our research studies and from the blast community of researchers, so that we can provide more direction and guidance to the military departments on how they can have safer actions out in the operational environment, in the training environment.

Senator WARREN. Okay. I appreciate that, and how are you going to make sure that it makes it all the way down to the ground level? There are anecdotes that suggest that we make policy changes, we all talk to each other up here in the abstract, and then down at the ground nothing has changed. Dr. Martinez.

Dr. MARTINEZ-LOPEZ. Ma'am, the first issue is this is a joint effort between the operational forces and we in the medical sector. So, it is the medical leadership and the operational leadership.

If we don't work it together, this is not going to pan out. So, the way we exercise that at DOD is through a safety oversight council. So, we are meeting with all the services and laid out the guidance, and we rely on the services then to push it down. It is an issue of policy internal to the services.

It is an issue of training in the services. It is an issue of equipping in the services. We will give them the medical guidance, you know, the best knowledge we have, but the implementation itself, how are you going to fire your weapon, where, and those kind of things have to be exercised by the line.

Now, I went over to Fort Campbell, and I talked to the CG of Fort Campbell. He was—and I told him, it is simple. Less is better, and less often and better. So really look at—pay attention to that.

Senator WARREN. Right. Right. Captain Williams, did you want to add anything on that? Okay, good. Senator Scott.

Senator SCOTT. So, have you guys ever had a glucose monitor? Do you know how they work? Okay, so I can put on glucose monitor, I can put in my exercise, I can put in my food, and I can just do it myself. I can sort of track to see, you know, how I feel when

my glucose goes up. So, why don't we have something just simple that people can do on their own?

Because if I knew, gosh, I get headaches or I get, you know—I have sleeping problems or I have any of these issues, then I would say, I mean, I can't do this anymore. I mean, why don't we do something—I mean, the technology is so simple, right.

I mean, it is basically you just go you go to—there is two companies that do the glucose one now that I know of. Why don't we just go there and say, will you give us the technology and we can implement this and just give it to everybody and let them monitor it themselves?

[Technical problems.]

Dr. MARTINEZ-LOPEZ. I am going to State the first steps—[technical problems]. The problem with glucose is I know exactly where the thresholds are. So, I know that like at 126 it is abnormal blood sugars, so anything above that or below that, and I can monitor it. On this issue, I don't know what the threshold is. So, we haven't determined that threshold yet, and even worse—

Senator SCOTT. No, I will decide for myself. I will decide that—the way I would look at it is, I will put the information in there and then I would say, hey, here is what I noticed. If I do this number of blasts, I get a headache. I do this number of blast, I can't sleep.

Then I start saying to myself, and I say, well, okay, I am not going to do that. I am not doing that to myself anymore because—you know what, this has happened to me so I am not an expert on this, but you would think, I mean, you know, we are all—we are all going to be better if we self-monitor ourselves, right? I mean, rather than some top down program that tries to tell us everything, and even glucose—I mean, your body is going to be different than my body.

So, what my high level should be is going to be different than yours, right. So, I am just saying, put the information in there. It is a real simple mode. Give it to everybody. Let them start following it on their own, and then they can easy—you know, like on those—anybody can connect.

You can say, oh, I am going to allow this person to connect. There is a company out there that allows people to do that now that—it is call levels and they are doing they are doing—I think they have 50,000 people or so on a study, where they are doing it on their own as a private sector, just with everybody voluntarily putting their data in there.

Captain WILLIAMS. Sir, if I may, one of the most important things—and what you are speaking about is really and truly precision medicine and targeted therapy to the individual. It is very variable for each individual who has had a TBI, the symptoms that they have.

One of the things that the past NDAA said was that the DOD needed to partner with private industry and private organizations to improve research and to improve treatment. That is one of the things that we want to look at, is look at what type of modalities are out there, or that can be developed to allow patient to focus on their individual symptoms.

But we have to know what that baseline is first for that individual. Biofeedback is something that we do in the Defense Intrepid network, at NICO, we help patients understand how to control their own individual symptoms.

But if each person is different, then that is going to be a challenging, should I say, monitoring to create, but it is possible. As we continue to do research, I think we can come—we can get there soon.

Senator SCOTT. So, to me, I just gave you my answer, that is a big government answer. Okay, just my—you might be absolutely right. Just, I am not saying you are wrong. I am just—I just actually do believe that I will do a better job of monitoring my health than anybody else will ever do my health. I don't care what the study is, I will do a better job.

I think—if I started—I can just say personally, if I eat something and I don't feel good, I am never touching it again, all right, period. I assume—I mean, it is smart—these are smart kids going in the service.

I mean, just look at these sports. All these people are getting smarter about this and saying, I am not doing this to my brain. I just think we ought to do exactly all the things you are doing, but it is pretty simple to set up a program to give and, you know—let the person monitor themselves because their body is going to be totally different than everybody else's. Like your blood glucose level is different than mine, I guarantee you.

Captain WILLIAMS. So, I totally agree with you, sir, and as an internist and a pediatrician, I always listen to the patient. I always listen to the parents, right. It is very important.

[Technical problems.]

Captain WILLIAMS. But I do want to say, though, I agree with you. I think as a medical professional though, and even as a researcher, we want to come up with a pathway forward for the patients to monitor their own.

That means we need to come up with baselines, with normals, which we just don't have at this point in time for TBI in general. When we move toward blood biomarkers, when we move toward much more concrete evidence, I think we can come up with the tool that you are talking about, that can allow a patient to monitor themselves.

Senator SCOTT. Thank you.

Senator WARREN. Good. So, I want to thank you all for being here—absolutely.

Senator BUDD. Thank you all for being here. So, North Carolina universities, including East Carolina University, ECU, UNC Chapel Hill, and health care providers like Atrium Health have prioritized research, care, and support for servicemembers and veterans diagnosed with TBIs.

I was able to see that when I was in the State last week. So again, I appreciate this hearing. Further understanding the cause of TBI will significantly improve that care that they offer, and I look forward to supporting their ongoing efforts.

Dr. Martinez, in the longitudinal study on blast pressure exposure of members of the armed services that you published in December, one of the key findings is a greater likelihood of TBI—can

you explain what you mean by a greater likelihood and quantify the increased likelihood of TBI? So, what percentage of people were exposed to what level blaster, likely to develop TBI?

Dr. MARTINEZ-LOPEZ. Senator, I will defer to me Ms. Lee for the answer.

Senator BUDD. Certainly. Thank you.

Ms. LEE. So, the Section 734 longitudinal study that you are referencing, where we looked at monitoring and documenting blast exposure and then also offerings a review of weapon systems, which we codified as 15 weapon systems that were most commonly used, and we went deep to figure out what all the safety regulations were about those.

Under the safety rubric as well, we looked at what the health and performance effects are, the brain health effects from all this blast overpressure stuff. In the report, we were able to—we reviewed 40 studies, 26 of those studies were funded by the Department of Defense.

We looked at what type of effects happen when you are doing blast overpressure, and then where do you have concerns about traumatic brain injury. Most of the areas that we found correlations were in the neurocognitive and thinking areas.

Also, in some health care utilization areas. We looked at blood biomarkers and proteins to try to see if there was any correlations, and we believe that that will bear fruit, but right now there is no clear trends in that regard.

So, we are relying on the symptom reporting as being the most indicative of someone that would have had a traumatic brain injury, and again, early detection of that through evaluation of multiple domains like their balance and their eye movements, and their thinking skills, and their symptom reporting.

Senator BUDD. Thank you for that. Dr. Williams, what recommendations would you make to improve the Department's ability to diagnose and treat military personnel who are repeatedly exposed to low level blast?

Captain WILLIAMS. Thank you for the question, Senator. As we spoke earlier in terms of baselining early. So, it has been stated several times, and when you know better, you do better. One of the most important things we can do is baseline our members from the moment they come into the military.

That means before they start the military training, and that allows us to follow them over time. I admit we have to find the right baselining tool. Right now, we use ANAM. ANAM focuses on cognition and that is an appropriate component, but we can do more. We can do better, and our goal is to, again, start early so we can continue to monitor.

Senator BUDD. Thank you. North Carolina is the proud home of the Kennedy Special Warfare Center and School at Fort Liberty, and research suggests that Special Operations forces experience higher rates of blast exposure in training and combat than other military personnel, and thus are at an elevated risk for repeated blast exposure related brain injury. So, does that track with your research?

Ms. LEE. Absolutely.

Senator BUDD. All three of you?

Captain WILLIAMS. Yes.

Senator BUDD. Thank you. While we certainly need to conduct more research, we have to also do a better job protecting our servicemembers with what we know today. That lines up with Dr. Williams, with what you were just sharing.

So, I am concerned that the Department is not moving quickly enough to address these TBI risks. So, there is tested, FDA approved devices that can limit TBIs, including some like neck collars that are currently being used by Special Operators and just like you see in the NFL.

Now, I am hearing, however, that there is still years of DOD testing that need to take place before they can be fielded for the broader force.

So, for the panel, for each of you, why aren't we expanding the fielding, FDA approved wearable devices now to keep our warfighters safer from TBI inducing head trauma and overpressure protection, rather than waiting for duplicative testing to be completed within Department? How can we expedite those devices, the use of those devices?

Captain WILLIAMS. You know, I would start with a simple answer, our goal is to do no harm. Right now we need more information for some of these devices to determine if they would do harm in the operational setting.

Senator BUDD. Even, doctor, if they are already FDA approved devices?

Captain WILLIAMS. I totally understand. FDA approval, often-times, is not tested in our population, and that is a different story. So, we realize now that a lot of times this research is being done and is not inclusive of operators, especially high level operators that we are caring for. I think our goal is to make sure we do no harm to that general population.

Senator BUDD. Thank you. Secretary.

Dr. MARTINEZ-LOPEZ. We may have to look at the data and we look at the size, if it is sound. Even in our study, we will adopt it. If it is really going to make a difference, we will. But we will put them through our internal processes, and that is true for every intervention we do have with our patients.

Senator BUDD. Ms. Lee?

Ms. LEE. Senator, the jugular vein compression devices that you are speaking about had mainly been studied in head impact in the sports community. So, pivoting to blast overpressure, which has a different mechanism of injury, is worth a look—definitely worth more than a look—to do more research to make sure that it is safe and effective in both the military population, as well as blast overpressure as the mechanism.

Senator BUDD. Understood. Thank you all. I yield.

Senator WARREN. Thank you, Senator Budd. I want to thank you all, all of our witnesses for being here today. I want to thank you for the work you do every day. My takeaways from this are that the Department of Defense needs to do better.

We need to identify those who were most at risk for TBI because of the particular work they do. We need to collect better data, and we need to do all of this on a much faster timetable.

Congress also needs to do better. We need to make sure that you have the resources to do your work, and we also need to make sure that those who are treating TBI like Home Base have the resources they need.

It is shameful that there are Active Duty military who have what appears to be TBI and they cannot be treated because the resources simply are not there. A waiting list at a place like Home Base is our failure.

We need those resources, and we need that capacity to be able to treat those who have suffered brain injuries because of their service to our Nation. We owe that to our servicemembers. So, again, thank you all for being here. I want to thank the senators who have been here.

I want to thank my partner, Senator Scott, in this, and this will be an issue we will take up during the next round of NDAA negotiations. Thank you.

[Whereupon, at 5:02 p.m., the Committee adjourned.]

[Questions for the record with answers supplied follow:]

QUESTIONS SUBMITTED BY SENATOR MAZIE K. HIRONO

TBI TREATMENT AT MILITARY TREATMENT FACILITIES

1. Senator HIRONO. Dr. Zafonte, I applaud your dedication and efforts as a principal investigator on DOD clinical trials evaluating novel treatments for TBI and PTSD. Do you think there is enough training for military medical professionals at treatment facilities, such as Tripler Army Medical Center, to identify and treat TBI and the accompanying symptoms?

Dr. ZAFONTE. As a non-profit academic medical center, outside DOD, I do not have personal knowledge of the extent of the TBI training programs at military medical centers.

2. Senator HIRONO. Dr. Zafonte, which novel treatments in your trials seem the most promising?

Dr. ZAFONTE. Home Base is proud of our TBI space's history of innovation. Nestled within the world-renowned Massachusetts General Hospital (MGH), Home Base's National Center of Excellence utilizes the extensive resources and faculty of MGH, Harvard Medical School, Spaulding Rehabilitation Hospital, the Massachusetts Eye & Ear Hospital, and other components of the Mass General Brigham integrated healthcare system to provide evidence-based care. Furthermore, this incredible ecosystem within which we operate provides us with insight into the latest research and clinical care opportunities, as well as daily access to world-leading researchers and clinicians who work at the forefront of mental health and brain injury care. This guarantees the synchronization, not the siloing, of our efforts to treat these invisible wounds.

Science is just beginning to understand the long-term impacts of mild and moderate TBIs. Home Base is actively investigating the short-term and long-term effects of these injuries, which encompass a spectrum of physical and psychological ailments ranging from neurodegenerative diseases to behavioral health disorders and even cancer. A critical issue is understanding the specific biopsychosocial injury patterns associated with repeated blasts. Through my research and collaboration with specialists, we are uncovering critical insights that continue to inform evidence-based interventions and elevate clinical care standards.

TBI AND MENTAL HEALTH

3. Senator HIRONO. Secretary Martinez-Lopez, Dr. McBirney, and Dr. Zafonte, traumatic brain injuries can range from mild to severe, and studies have shown notable correlations between TBI and mental health conditions such as anxiety, PTSD, depression, and suicidality among current and former servicemembers. Can you speak to this correlation and what steps are being taken to address treatment with this relationship in mind?

Secretary MARTINEZ-LOPEZ. DOD Response (Secretary Martinez-Lopez): Yes, DOD funded research has elucidated relationships between traumatic brain injury (TBI) and mental health conditions. During the acute evaluation of mild TBI using the Military Acute Concussion Evaluation (MACE) 2 screening tool, there are questions about a history of depression, anxiety, or other behavioral health concerns so that we can offer additional assistance and followup for servicemembers who report these concerns.

The MACE 2 also approaches concussion from a symptom cluster perspective. Anxiety is covered under the concussion symptom clusters and we manage each symptom cluster uniquely, recognizing that the combination of symptoms changes recovery trajectory. We know Servicemembers may take longer to recover (similar to other combined injuries) and may require more followup medical encounters to facilitate recovery if a history of a mental health condition (or other non-mental health concussion symptomatology) is present.

In addition, other DOD guidelines and tools incorporate psychological interventions as part of the multi-disciplinary approach to TBI treatment. There are standardized concussion tools, such as the Progressive Return to Activity (PRA) protocol, that outline state-of-the-art treatments as well as how to return Servicemembers to duty and full function. The PRA is meant to incorporate a range of symptoms post-concussion and direct an individualized recovery plan. The DOD also has specialty clinical and comprehensive interdisciplinary centers of excellence called the Defense Intrepid Network (DIN) for TBI and Brain Health. These programs have been developed to deliver a holistic patient centered interdisciplinary TBI model of care. Behavioral health services can include psychiatry, psychology, and social work. Additional services may include neurology, sleep medicine, pain management, and rehabilitation services, such as balance and vision therapy. These centers of excellence also offer innovative treatments such as creative arts therapies, animal-assisted therapies, and mind-body wellness services.

Dr. MCBIRNEY. My research has remained focused on traumatic brain injury (TBI) and subconcussive injuries, so, while I do know that there is a correlation between TBI and some mental health conditions, such as anxiety, posttraumatic stress disorder (PTSD), depression, and suicidality,¹ I do not feel qualified to speak to the correlation and any subsequent treatment efforts.

Dr. ZAFONTE.

The Need

My research with TBI has noted an elevated 10-year risk of behavioral concerns such as depression, anxiety, and even bipolar disorder. TBI can have wide-ranging psychological effects. Some signs or symptoms may appear immediately after the traumatic event, while others may appear days or weeks later. According to the Department of Defense, since 2000, over 413,000 US (United States) servicemembers have experienced at least one TBI, and 40 percent of those with in-theater TBIs later screened positive for comorbid psychological health conditions, including post-traumatic stress disorder (PTSD), depression, and anxiety.

Innovative Treatment Models

In 2015, Home Base launched a 2-week intensive clinical program (ICP) for veterans, servicemembers, and their families impacted by the invisible wounds, including a TBI-specific track. The ICP combines evidence-based therapy with complementary and alternative medicine. What sets the ICP apart from other programs is that it is staffed not only by Massachusetts General Hospital clinicians and fitness and nutrition experts—all trained in military culture and specializing in treating invisible wounds—but also by veterans, servicemembers, and military family members who are subject-matter experts and are able to provide high-level peer support

¹Jennifer N. Belding, Claire A. Kolaja, Rudolph P. Rull, and Daniel W. Trone, "Single and Repeated High-Level Blast, Low-Level Blast, and New-Onset Self-Reported Health Conditions in the U.S. Millennium Cohort Study: An Exploratory Investigation," *Frontiers in Neurology*, Vol. 14, March 2023; Michelle R. Dickerson, Susan F. Murphy, Michael J. Urban, Zakar White, and Pamela J. VandeVord, "Chronic Anxiety and Depression-Like Behaviors Are Associated with Glial-Driven Pathology Following Repeated Blast Induced Neurotrauma," *Frontiers in Behavioral Neuroscience*, Vol. 15, December 2021; Yueh-Chien Lu, Ming-Kung Wu, Li Zhang, Cong-Liang Zhang, Ying-Yi Lu, and Chieh-Hsin Wu, "Association Between Suicide Risk and Traumatic Brain Injury in Adults: A Population Based Cohort Study," *Postgraduate Medical Journal*, Vol. 96, No. 1142, December 2020; Trine Madsen, Annette Erlangsen, Sonja Orlovskaya, Ramy Mofaddy, Merete Nordentoft, and Michael E. Benros, "Association Between Traumatic Brain Injury and Risk of Suicide," *JAMA*, Vol. 320, No. 6, 2018; Sarah L. Martindale, Anna S. Ord, Lakeisha G. Rule, and Jared A. Rowland, "Effects of Blast Exposure on Psychiatric and Health Symptoms in Combat Veterans," *Journal of Psychiatric Research*, Vol. 143, November 2021.

through their shared life experiences. Veterans and servicemembers work with their treatment team to determine an individualized treatment plan. Our clinicians are experienced in delivering the most effective and innovative treatments to help heal the invisible wounds of war. We encourage family members and support people to participate in our program offerings as they are integral parts of the healing process. We also provide them with their own education and support options.

Home Base recognizes that TBI treatment cannot exist in isolation. The overwhelming majority of the patients who we treat in our ICP for TBI also receive treatment for co-occurring mental and behavioral health concerns through individual and group therapy, emotional regulation training, mindfulness, and wellness classes. The TBI patients receive supplementary services to treat their TBI concerns, including daily cognitive rehab, physical medicine, and rehabilitation (PM&R), and physical therapy.

HOLISTIC TREATMENT FOR TBI

4. Senator HIRONO. Secretary Martinez-Lopez, Dr. McBirney, and Dr. Zafonte, if current medical approaches to treating TBI and related outcomes in American servicemembers are lacking or require additional resources, what alternative pathways are being explored to treating TBI from a holistic perspective?

Secretary MARTINEZ-LOPEZ. The Department has a multipronged approach to care, allowing for each element to be enhanced as needed. The core elements are standardized assessment tools and protocols; specialty clinical sites networked for information sharing; and standardized policy to optimize documentation, screening, and care. The Defense Health Agency (DHA) established the Acute Concussion Care (ACC) Pathway as part of the Fiscal Year 2021 Quadruple Aim Performance Plan to standardize acute concussion assessment and care across the Military Health System (MHS). The goal of the ACC Pathway is to improve recovery times and outcomes by utilizing a multi-modal assessment tool at the time of injury (MACE 2) and to ensure timely access to repeat evaluations with personalized treatment protocols in alignment with a progressive return to activity process.

Supporting the goal of the ACC Pathway, the DHA Procedural Instruction 6490.04, "Required Clinical Tools and Procedures for Assessment and Clinical Management of Mild Traumatic Brain Injury/Concussion in Non-Deployed Setting," April 26, 2021, established the required clinical tools and procedures for management of mild TBI, or concussion, in a non-deployed setting. Specifically, the use of the MACE 2 and the PRA are the main tools used for the assessment, management, and rehabilitation of all patients with a mild TBI. Our current focus is on enhanced use of the existing mechanisms as well as documentation to enable continued refinement.

The Defense Intrepid Network (DIN) for TBI and Brain Health, which includes the National Intrepid Center of Excellence (NICoE), collaborates with civilian healthcare facilities to enhance care for servicemembers with TBIs and psychological health (PH) conditions. The DIN provides state-of-the-art clinical care, best practices, translational research, and education and training for the DOD and U.S. Government. The DIN delivers a comprehensive, holistic, interdisciplinary care model for the continuum of brain injuries and associated behavior health conditions. This interdisciplinary care model is noted to be the most successful treatment for cases that have not responded to traditional care. The DIN's model is the foundation on which the majority of other TBI programs across the country are based. The network includes 13 sites (located across the United States and one in Germany). NICoE serves as the DIN's headquarters and is home to some of the most advanced TBI and brain health research in the Nation. The DIN's interdisciplinary care model combines traditional medicine services such as behavioral health, neurologic, and rehabilitative care, with a host of complementary services such as acupuncture, chiropractic, and meditation, along with integrative health services such as art, music, and dance movement therapies. NICoE has a broad armamentarium of technologies and techniques to diagnose, treat and rehabilitate servicemembers. The model is rooted in a wellness mindset. The DIN consistently shares its model of integrating care and research with civilian facilities and leverages civilian expertise and assistance through the referral service.

Dr. MCBIRNEY. Given my lack of clinical experience, particularly compared with others on the panel, I do not consider myself to be well positioned to answer this question. I will defer to my colleagues.

Dr. ZAFONTE. Home Base views all our patient care issues, from PTSD to TBI, through a holistic lens. At Home Base, our approach to holistic treatment for warriors is centered on addressing the complex interplay of biopsychosocial issues that they often face. Our comprehensive and integrative model focuses on treating the

whole person, recognizing that mental, physical, and social health are deeply interconnected. Here is an outline of our approach:

Mindfulness and Mental Health

- *Mindfulness Practices:* We incorporate mindfulness-based stress reduction (MBSR) techniques to help warriors manage stress, anxiety, and depression. Practices such as meditation, deep breathing exercises, and guided imagery are taught to enhance emotional regulation and promote a sense of calm.
- *Cognitive Behavioral Therapy (CBT):* CBT is employed to address negative thought patterns and behaviors, helping warriors develop healthier coping mechanisms.
- *Trauma-Informed Care:* Recognizing the impact of trauma on mental health, we provide therapies specifically designed to address PTSD and other trauma-related conditions. This includes Eye Movement Desensitization and Reprocessing (EMDR) and trauma-focused CBT.

Addressing Physical Dysfunction and Pain Management

- *Comprehensive Physical Therapy:* We offer personalized physical therapy programs to address musculoskeletal issues, improve mobility, and reduce pain. These programs often include exercises tailored to individual needs, manual therapy, and strength training.
- *Pain Management Strategies:* Our approach to pain management is multifaceted, incorporating both traditional and complementary methods. This includes pharmacological treatments, acupuncture, chiropractic care, and massage therapy.
- *Functional Movement Training:* We focus on improving functional movement patterns to prevent injury and enhance physical performance. This includes education on proper biomechanics and posture.

Facilitating Safe and Vigorous Evaluation of Novel Holistic Therapies

- *Research and Evidence-Based Practice:* We are committed to staying at the forefront of medical research to ensure our treatments are grounded in the latest scientific evidence. We conduct and participate in clinical trials to evaluate the efficacy and safety of novel holistic therapies.
- *Integrative Medicine:* Our integrative medicine approach combines conventional medical treatments with complementary therapies. This might include nutrition counseling, herbal medicine, and mind-body practices such as yoga and tai chi.
- *Patient-Centered Care:* Each warrior receives a personalized treatment plan based on their unique needs and preferences. We involve patients in the decisionmaking process, ensuring that their values and goals are respected.

Social Support and Community Integration

- *Family and Community Support Programs:* Recognizing the importance of social connections, we offer support programs for families and facilitate community engagement activities. This helps warriors build a strong support network.
- *Peer Support Groups:* Peer support is a vital component of our approach. We provide opportunities for warriors to connect with others who have had similar experiences, fostering a sense of camaraderie and mutual support.
- *Holistic Wellness Programs:* Our holistic treatment approach at Homebase aims to empower warriors by addressing the full spectrum of their health needs, promoting resilience, and enhancing their quality of life.
- *Nutrition and Lifestyle Counseling:* Proper nutrition and a healthy lifestyle are crucial for overall well-being. We offer guidance on diet, exercise, and sleep hygiene to support warriors' holistic health.
- *Recreational and Creative Therapies:* Engaging in recreational activities and creative arts can be therapeutic. We provide opportunities for warriors to participate in art therapy, music therapy, and recreational sports.

QUESTIONS SUBMITTED BY SENATOR ELIZABETH WARREN

WEAPONS TRAINING AND BRAIN HEALTH

5. Senator WARREN. Secretary Martinez-Lopez, there is currently no uniform chart or scale for safe levels of blast exposures for the weapons that servicemembers routinely train on. When and what steps will DOD take to implement safety standards and guidance to servicemembers and military leaders that use, fire, and/or train on these weapon systems?

Secretary MARTINEZ-LOPEZ. DOD Response (Secretary Martinez-Lopez): The DOD is focused on safety and mitigation to avoid unnecessary blast exposures and will continue to issue weapon specific guidance in accordance with research developments. We have learned that each combat or training scenario modifies blast overpressure (BOP) in unique ways, which presents challenges in developing uniform guidance. Accordingly, while we continue to develop solutions to characterize BOP threats, the Department has implemented an ‘as low reasonably achievable (ALARA)’ policy approach to maximize safety.

In parallel to this policy guidance, the Department is reviewing and generating new data concerning blast exposures in training and combat to update safety protocols for the prevention of TBI. In November 2022, the Assistant Secretary of Defense for Readiness issued “Interim Guidance for Managing Brain Health Risk from Blast Overpressure.” This interim guidance provides that DOD Components will manage the risk of BOP exposures exceeding 4 pounds-force per square inch (psi) as a part of training, planning, and execution. This policy is currently being updated to expand on risk management actions based on the outcome of research and studies.

6. Senator WARREN. Secretary Martinez-Lopez, in order to get an accurate measure of servicemembers’ brain health over time, we must have a starting point or baseline to serve as a point of reference and comparison through force-wide cognitive testing. Previously, DOD responded to a congressional inquiry that “DOD will start with the 15 initial military training (IMT) sites. Each Military Service has different lengths of IMT from 7 to 13 weeks. Cognitive baseline testing will occur during IMT and varies as to the actual week during IMT that this will occur based on current training cycles and new recruit throughput. DOD’s regular cognitive testing program will cover all personnel in a phased approach, beginning with the Active Duty component and then the Reserve Component. At minimum, cognitive testing will be repeated every 5 years.” How many IMT sites does this leave out and what actions will be taken at those remaining IMT locations?

Secretary MARTINEZ-LOPEZ. There are a total of 15 IMT sites across the Department that encompasses enlisted and officer servicemembers in both the Active Duty and Reserve components. Therefore, there are no IMT sites that are left out. All newly accessioned servicemembers will be tested at one of the 15 IMT sites. The Cognitive Monitoring Program baseline collection is anticipated to begin June 2024 and IMT sites will be phased in throughout the rest of calendar year (CY) 2024.

7. Senator WARREN. Secretary Martinez-Lopez, what cognitive test will you use for the baseline and periodic testing and will you implement it at Military Entry Processing Stations (MEPS)?

Secretary MARTINEZ-LOPEZ. The DOD currently uses the Automated Neuropsychological Assessment Metrics (ANAM) for baseline and periodic testing pursuant to DOD Instruction (DODI) 6490.13, “Comprehensive Policy on Traumatic Brain Injury-Related Neurocognitive Assessments by the Military Services,” September 11, 2015, as amended. DODI 6490.13 states “The [ANAM] is the DOD-designated neurocognitive assessment tool until such time as evolving science and medical best practices inform a change in policy.” The DOD has approved testing to begin at various points at each IMT site (not at the Military Entry Processing Stations). The Cognitive Monitoring Program baseline collection is anticipated to begin June 2024 and installations will be phased in throughout the rest of calendar year 2024.

8. Senator WARREN. Secretary Martinez-Lopez, what is the Department’s plan to rapidly expand testing capabilities and sites that can do them?

Secretary MARTINEZ-LOPEZ. In September 2023, the Executive Council on Recruit and Basic Training (CORBT) supported the establishment of a DOD CORBT Cognitive Monitoring Working Group for the implementation of cognitive assessments at the IMT sites. The cognitive monitoring office, in coordination with the CORBT, has identified 15 IMT sites to establish baseline testing. As discussed in question 6, baseline collection is anticipated to begin June 2024 and IMT sites will be phased in throughout the rest of calendar year 2024.

9. Senator WARREN. Secretary Martinez-Lopez, do you have an estimate of how much it would cost to expand testing capabilities and sites to all IMT locations?

Secretary MARTINEZ-LOPEZ. The Department has conducted a cost analysis plan (CAP) and, as a result, the Department has programmed resources for implementation of baseline testing at IMT. The current estimated cost is 4 million dollars to conduct initial assessments at all 15 IMT sites.

10. Senator WARREN. Secretary Martinez-Lopez, what support and resources will the Services need from DHA to meet increased demand for assessments?

Secretary MARTINEZ-LOPEZ. The DHA, in coordination with the Army, has evaluated the resources needed to conduct the Cognitive Monitoring Program, which involves obtaining baseline cognitive assessments and then repeating, at minimum, every 5 years. The Department has programmed resources for implementation of the Cognitive Monitoring Program, which includes the estimates to conduct cognitive monitoring at the IMT's.

11. Senator WARREN. Secretary Martinez-Lopez, what are the 15 sites where the DOD will implement cognitive testing during IMT?

Secretary MARTINEZ-LOPEZ. The 15 sites are below.

Army	Navy	Marine Corps	Air Force/Space Force
Fort Moore, GA	Navy RTC Great Lakes, IL	TBS Quantico, VA	Lackland AFB, TX
Fort Jackson, SC	OTC Newport, RI	MCRD San Diego, CA	Maxwell AFB, AL
Fort Knox, KY	U.S. Naval Academy, MD	MCRD Parris Island, SC	U.S. Air Force Academy, CO
Fort Leonard Wood, MO			
Fort Sill, OK			
U.S. Military Academy, NY			

12. Senator WARREN. Secretary Martinez-Lopez, when will cognitive testing be available and required for all IMTs within DOD?

Secretary MARTINEZ-LOPEZ. Cognitive baseline testing will begin at select IMT sites in June 2024 and will be phased in throughout the rest of calendar year 2024 until testing is available at all 15 IMT sites. All newly accessioned servicemembers will go to one of the 15 IMT sites and receive cognitive testing.

13. Senator WARREN. Secretary Martinez-Lopez, what process do each of the service branches follow to screen Active Duty servicemembers for symptoms of blast overpressure and when do they conduct these screenings?

Secretary MARTINEZ-LOPEZ. All Services follow the same approach to screen for symptoms associated with BOP, as outlined in standardized clinical tools.

Historically, the focus in medical assessments after deployment has been exposures to potentially concussive events, including blast related exposures, and symptom based, with the latter typically driving the need for further assessments or treatment. Standardized medical assessments occur twice after deployment and are facilitated through the Post Deployment Health Assessment Form DD 2796 and the Post Deployment Health Re-Assessment Form DD 2900. All military medical treatment facilities (MTFs) have providers trained in TBI screening with the ability to refer patients to one of the TBI Specialty Care clinics or the Defense Intrepid Network for TBI and Brain Health for more comprehensive care. As a part of the continuum of care, servicemembers receive ongoing evaluation and treatment by a primary care provider during the annual Periodic Health Assessment, and those individuals reporting a history of TBI (or circumstances suggestive of the possibility) are further assessed for their Service or treatment needs.

14. Senator WARREN. Secretary Martinez-Lopez, what steps are each of the service branches taking to support servicemembers who are experiencing TBI and blast overpressure symptoms due to exposure during training?

Secretary MARTINEZ-LOPEZ. The Military Departments support servicemembers who are experiencing TBI and BOP through clinical treatments for symptoms, and by enhancing awareness, education, and training to enable early recognition and treatment. The DHA provides a robust compliment of evaluation and treatment services to address those servicemembers who present with symptoms secondary to exposure to BOP and TBIs. To help bring servicemembers into the healthcare system, in December 2023, the DHA established the new Warfighter Brain Health (WBH) hub (<https://health.mil/Military-Health-Topics/Warfighter-Brain-Health>) that

provides a unified approach toward optimizing servicemember brain health. In addition, the WBH Strategy and Action Plan, Objective 3d, “Optimize Medical Care to Return Warfighters to Full Duty Following TBI,” aims to identify, develop, and deploy evidence-based assessment, diagnostic, treatment, and rehabilitation strategies for TBIs. In support, the DHA developed the July 2023, Provider Fact Sheet, that informs providers about low-level blast exposure and steps to take to ensure patient education, documentation, and treatment.

15. Senator WARREN. Secretary Martinez-Lopez, when will DOD start to conduct routine cognitive testing for servicemembers who are already in the service (not initial entry servicemembers)?

Secretary MARTINEZ-LOPEZ. The Department plans to begin conducting routine cognitive testing for servicemembers who are already in the Service in December 2025; 18 months after the start of cognitive testing in accessioned servicemembers at the IMTs.

TOOLS FOR MEASURING BRAIN HEALTH

16. Senator WARREN. Ms. Lee, what tools would the department need to equitably and accurately assess soldier brain health and the diagnosis and prevention of brain injuries in soldier fitness tests and operational performance?

Ms. LEE. As discussed in question 7, the DOD uses the ANAM for baseline and periodic testing for brain health and as appropriate for diagnosed TBIs with cognitive deficits. The ANAM is a cognitive assessment tool designed to detect the speed and accuracy of attention, memory, and thinking ability. ANAM is useful as a complimentary tool to determine if there are cognitive changes in a servicemember. For this reason, ANAM testing is conducted prior to deployment and can be used to identify and monitor changes in function before and after an injury. The DOD also continues to explore other tools that can be used to assess WBH through conducting research analysis through in progress reviews and sending out requests for information from industry and academic communities. For concussions, injuries that are part of the spectrum of brain injuries, the DOD continues to use the MACE 2 and PRA tools in conjunction with networked specialty care.

17. Senator WARREN. Secretary Martinez-Lopez, what partnerships or collaborations does the Department of Defense have with private sector companies or universities and are these partnerships advancing solutions for traumatic brain injury prevention and recovery?

Secretary MARTINEZ-LOPEZ. The DOD collaborates with multiple universities and industry partners, such as the National Collegiate Athletic Association, University of California San Francisco through the Transforming Research and Clinical Knowledge in Traumatic Brain Injury (TRACK TBI) initiative, Abbott, and the National Academy of Science, Engineering, and Medicine, just to name a few.

Yes, these partnerships are advancing solutions for prevention, diagnostics, treatments and recovery following TBI.

PROTECTING MOST AT-RISK SERVICE MEMBERS

18. Senator WARREN. Dr. McBirney, what would be the benefits of establishing strategies specific to the Military Occupational Specialties (MOS) most at risk for blast overpressure?

Dr. MCBIRNEY. Establishing strategies specific to the MOSs most at risk would allow for targeted prevention and mitigation efforts, which would offer several benefits. One is improved occupational safety. MOS-specific strategies would enhance the overall safety and well-being of the servicemembers and reduce the likelihood of brain injury among personnel who are regularly exposed to blasts. Additionally, by safeguarding the health and well-being of servicemembers in roles with known blast exposure risk, the military can maintain higher levels of mission readiness and effectiveness. Moreover, MOS-specific strategies would better support post-service transition and veteran care for veterans who may have been exposed to blast overpressure during their military service. Lastly, establishing MOS-specific strategies would allow for limited resources to be focused where they are needed most.

19. Senator WARREN. Ms. Lee, when will DOD establish strategies specific to the Military Occupational Specialties most at risk for blast overpressure?

Ms. LEE. Please see information provided in response to question 5. In addition, the Department has identified MOS's that are most vulnerable to BOP exposures and is implementing risk mitigation activities aimed at those high risk MOS's and the utilization of Tier 1 weapon systems and munitions.

20. Senator WARREN. Secretary Martinez-Lopez, although DOD has identified the most at risk MOSs, it has grouped some broader groups together. For example, putting all combat arms in the high risk group combines heavy weapons troops with light infantry, which may risk missing subpopulations such as mortar soldiers who may be at higher risk than light infantry soldiers. Does DOD have plans to break down these subpopulations to ensure that they are not missing out on critical groups?

Secretary MARTINEZ-LOPEZ. The Department is in the process of re-evaluating munitions-related training and associated MOS's that put servicemembers at risk of BOP exposure. As discussed above, recently the Services have identified specific MOS's for the Department's WBH Initiative to focus blast exposure efforts, to include mitigation of activities and enhanced screening for servicemembers.

21. Senator WARREN. Secretary Martinez-Lopez, the New York Times reported at least one suicide in each of the artillery units they investigated that experienced significant effects of blast overpressure from fighting ISIS in Iraq and Syria in 2016 and 2017. Please provide a breakdown of the rates of deaths by suicide among artillery units sent to Syria and Iraq to fight against ISIS.

Secretary MARTINEZ-LOPEZ. Currently, the DOD does not have a means to longitudinally track each servicemember by MOS and their disposition based on possible BOP exposure. The DOD is working closely with the research community to develop a BOP dose response curve to update the occupational exposure tracking system, which would allow for tracking of those exposed to BOP.

TRACKING BLAST OVERPRESSURE DATA

22. Senator WARREN. Secretary Martinez-Lopez, what is DOD's plan for a wide scale rollout for integrating blast overpressure data into servicemember's individual longitudinal exposure record (ILER) following the pilot study with 500 servicemembers?

Secretary MARTINEZ-LOPEZ. The next steps include the finalization of the common data elements to be captured for each servicemember exposure event. Long term storage capability is also important so that blast exposure data will be available for ongoing evaluation and research purposes.

23. Senator WARREN. Secretary Martinez-Lopez, when will DOD be able to stand up this program and how much funding is needed to establish a permanent module?

Secretary MARTINEZ-LOPEZ. The Department is conducting a business case analysis (BCA) to inform the development of a standardized monitoring program for blast exposures. The BCA will evaluate the resources necessary to monitor, record, and analyze BOP exposures. The BCA is projected to be completed by December.

24. Senator WARREN. Secretary Martinez-Lopez, will the information on blast exposure data added to the ILER records include retrospective data for servicemembers?

Secretary MARTINEZ-LOPEZ. All data in the ILER is retrospective and is inclusive of environmental data that could impact servicemember health. As blast exposure data becomes available, it will be evaluated for the optimal way to include it in ILER.

25. Senator WARREN. Secretary Martinez-Lopez, while the Defense Department is tracking servicemembers who have had traumatic brain injury, this misses out on important data regarding those who are impacted by blast overpressure in other ways, such as sleep problems, headaches, behavior health issues, irregular heartbeats, and vestibular injuries. What steps is DOD taking to track a broader swath of servicemembers impacted by blast overpressure and blast exposure, beyond just TBI?

Secretary MARTINEZ-LOPEZ. The Department's focus is connecting servicemember level exposure to the ILER, with the Electronic Health Record (EHR) being the primary means to link blast exposure and health effects. The first priority is to encourage servicemembers to seek treatment and to make them aware of the reasons they may want to seek treatment for possible BOP related symptoms. Policy, standardized screenings, and education all help enable that objective. Once in the system, the DOD is seeking to track BOP as an exposure in the health records if a servicemember presents for related symptoms. Currently if a servicemember was experiencing adverse health effects from BOP in the garrison environment, then they would seek care within the MHS. In the deployed setting, all servicemembers who are within 50 meters of a blast event are required to undergo a mandatory medical

screening and evaluation. The documentation of servicemember blast exposure is critical.

To achieve this in the EHR, the DOD, in partnership with the Department of Veterans Affairs (VA), developed a specific blast medical diagnosis code in the International Classification of Diseases, Tenth Revision (ICD-10) for primary blast injury to the brain. The Department is developing guidance to ensure clear instructions for use of this new blast medical record code to help provide additional insights to inform clinical or operational decisions. This effort is expected to be completed this year to enable better medical surveillance for BOP exposure and injury.

26. Senator WARREN. Secretary Martinez-Lopez, what updates does DOD provide to servicemembers after they participate in studies monitoring blast overpressure? Please provide a breakdown of the rates of deaths by suicide among artillery units sent to Syria and Iraq to fight against ISIS.

Secretary MARTINEZ-LOPEZ. The DOD does not routinely provide updates or information to servicemembers after they consent to be in a research study. For most of the studies, the data collected by individual servicemembers are aggregated and de-identified for purposes of data analysis. There are plans to provide the results from the anonymized studies that are summarized and made available on the WBH Portal.

For the second part of this question, please refer to response to question 21.

27. Senator WARREN. Dr. McBirney, and Dr. Zafonte, what are the benefits of establishing blast exposure and traumatic brain injury logs for servicemembers?

Dr. MCBIRNEY. These logs would allow the Department of Defense (DOD) to better track the frequency of low-level blast exposure, assess the occurrence among high-risk occupational specialties, determine the connection between exposure and health outcomes, and develop strategies to mitigate low-level blast exposure in training environments. Ultimately, in-depth exposure records could be used to develop an index score to gauge an individual's combat readiness and potential health risks.²

Dr. ZAFONTE. Logs would create a method by which patients could bring more data to bear in their evaluations for TBI and allow for more uniformity. Data would also give servicemembers greater control over their healthcare, as they could make informed choices when seeking treatment.

ADDRESSING CULTURAL BARRIERS

28. Senator WARREN. Secretary Martinez-Lopez, what efforts is DOD and all the services undertaking to inform, educate, and build a culture of safety in units to follow appropriate safety measures to protect from blast exposure, such as accurately wear personal protective equipment (PPE) or blast gauges, pausing the use of weapons once an unsafe threshold has been reached?

Secretary MARTINEZ-LOPEZ. The November 2022 the interim guidance memorandum, "Managing Brain Health Risk from Blast Overpressure," (discussed above) stated that until the relationship between BOP and brain health effects are more fully understood, DOD Components will manage the risk of exposures from weapon systems exceeding 4 pounds per square inch as part of training, planning, and execution. This memorandum specified risk management requirements for DOD Components, including minimizing the number of personnel in the vicinity of BOP events, increasing standoff distances from weapons; minimizing the duration of live-fire events; establishing a maximum allowable number of rounds fired during each training event; ensuring application of personal protective equipment; and training and educating on BOP hazards and risk management actions. This policy is currently being updated to expand on risk management actions based on the outcome of research and studies.

The DHA, with all three Military Departments and the Assistant Secretary of Defense for Health Affairs, developed the "DOD Service Member Fact Sheet, Information on Low-Level Blast Exposure," July 2023, found at: <https://www.health.mil/Military-Health-Topics/Centers-of-Excellence/Traumatic-Brain-Injury-Center-of-Excellence/Low-Level-Blast-Exposure>. The fact sheet was designed for servicemembers, where their occupational specialties may involve working with or exposure to blasts

² Charles C. Engel, Emily Hoch, and Molly M. Simmons, *The Neurological Effects of Repeated Exposure to Military Occupational Blast: Implications for Prevention and Health: Proceedings, Findings, and Expert Recommendations from the Seventh Annual Department of Defense State-of-the-Science Meeting*, RAND Corporation, CF-380/1-A, 2019, <https://www.rand.org/pubs/conf-proceedings/CF380z1.html>; Lauren Fish and Paul Scharre, *Protecting Warfighters from Blast Injury*, Center for a New American Security, May 2018.

generated from firing heavy weapon systems or explosives in combat or training environments. The last page gives examples of MOS's that can be exposed to low level blast.

29. Senator WARREN. Secretary Martinez-Lopez, what training is DOD and the services providing to unit leaders on protecting their units from the blast overpressure and blast exposure?

Secretary MARTINEZ-LOPEZ. As specified within the interim guidance memorandum, "Managing Brain Health Risk from Blast Overpressure," (mentioned above) DOD Components are required to train and educate on BOP hazards and risk mitigation actions. Additionally, Commanders are to implement actions to further reduce risk by training and educating personnel on BOP hazards and risk management actions. The Military Departments and unit commanders are responsible to determine how often and in what manner training is conducted and tracked to ensure proficiency while training safely in compliance with current safety and range regulations.

30. Senator WARREN. Secretary Martinez-Lopez, what steps is DOD and each of the services taking to destigmatize servicemembers who come forward with blast overpressure and TBI symptoms, both for those who have and have not engaged in direct combat?

Secretary MARTINEZ-LOPEZ. Our first priority is the health of our servicemembers which is why we make every effort to encourage anyone who has experienced symptoms related to blast overpressure (BOP) exposure or traumatic brain injury (TBI) to seek diagnosis and treatment. Policy, standardized screenings, and education all help enable that objective—and to ensure that servicemembers throughout the Department do not perceive any potential stigmatizing barriers to care. The Military Departments support servicemembers who are experiencing symptoms related to TBI or BOP exposure through clinical treatments for related symptoms, and by enhancing awareness, education, and training to enable early recognition and treatment.

Currently, if a servicemember is experiencing adverse health effects from BOP exposure in the garrison environment, then they would seek care within the Military Health System (MHS) as outlined in the July 2023, Service Member Fact Sheet (Information on Low-Level Blast Exposure: Service Member Fact Sheet (health.mil)). In the deployed setting, all servicemembers who are within 50 meters of a blast event are required to undergo a mandatory medical screening and evaluation. Required screenings and evaluation further build awareness of possible risks and normalizes use of the MHS to receive care for these types of experiences, thus further reducing any possible stigma associated with seeking care. Incident based protocols do not require the servicemember to self-identify the need for a medical evaluation; it is mandatory based on the potentially concussive event (i.e., blast event). Furthermore, servicemembers receive training and education on how to recognize BOP symptoms, requirements to report exposures to their command, and seeking an evaluation from their medical provider if experiencing symptoms.

Military medical training institutions emphasize TBI prevention, diagnosis, and treatment through both enlisted and officer courses as part of our efforts to encourage accessing care and, whenever applicable, reduce and eliminate any potential stigma associated with receiving help. Additionally, the Military Services require servicemembers to take the Joint Knowledge Online course US 1114 "Concussion Training for servicemembers," which describes actions and responsibilities to protect warfighter brain health. Topics covered include the definition and causes of concussion, signs and symptoms of concussion, its impact on physical performance and mission readiness, and the roles and responsibilities of servicemembers and leaders as they pertain to concussion.

31. Senator WARREN. Secretary Martinez-Lopez, what steps is DOD and each of the services taking to ensure that servicemembers who come forward due to traumatic brain injury or blast overpressure effects do not face retaliation for doing so?

Secretary MARTINEZ-LOPEZ. Our first priority is the health of our servicemembers which is why we make every effort to encourage anyone who has experience symptoms related to BOP exposure or TBI to seek diagnosis and treatment. Taking care of our people, which includes protecting them from retaliation or reprisal in any form at any level, is important for our servicemembers' wellness and the overall readiness of our force. The Military Departments support servicemembers who are experiencing symptoms related to TBI or BOP exposure through clinical treatments for related symptoms and education and training on early recognition and treat-

ment, the Department is implementing policy to ensure they are afforded every opportunity to protect their ability to serve along the way.

32. Senator WARREN. Secretary Martinez-Lopez, the New York Times reporting revealed that there are many cases where policies are not being implemented on the ground, i.e. troops were not actually following safety measures on the ground. What steps are you taking to work with the services to ensure that policy changes are being implemented on the ground?

Secretary MARTINEZ-LOPEZ. The DOD's Deputy's Safety Oversight Committee (DSOC) governance structure has been and will continue to support oversight and compliance activities to ensure policy changes are being implemented on the ground.

33. Senator WARREN. Dr. McBirney, and Dr. Zofante, are you aware of cases where servicemembers were retaliated against for coming forward about their injuries from blast overpressure and exposure?

Dr. MCBIRNEY. I am not aware of any specific cases in which servicemembers were retaliated against for coming forward about their injuries from blast overpressure and exposure. However, there is ample research on the underreporting of injuries among servicemembers³—specifically, the underreporting of TBIs—and the reasons servicemembers underreport, one of them frequently being concerns that reporting could have negative consequences. A 2020 study assessing unreported and untreated TBI among more than 5,000 soldiers concluded that, of those who reported a concussion, only 52 percent sought medical care. Of those who did not seek care, 18 percent were concerned that reporting might have negative repercussions on their careers. Additionally, 28 percent of soldiers who experienced a mild TBI (and 11 percent of soldiers who did not) reported that there is a stigma associated with mild TBI.⁴ This stigma goes beyond TBI and speaks to the culture across DOD—one in which there is stigma associated with seeking medical services and/or mental health treatment.⁵

Dr. ZAFONTE. I am not personally aware of any retaliation.

34. Senator WARREN. Dr. McBirney, and Dr. Zofante, what steps should DOD and the services take to encourage servicemembers to seek treatment and help both during and after their career?

Dr. MCBIRNEY. Research shows that two common reasons servicemembers do not seek treatment for TBIs relate to stigma and the belief that their injury did not require care,⁶ the latter of which stems from a lack of education and awareness. Additional barriers to seeking treatment include logistical barriers and structural factors related to the military medical system (as detailed in Question 7).⁷ Therefore, there are several options that DOD has to encourage servicemembers to seek treatment. These include destigmatizing [mental] health care, enhancing the accessibility of services, implementing routine mental health screenings, training servicemembers and leadership on the signs of [mental] health issues and potential brain injury, establishing clear, confidential channels for servicemembers to provide feedback on care received and any barriers they encountered, and developing further peer support programs.⁸

³Laurel Smith, Richard Westrick, Sarah Sauers, Adam Cooper, Dennis Scofield, Pedro Claro, and Bradley Warr, "Underreporting of Musculoskeletal Injuries in the US Army: Findings from an Infantry Brigade Combat Team Survey Study," *Sports Health*, Vol. 8, No. 6, November/December 2016.

⁴Sandra M. Escolas, Margie Luton, Hamid Ferdosi, Bianca D. Chavez, and Scot D. Engel, "Traumatic Brain Injuries: Unreported and Untreated in an Army Population," *Military Medicine*, Vol. 185, Supp. 1, January–February 2020.

⁵Kyong Hyatt, Linda L. Davis, and Julie Barroso, "Chasing the Care: Soldiers Experience Following Combat-Related Mild Traumatic Brain Injury," *Military Medicine*, Vol. 179, No. 8, August 2014.

⁶Joie D. Acosta, Wenjing Huang, Maria Orlando Edelen, Jennifer L. Cerully, Sarah Soliman, and Anita Chandra, *Measuring Barriers to Mental Health Care in the Military: The RAND Barriers and Facilitators to Care Item Banks*, RAND Corporation, RR-1762-OSD, 2018, <https://www.rand.org/pubs/research-reports/RR1762.html>; Escolas et al., 2020; Hyatt, Davis, and Barroso, 2014; Marie-Louise Sharp, Nicola T. Fear, Roberto J. Rona, Simon Wessely, Neil Greenberg, Norman Jones, and Laura Goodwin, "Stigma as a Barrier to Seeking Health Care Among Military Personnel with Mental Health Problems," *Epidemiologic Reviews*, Vol. 37, January 2015; Terri Tanielian, Mahlet Woldetsadik, Lisa Jaycox, Caroline Batka, Shaela Moen, Carrie Farmer, and Charles C. Engel, "Barriers to Engaging Service Members in Mental Health Care Within the U.S. Military Health System," *Psychiatric Services*, Vol. 67, No. 7, July 2016.

⁷Acosta et al., 2018; Tanielian et al., 2016.

⁸Donald Berwick, Katherine Bowman, and Chanel Matney, eds., "Traumatic Brain Injury Prevention and Awareness," in *Traumatic Brain Injury: A Roadmap for Accelerating Progress*, The

Dr. ZAFONTE. As a non-profit academic medical center, outside the system, I do not have sufficient personal knowledge of the internal barriers servicemembers face to seeking TBI treatment to respond to this question in detail.

35. Senator WARREN. Dr. McBirney, and Dr. Zofante, what steps should DOD and the services take to encourage servicemembers to follow safety measures to protect themselves from blast overpressure?

Dr. MCBIRNEY. Perhaps the most effective way to encourage servicemembers to follow safety measures is through education and awareness. Servicemembers and leadership need authoritative information about the dangers of blast overpressure, including its sources and the potential short-and long-term health consequences. Regular training and awareness campaigns can help personnel understand why protective measures are necessary and how they can effectively mitigate risks.⁹ Additionally, the dissemination of safety equipment that is both validated and functional will encourage safety members to protect themselves from blast overpressure.

Dr. ZAFONTE. As a non-profit academic medical center, outside the system, I do not have sufficient personal knowledge on the internal incentives or barriers to servicemembers following safety measures.

PROVIDING SERVICE MEMBERS CARE

36. Senator WARREN. Dr. Zofante and Captain Williams, how many servicemembers do you have on your waitlist and what is the average wait period for them to start your respective programs?

Dr. ZAFONTE. Currently, there are 236 Special Operations personnel in the screening and review process. We have scheduled 241 Special Operations personnel for an upcoming cohort. From the start of the first engagement with a potential participant, the average wait time is 12–15 months.

Captain WILLIAMS. The National Intrepid Center of Excellence (NICoE) and the larger Defense Intrepid Network (DIN), 13 facilities total, have two outpatient program types, the traditional outpatient traumatic brain injury (TBI) clinic model and the interdisciplinary intensive outpatient program (IOP). The Defense Health Agency access to care standard for a specialty care program is 28 calendar days from date of referral. Servicemembers referred to the traditional outpatient clinic model consistently meet the access to care standard.

Nine of the 13 DIN sites have the IOP, and the waitlist for these locations is approximately 640 servicemembers. Each site proactively schedules patients into the program as openings become available, with servicemembers typically booked within three to 6 months.

It should be noted that, in pursuit of career goals, there are periods in the training and deployment rotation of servicemembers where they are more willing to commit to the 4-week IOP program. Many of these patients are still functioning at a high capacity (but not at their full potential). Therefore, time from referral to engagement in the IOP is not always considered to be an “as soon as possible” appointment by the servicemembers.

37. Senator WARREN. Dr. Zofante and Captain Williams, how much additional funding would you need to address the servicemembers on your wait list for your respective programs?

Dr. ZAFONTE. Home Base is funded almost entirely through philanthropy with some supplemental State and Federal appropriations. Every dollar that we bring in makes an impact on how many patients we can treat, the programs we can support, and the innovation that we can pilot. The primary obstacle to reducing the waitlist is the absence of adequate physical space for treatment and the need to expand our pool of qualified healthcare providers. Home Base launched a capitol campaign and was successful in raising funds to build a new floor for our headquarters in Charles-

National Academies Press, 2022; Kathryn E. Bouskill, Carrie M. Farmer, Irineo Cabrereros, Jonathan H. Cantor, Natalie C. Ernecoff, Lynn Hu, Shira H. Fischer, Aaron Kofner, Lisa S. Meredith, Matthew L. Mizel, Aneesa Motala, Tepring Piquado, Zachary Predmore, and Rajeev Ramchand, *Improving Care for Veterans with Traumatic Brain Injury Across the Lifespan*, RAND Corporation, RR-A1205-1, 2022, <https://www.rand.org/pubs/research-reports/RRA1205-1.html>; Escolas et al., 2020; Michael S. Jaffee, “Traumatic Brain Injury and the Military Health System,” in David Butler, Jessica Buono, Frederick Erdtmann, and Proctor Reid, eds., *Systems Engineering to Improve Traumatic Brain Injury Care in the Military Health System: Workshop Summary*, The National Academies Press, 2009; School of Education and Human Development, Texas A&M University, “Support for Family Caregivers After Military Traumatic Brain Injuries,” November 27, 2018.

⁹Berwick, Bowman, and Matney, 2022.

ton, MA. When we complete that space in mid-2024, we will have the capacity to see twice as many patients weekly as part of the ComBHaT program. Increased Federal support for Home Base would allow the organization to continue building out a world-class provider team, ensure continued investment in innovative treatment models and technology, and allow us to remain the gold standard for treating TBI and invisible wounds of war.

Captain WILLIAMS. The additional resources necessary to address the wait list are associated with increased specialized clinical personnel and an exemption from standard healthcare productivity practices. Staffing models for practice guidelines of interdisciplinary care, including outpatient and IOP programs, are currently being established for further determination of manning requirements.

38. Senator WARREN. Dr. Zofante and Captain Williams, how much advance notice do servicemembers get before they are able to enter your program?

Dr. ZAFONTE. Entering the ComBHaT program is a multi-step process. Prospective participants reach out over the phone, via email, or through an online “connect to care” platform. Once an interest form is submitted, a team member from Home Base reaches out to the prospective patient and begins the screening and intake process. That process is multi-faceted and may include a medical clearance process before the Special Operations personnel can participate. Once cleared for admission, the team works with the participant to find a time that can work with the up-tempo schedule of Active Duty Special Operations personnel. The entire process can take 12 to 18 months. Home Base also maintains a standby list of people who are interested in filling the spot for a last-minute cancellation.

Captain WILLIAMS. Each DIN site varies on the advance notice provided to servicemembers. Typically, servicemembers often prefer dates that are optimal for their training and deployment rotations and can have upwards of 3 months’ notice. However, due to the potential for quickly changing circumstances with each individual patient, positions in the IOP cohorts may open due to cancellations, sometimes with only days or a few weeks’ notice. Unscheduled members on the waitlist are immediately offered the opportunity to attend if they are agreeable and available.

See comment on question 36 above for additional clarification.

39. Senator WARREN. Dr. Zofante and Captain Williams, what onsite childcare options do you have for servicemembers when they attend your program?

Dr. ZAFONTE. Home Base does not currently offer onsite childcare for our participants.

Captain WILLIAMS. There are currently no onsite dedicated childcare services across the network. Some installations have Child Development Centers or Child and Youth Services that may be able to provide hourly care for those registered with each individual program.

40. Senator WARREN. Dr. Zofante and Captain Williams, what is the average number of servicemembers whose families are able to attend your respective programs as well?

Dr. ZAFONTE. We invite all ComBHaT participants to bring family support. Approximately 50 to 60 percent of ComBHaT patients bring a family support member with them for the 5-day evaluation program.

Captain WILLIAMS. The numbers of spouses/families that choose to participate varies across locations in the DIN, ranging from 5 to 25 percent of spouses/families.

41. Senator WARREN. Dr. Zofante and Captain Williams, at what point in their career do most servicemembers attend your respective programs?

Dr. ZAFONTE. We have a diverse range of participants in ComBHaT, from early careers to veterans. While we do not actively track our participants’ career stages in our data set, anecdotally, the majority are in their final few years of service. Home Base has recently seen an uptick in senior leaders (E-8/E-9 and O-5 through O-9) participating in the ComBHaT program.

Captain WILLIAMS. Most members attending the DIN intensive outpatient programs have greater than 15 years’ time in service.

This percentage is slightly impacted by the military occupation and/or community, severity of TBI and Service affiliation. It is common for servicemembers with TBI symptoms and associated conditions to not seek care until they are nearing the end of their careers due to fears of stigma, non-deployability, or duty limiting profiles. Therefore, comprehensive medical and psychological evaluations near the end of their career, including diagnoses and treatment for TBI symptoms, continues to be highly sought after. Specific DIN locations reported the following:

- A. ISC Fort Liberty (Army Special Operations) reported that about 75 percent are within 2 years of retirement with the other 25 percent at mid-career (10–12 year).
- B. ISC Camp Lejeune (Marine Special Operations) reported that the majority of IOP patients are at 15 to 18 years of service; the outpatient program varies from first acute concussions event to pending retirement (e.g., 18+ years).
- C. ISC Eglin (Airforce Special Operations) reports for both IOP and OP the average is 16 years' time in service with an average patient age of 37 years old.
- D. ISC Camp Pendleton (1st Marine Expeditionary Force) reported a majority of servicemembers have ten or more years of service.
- E. ISC Ft. Cavazos reported there has been a diverse representation of mid and late career enlisted and officer participation at both levels of care (outpatient and IOP) over the last decade. In the last 2 years, there has been a spike in early career or junior soldiers who have not deployed but sustained concussions in while in garrison.

42. Senator WARREN. Dr. McBirney, and Dr. Zofante, what are the biggest gaps in information getting to servicemembers and their families about blast overpressure risks and symptoms, as well as options for treatment?

Dr. MCBIRNEY. My research has not focused on this, so I will defer to my colleagues to answer this question.

Dr. ZAFONTE. As a non-profit academic medical center outside the DOD system, I do not have sufficient personal knowledge on how DOD shares information with servicemembers and their families. However, to my knowledge, most servicemembers who come to Home Base learn about the program from their peers and self-refer to the program. I recommend that DOD ensure that high-quality evidence-based programs in the private sector are easily accessible to servicemembers and their families.

43. Senator WARREN. Dr. McBirney, and Dr. Zofante, what are the biggest barriers to servicemembers seeking and obtaining treatment for blast overpressure and exposure?

Dr. MCBIRNEY. While there is little to no research on the barriers that prevent servicemembers from seeking and/or obtaining treatment specifically for blast overpressure and exposure, there is some research on barriers that prevent servicemembers from seeking treatment for TBI and further research on barriers related to the treatment of mental health and other health issues. Barriers include those that are purely logistical (e.g., difficulty scheduling an appointment¹⁰); structural factors associated with the military medical system (e.g., limited capacity of the system, limited number of providers available to address needs);¹¹ a lack of knowledge of the risks of exposure to lower-level blasts;¹² and institutional attitudes and cultural issues, also known as public stigma¹³ (e.g., perceived attitudes held by leadership,¹⁴ concerns that seeking care could have negative career repercussions¹⁵).

Dr. ZAFONTE. Servicemembers often avoid seeking care for blast-related injuries due to several interrelated reasons:

1. Stigma: There is a pervasive stigma associated with seeking medical or psychological help, often viewed as a sign of weakness. Many servicemembers fear that admitting to an injury, especially one involving mental health, could negatively impact their careers and how peers and superiors perceive them.

2. Desire to Stay in the Fight: The strong sense of duty and commitment to their mission drives many servicemembers to downplay or ignore their injuries. They may fear being sidelined or removed from Active Duty, which could prevent them from fulfilling their responsibilities and supporting their comrades.

3. Concern for Team Members: Servicemembers often prioritize the well-being of their team over their own health. They worry that seeking treatment could leave their team shorthanded, increasing the risk for their fellow soldiers and potentially compromising the mission.

4. Lack of Recognition of Subtle Symptoms: Blast-related injuries, particularly traumatic brain injuries (TBI), can have subtle and delayed symptoms that are not

¹⁰ Acosta et al., 2018.

¹¹ Tanielian et al., 2016.

¹² Escolás et al., 2020.

¹³ Tanielian et al., 2016.

¹⁴ Acosta et al., 2018; Sharp et al., 2015; Tanielian et al., 2016.

¹⁵ Escolás et al., 2020; Hyatt, Davis, and Barroso, 2014; Tanielian et al., 2016.

immediately recognized. Servicemembers may attribute these symptoms to stress, fatigue, or other benign causes, leading to a delay in seeking appropriate care.

Addressing these barriers requires a cultural shift within military organizations to normalize seeking help and recognize the importance of early intervention for blast-related injuries.

QUESTIONS SUBMITTED BY SENATOR TAMMY DUCKWORTH

BLOOD TESTS FOR TBI SCREENING

44. Senator DUCKWORTH. Secretary Martinez-Lopez and Ms. Lee, the Department of Defense (DOD) has recognized the need for an accurate blood test to assess concussions and screen military personnel for traumatic brain injuries. Due to DOD's leadership in this space and working with industry to bring such a test to market, there now exists an FDA-cleared blood test available to servicemembers and civilians alike. However, more research and clinical trials are needed to make this test available from the battlefield to the sports field, and to truly operationalize the point-of-care ability of a TBI test. How is DOD continuing to work with the stakeholder community to drive this research forward?

Secretary MARTINEZ-LOPEZ and Ms. LEE. The Department published the WBH Research Strategy in January 2024 which provides guidance for DOD medical and operational research and development (R&D) activities to coordinate, optimize, and advance WBH science. Specifically, focus area 2.6 of the WBH Research Strategy, "Assessing and Diagnosing Warfighter Brain Injuries," recognizes blood biomarkers as a priority. Select medical units within the DOD have fielded blood biomarker kits in their medical equipment sets. The WBH Vision outlines R&D efforts focused on brain health hazards, threats, and operational requirements, with the goal of rapidly transitioning products and practices to optimize WBH and performance. The Department also collaborates with multiple stakeholders to include industry partners, academic institutions, and other Federal agencies within the context of the National Academies of Science, Engineering and Medicine (NASEM) TBI Forum, specifically in the area of biomarkers for TBI. In April, the Director of the WBH Office presented at a National Academies of Science, Engineering, and Medicine (NASEM) workshop on 'Innovation Trends in Technology for the Prevention, Treatment, and Management of TBI' to outline the DOD's challenges and barriers to using TBI FDA cleared devices as part of ongoing efforts to maximize implementation and to drive research and innovation in this space.

45. Senator DUCKWORTH. Secretary Martinez-Lopez and Ms. Lee, are there other opportunities to work with Federal partners like VA, CDC, BARDA, and NIH to research, update, and disseminate best practices and evidence-based diagnosis for TBI?

Secretary MARTINEZ-LOPEZ and Ms. LEE. Yes, there are many opportunities to partner. The Department has a long history of successful partnerships with other Federal agencies and organizations in advancing clinical practice, conducting research, developing educational and prevention and awareness products and exploring technology solutions. For example, the DOD partnered with the VA to publish the "VA/DOD Clinical Practice Guideline for the Management and Rehabilitation of Post Acute Mild Traumatic Brain Injury," in June 2021. In 2023, the Department has partnered with the Department of Health and Human Services, the VA, and the Department of Transportation to lead and support recently published recommendations from the NASEM report, "Traumatic Brain Injury: A Roadmap for Accelerating Progress."

QUESTIONS SUBMITTED BY SENATOR JONI ERNST

EARLY DETECTION

46. Senator ERNST. Dr. Zafonte and Captain Williams, what methods are there to diagnose TBI where the wounds are undetectable on MRI and PET scans?

Dr. ZAFONTE. For servicemembers with negative standard anatomic MRI scans, more sophisticated diagnostic tools are essential to detect subtle or cumulative injuries that might not be visible on conventional imaging. Multimodality scanning, which employs advanced MRI paradigms potentially linked to PET-based markers, offers a more comprehensive assessment of brain function and structure. These advanced imaging techniques can reveal microstructural damage, metabolic changes, and other subtle abnormalities indicative of traumatic brain injury (TBI).

Additionally, blood-based biomarkers, as well as physiological and reaction markers, hold promise for enhancing our understanding of both short- and long-term exposure effects. These biomarkers can provide critical information about the biological processes underlying injury and recovery, thereby supporting clinical diagnosis and monitoring.

It is crucial to link these sub-markers and tools to clinical symptoms, resilience factors, and long-term maladaptation. This linkage ensures that diagnostic findings are relevant and actionable within a clinical context. By correlating biomarkers and advanced imaging results with clinical presentations and patient outcomes, we can develop more targeted and effective treatment plans. This holistic approach enhances our ability to identify those at risk, monitor their recovery, and ultimately improve the long-term health and resilience of our servicemembers.

Captain WILLIAMS. The most reliable method to diagnosis continues to be history and physical examination of the patient. Blood based biomarkers are an important emerging tool in TBI diagnosis. Advanced technologies to further characterize TBI, including magnetoencephalography (MEG) and quantitative EEG methods that look at neural network disruptions, remain under research investigation.

The most reliable mechanism for assessing the invisible wounds of war is still a sound medical history and neurological/neuropsychological and behavioral health evaluations. Interdisciplinary approaches leverage the expertise of each provider and enhances the understanding of the multifaceted disease State. Not only do neurological and behavioral health providers shed light on brain health and functioning, but assessments by internal medicine (endocrinological disturbances, nutritional deficiencies), psychiatry, and rehabilitation providers identify important medical conditions that impact cognitive bandwidth, level of performance, and emotional regulation.

Each interdisciplinary team member has objective and subjective screening tools and outcome measures. These approaches include not only diagnosis of TBI but treatment of symptoms and sequelae. Some examples include a servicemember's neurocognitive testing helps to understand disruption of cognitive domains, levels of functioning, and emotional regulation. Assessment of sleep disturbances is also a critical component in the assessment and treatment of TBI, subconcussive events, blast exposure, and psychological health conditions. In addition, utilization of the creative arts therapies has been advantageous in the externalization of otherwise compartmentalized and untreated symptoms for servicemembers.

47. Senator ERNST. Dr. Zafonte, are there other alternatives available Automated Neuropsychological Assessment Metrics (A-NAM) test that is used by the DOD as an accurate method of detecting changes in cognition that can lead to a TBI diagnosis?

Dr. ZAFONTE. ANAM is used to assess for cognitive deficits acutely, usually within the first week, following a traumatic brain injury. It is typically used in the first few days following a mild traumatic brain injury. There has been a large amount of research published over the past 15 years relating to using ANAM and other neuropsychological test batteries for this purpose. Each battery carries known limitations and strengths. To address this question adequately, a working group would need to review the State of the science on this topic.

48. Senator ERNST. Dr. Zafonte, would wearable devices assist in the diagnosis of these types of TBI? If so, what kind?

Dr. ZAFONTE. Implementing wearable technology to detect blast exposure represents a significant advancement in identifying servicemembers at cumulative risk and refining exposure thresholds. These devices can continuously monitor environmental factors and physical responses, providing real-time data on blast intensity and frequency. This information is crucial in recognizing those who might be at increased risk due to repeated low-level exposures that could cumulatively result in significant harm.

While wearable technology offers valuable insights, it is important to understand that it does not diagnose traumatic brain injuries (TBI) on its own. Instead, these devices serve as an early warning system, raising suspicion of potential injuries based on exposure patterns. They provide additional evidence that clinicians can use to make more informed decisions about further evaluation and potential intervention.

By integrating data from wearable technology with clinical assessments, we can enhance our ability to identify at-risk individuals early, potentially before significant symptoms manifest. This proactive approach supports better outcomes by enabling timely and targeted care, ultimately improving the health and readiness of our servicemembers.

49. Senator ERNST. Secretary Martinez-Lopez and Captain Williams, earlier, we heard from Mr. Larkin, whose son Ryan had microscopic tears on his brain that were not detectable on MRI and PET scans. What methods are there to diagnose TBIs like this?

Secretary MARTINEZ-LOPEZ and Captain WILLIAMS. There is no approved technology to radiographically diagnose microscopic tears. These injuries can be below the resolution of conventional and advanced imagery; therefore, a variety of assessment and treatment approaches are utilized to identify neurological network disruptions. This makes the interdisciplinary model critical for targeting treatment and recovery, as well as deploying investigatory technology such as MEG and Quantitative Electroencephalography (QEEG).

See comment on question 46 above for additional information.

50. Senator ERNST. Secretary Martinez-Lopez, when will the DOD transition from the pre-deployment neurocognitive testing to the broader screening program?

Secretary MARTINEZ-LOPEZ. The Department plans to expand the current cognitive assessment testing beginning June 2024 at 15 initial military training sites.

51. Senator ERNST. Secretary Martinez-Lopez, what neurocognitive test are you using and why is this best suited for our servicemembers?

Secretary MARTINEZ-LOPEZ. For several years, the DOD has used the ANAM as the primary neurocognitive test to meet the requirements outlined in DOD Instruction 6490.13, "Comprehensive Policy on Traumatic Brain Injury-Related Neurocognitive Assessments by the Military Services," September 11, 2015, as amended. The Army has been the lead agent in executing the Department's neurocognitive program and has collected over 3.7 million baseline tests (approximately 93–95 percent are pre-deployment). A sample size of the data within the repository supported the publication of the "Long-Term Test—Retest Stability of ANAM in a Large Military Sample¹." The study results indicate that the use of the ANAM baseline for comparison can be done up to 5 years, thus the baseline results are stable. To date the Department continues to use the ANAM as the primary neurocognitive test as there has been no data to demonstrate superiority of another assessment tool, despite head-to-head comparison studies of computerized neurocognitive tests².

52. Senator ERNST. Ms. Lee, what information are you providing to servicemembers and their families about the Warfighter Brain Health Initiative?

Ms. LEE. In addition to information provided to servicemembers seen in TBI clinics, we have education and awareness efforts tailored for military and family members. The WBH Hub, established in December 2023 (at health.mil/brain), serves as the single source of information on brain health topics. Our goal is to make the latest brain health information easy to access for our servicemembers, providers, families, and the public and provide a bridge from our clinical community to the operational environment.

53. Senator ERNST. Ms. Lee, what positive impacts has the Warfighter Brain Health Initiative made on the servicemembers and their families?

Ms. LEE. The outreach activities that support the WBH Initiative (WBHI) have positively impacted the overall awareness of the importance of optimizing brain health. Due to multiple educational efforts, especially throughout March, which is Brain Injury Awareness Month, servicemembers and their families have increased knowledge and resources available to them. The WBHI offers extensive support in areas crucial to military relevance, including cognitive performance, brain health, BOP exposures, TBI evaluations, treatments, care, and long term or late effects of brain exposures and injuries. This broad scope provides numerous opportunities for positively impacting the readiness of the Force and enhancing the quality of life for servicemembers and their families.

54. Senator ERNST. Secretary Martinez-Lopez and Ms. Lee, how is the Department screening servicemembers who may have developed TBI in a deployed location?

¹ Meyers J. (2019). Long-Term Test-Retest of ANAM in a Large Military Sample. *Archives of Clinical Neuropsychology* 35 (2020) 70–74.

² Wesley C. (2017). A Comparison of Four Computerized Neurocognitive Assessment Tools to a Traditional Neuropsychological Test Battery in servicemembers with and without Mild Traumatic Brain Injury. *Archives of Clinical Neuropsychology* 33 (2018) 102–119.

Secretary MARTINEZ-LOPEZ and Ms. LEE. DODI 6490.11, “DOD Policy Guidance for Management of Mild Traumatic Brain Injury/Concussion in the Deployed Setting,” September 18, 2012, as amended, directs a medical screening and evaluation of a servicemember that has been involved in a potentially concussive event, such as being 50 meters or closer to a blast incident. DOD policy dictates that the MACE 2 screening tool and PRA are used nearest to time of injury and drive clinical decisionmaking for immediate care. Upon redeployment there are standardized medical assessments which occur twice and are facilitated through the Post Deployment Health Assessment Form DD 2796 and the Post Deployment Health Re Assessment Form DD 2900. All military health care facilities have providers trained in TBI screening with the ability to refer patients to one of the TBI clinics or to the Defense Intrepid Network for TBI and Brain Health for more comprehensive care. As a part of the continuum of care, servicemembers receive ongoing evaluation and treatment by a primary care provider during the annual Periodic Health Assessment, and those individuals reporting a history of TBI (or circumstances suggestive of the possibility) are further assessed for their Service or treatment needs.

55. Senator ERNST. Secretary Martinez-Lopez and Ms. Lee, what can the DOD do to expedite developing a system to monitor blast exposure among servicemembers?

Secretary MARTINEZ-LOPEZ and Ms. LEE. The DOD has multiple efforts underway, the first major step was the Assistant Secretary of Defense for Readiness memorandum (discussed above), published November 4, 2022, “Interim Guidance for Managing Brain Health Risk from Blast Overpressure.” This memorandum provided guidance to implement the following mitigation strategies: (1) minimizing the number of personnel in the vicinity of BOP events; (2) increasing standoff distances from weapons; (3) minimizing the duration of live fire events; (4) establishing a maximum allowable number of rounds that may be fired during each event or time period; (5) ensuring application and appropriate use of personal protective gear and equipment (e.g., hearing protection); and (6) training and educating on blast overpressure hazards and risk management actions.

The Assistant Secretary of Defense for Health Affairs is working with the Military Departments the Assistant Secretary of Defense for Readiness, and DOD’s Public Health and occupational health subject matter experts to develop a dose response curve for BOP (currently this does not exist in either the military or the civilian sector). In parallel, we are seeking supplementary data sources and ammunition distribution logs that might provide blast exposure by weapon system or round with both timing and unit level information. Last, the DHA is leading a BCA on BOP monitoring, with a projected completion of December 2024. The BCA will evaluate various methods for monitoring and documenting BOP exposures, such as recording shot counts, using MOS’s as proxies for blast exposure, surveys and questionnaires through self-reporting, and wearable blast sensors.

56. Senator ERNST. Secretary Martinez-Lopez, Ms. Lee, and Captain Williams, can you detail the current State of brain-computer interface (BCI) technology and how it’s being utilized within the Department of Defense (DOD) to detect, measure, or assist in recovery from traumatic brain injuries (TBIs) among servicemembers?”

Secretary MARTINEZ-LOPEZ, Ms. LEE, and Captain WILLIAMS. The DIN uses Bio and Neurofeedback (NFB) as a form of BCI. BCI represents a body of science focused on the acquisition of brain signals, signal analysis and translation into commands that control an external device to replace or restore useful function to people with neurological/neuromuscular disorders.

In the DIN, utilization of BCI focuses on techniques designed to improve internal brain-body performance by acquiring brain wave information and augmenting brain wave band power through NFB. NFB converts neural signals into visual, auditory, and tactile information, and the subject can selectively enhance or inhibit certain components to promote learning and regulate brain function through real-time NFB training. Studies in the DIN network and in the academic community have demonstrated the ability to enhance performance in memory, concentration, and limb movement. A similar process is used in biofeedback to regulate internal brain-heart coherence, sweat response, respiration rate and skin temperature to modulate the bodies autonomic nervous system. Additionally, NICoE is leveraging MEG technology in research protocols to characterize the complex waveform harmonics of the brain in understanding distortion and patterns in posttraumatic stress disorder. These precision real-time characterizations may provide future strategies for improving treatment of posttraumatic stress and other behavioral health disorders in the setting of traumatic brain injury.

57. Senator ERNST. Secretary Martinez-Lopez, Ms. Lee, and Captain Williams, how is BCI technology being planned for and/or transitioned from various innovation and R&D portfolios across the Department and services to be integrated into operational routines to potentially monitor and measure overall brain health and TBI indicators from the time of entry into service until completion of service for our servicemembers?

Secretary MARTINEZ-LOPEZ, Ms. LEE, and Captain WILLIAMS. The DOD, to include the DIN, does not currently utilize BCI technology for monitoring of overall brain health and TBI indicators during service. We will continue to evaluate findings from our research investments for possible integration where appropriate.

See comment on question 56 above for more information.

58. Senator ERNST. Secretary Martinez-Lopez, Ms. Lee, and Captain Williams, what are the projected priorities, investments, and key developments in the field of BCI technology over the current FYDP and future needs for the Department, specifically as it relates to improved monitoring, data, and improved detection to improve outcomes for servicemembers with TBI?

Secretary MARTINEZ-LOPEZ, Ms. LEE, and Captain WILLIAMS. There are currently no set clinical priorities for BCI technology.

See comment on question 56 above for more information.

59. Senator ERNST. Secretary Martinez-Lopez, Ms. Lee, and Captain Williams, what is the current protocol, cadence, and process for a servicemember to be identified as being at risk for TBI, evaluated, and subsequent followup? Please include associated timelines, general cost per servicemember, and confidence/accuracy of reliable TBI detection at scale.

Secretary MARTINEZ-LOPEZ, Ms. LEE, and Captain WILLIAMS. Comprehensive screening protocols to identify servicemembers being at risk for TBI include assessing for potential risk factors such as history of head injuries, behavioral health conditions, and combat exposure. Cadence of screenings varies depending on factors such as deployment cycles, mission requirements and changes in individual health status. Deployment cycle evaluations include the pre deployment health assessment, the post deployment health assessment and the post deployment health reassessment, which are all opportunities for servicemembers to be identified as being at risk for TBI and evaluated. Throughout all these standardized processes, if a servicemember is identified as being at risk for TBI, then they are referred for further evaluation. There is no monetary cost to the servicemember.

60. Senator ERNST. Secretary Martinez-Lopez, Ms. Lee, and Captain Williams, what congressional support and guidance needs to be provided in order for the Department of Defense to have the necessary authorities and resources to ensure that the personnel and healthcare leadership across each service are able to develop and employ programs that would use BCI technology to monitor, track and mitigate risks such as TBI, costly fatigue/focus mishaps, or other relevant brain health categories?

Secretary MARTINEZ-LOPEZ, Ms. LEE, and Captain WILLIAMS. The Department has the necessary authorities to employ BCI technology to monitor, track, and mitigate risks such as TBI, which would require a prospective longitudinally monitored program to establish a normative data set with neurocognitive testing, blood biomarkers, cerebral vasomotor reactivity measurements and quantitative electroencephalography matched against time in service, and the tracking of various Military Occupational Specialties with different levels of exposure to different weapons systems (including Explosive Ordnance Disposal, Special Warfare Combatant Crewmen personnel, and paratroopers).

See comment on question 56, 57 and 58 above for more information.

TREATMENT APPROACHES

61. Senator ERNST. Ms. Lee, during your tenure at the Warfighter Brain Health Policy Initiative, what non-conventional treatments have been seen to be effective in treating TBI?

Ms. LEE. The Defense Intrepid Network for TBI and Brain Health utilizes many innovative and non-conventional treatments to help relieve symptoms and to optimize functioning and well-being. Many of these treatments are undergoing empirical validation of their effectiveness. Some examples of these treatments include bio-feedback and mindfulness training, acupuncture, therapeutic arts, such as music, writing, art, dance and movement, and animal engagement, such as canine and equine therapy.

62. Senator ERNST. Captain Williams, Intrepid Centers offer specialized treatments focused on treating TBI that are not widely available at other military treatment facilities. Can you describe some of these treatments and their effectiveness in treating TBI?

Captain WILLIAMS. Repetitive TBI operational stressors can result in an overall disruption of brain health characterized by a wide variety of symptoms and conditions. The key to treatment is the establishment of a patient-centric interdisciplinary holistic program, to address the injuries of mind, body, brain, and spirit, to enhance return to duty, and improve interpersonal relationships, and overall functioning.

The DIN uses an interdisciplinary model of care, where the treatment team specialties to treat TBI and associated psychological health conditions are co-located within one facility. The NICoE program leverages the co-localization of 18 disciplines and treatment modalities combine conventional neurological, behavioral health and rehabilitation therapies with integrative medicine interventions and educational modules to promote a culture of healing, self-efficacy, and self-advocacy. This includes creative arts therapies (art therapy, dance movement therapy and music therapy) that provide an essential integrated behavioral health approach, in conjunction with mind-body wellness services, biofeedback, and psychological health services. Integration of this “high touch” to the “high tech” paradigm, includes neuroimaging, neuro-optometry, audiology, vestibular testing, and augmented reality/virtual reality assessment and treatment. NICoE and other DIN sites also teach detailed cognitive strategy and assistive technology training, including the Brain Fitness Center, which uses personal cognitive training programs.

The interdisciplinary team approach expedites diagnostic evaluation and helps achieve a collaborative comprehensive care plan. Studies have shown significant improvement using this model of care in recovery across multiple neurological and behavioral health domains. Since the onset, there are now 13 centers that use this interdisciplinary model for both intensive outpatient programs and extended outpatient programs.

The NICoE intensive outpatient program includes the scheduling of 105–130 separate encounters (varies with individual need) across 4 weeks with the assessment and treatment across 18 disciplines. The clinical program is informed by research conducted at the NICoE and with academic and industry partners. Our research has demonstrated statistically significant and clinically meaningful recovery across seven major domains of functioning.

63. Senator ERNST. Captain Williams, how do we make these treatments more accessible to servicemembers with TBIs?

Captain WILLIAMS. The formalization of the DIN will accelerate the standardization of TBI specialty care across the DHA and increase programs that provide the same high-quality care for our beneficiaries. Our best practices can be utilized by all TBI providers across the military health system.

The establishment of the DIN supports local and regional patient populations, as well as local and regional referring entities. It will allow expansion of services and sharing of resources within the DIN sites via telehealth services. The primary focus will be Active Duty servicemembers who have experienced a TBI, are at greatest risk of TBI injury and blast exposure, or those who may experience sub-concussive events. Formalization of the DIN will also allow for retirees and beneficiaries to access services. The DIN also strives to partner with other Centers of Excellence to continue expansion and accessibility of care.

In addition, the Continuum of Caring, Healing and Thriving Initiative (the Continuum) is intended to facilitate a seamless transition of care by sharing resources for mental health treatment and peer networks at the Department of Veterans Affairs and non-governmental organizations, creating great opportunities for public-private partnerships and to work closer with operational units to prevent, educate and build resilience in the warfighter (aligning with lines of effort of the Warfighter Brain Health Initiative). The Continuum will allow the DIN the opportunity to support servicemembers in their journey long after they have completed treatment, with peer support and case management, and assist them as they transition into civilian life.

64. Senator ERNST. Secretary Martinez-Lopez and Dr. Williams: The legislation responsible for the creation of the National Intrepid Center of Excellence is 15-years old, yet I understand that your program is not a “program of record” for the Department of Defense. Is that accurate, and if so, why is that the case? What are the implications of not being a program of record?

Secretary MARTINEZ-LOPEZ, and Captain WILLIAMS. Yes, the DIN, which includes the NiCoE, is not a program of record. As the TBI facilities have become a network with centralized governance, establishing the DIN as a program of record is the next step.

Activities that are not a program of record do not have a separate allocation of funds for that activity. That means the activity is included in the overall medical facility funding and must compete with other personnel and resource funding priorities. The impact to care can be more consequential at DIN sites where there is a model of care utilizing unique staffing patterns and there may be little capability in the private sector. Presently, the NiCoE, and associated DIN TBI clinics are funded from Defense Health Program dollars for their respective military medical treatment facilities.

65. Senator ERNST. Captain Williams, what recommendations would you make to improve the Department's ability to treat military personnel who, as part of the job, are repeatedly exposed to low-level blasts?

Captain WILLIAMS. Start conducting baseline identification upon entering the military and/or engaging in high-risk Military Occupational Specialties, including neurocognitive testing, and monitoring over time and/or change in functioning. It is also crucial to support early career training on sleep hygiene, dietary/nutritional assessment, exercises that promote autonomic control, and emotional regulation. Behavioral health assessments and treatment following deployment are also important to introduce behavioral health as self-care and teach team member monitoring as part of the culture of peak combat performance. This will help minimize the stigma of prevention and increase resilience.

WARFIGHTER BRAIN HEALTH INITIATIVE

66. Senator ERNST. Secretary Martinez-Lopez and Ms. Lee, in order to assess the operation needs of the Services with regard to the Warfighter Brain Health Initiative, how does the DOD/DHA maintain awareness of the needs and concerns of the operational communities that they support?

Secretary MARTINEZ-LOPEZ and Ms. LEE. DOD governance structures are the primary means by which we maintain awareness of the needs and concerns of the operational community. I, as the Assistant Secretary of Defense for Health Affairs, coordinate through the Under Secretary of Defense for Personnel and Readiness, with the Assistant Secretary of Defense for Readiness and other senior officials within the Office of the Secretary of Defense, to execute requirements related to operational communities. To maintain awareness, DOD leverages the current MHS governance structure, which includes representatives from the Military Departments, and executes operational needs and requirements through the Joint Staff processes and initiatives.

67. Senator ERNST. Secretary Martinez-Lopez and Ms. Lee, how are the military department's priorities communicated to the DHA Commander and staff and likewise, what is the mechanism for DHA to engage with senior operational leaders providing updates on the evolving science impacting the Military Department's personnel health and readiness?

Secretary MARTINEZ-LOPEZ and Ms. LEE. Refer to question 66 above for the same mechanism to communicate the Departments priorities.

68. Senator ERNST. Secretary Martinez-Lopez and Ms. Lee, who in DHA has the responsibility for drafting the requirement/Capabilities Development Document for the blast dosimeter program? Has this process already started? What is the status of the program?

Secretary MARTINEZ-LOPEZ and Ms. LEE. A blast dosimeter program has not been developed. The DHA J5 (Strategy, Plans and Policy) is responsible for drafting requirements documents. Currently the MHS has published Initial Capabilities Documents addressing research solutions for WBH, combat casualty care and military operational medicine, which will support the development of Capabilities Development Documents for a blast dosimeter program.

QUESTIONS SUBMITTED BY SENATOR DAN SULLIVAN

MARINE ARTILLERYMEN TBIS IN SYRIA

69. Senator SULLIVAN. Secretary Martinez-Lopez and Ms. Lee, in large scale combat operations against a peer adversary, artillerymen are going to fire thousands

of rounds. Can you tell me what the DOD is doing to ensure the experience of the marines who were deployed to Syria in 2016 and 2017, as reported in the New York Times article from November 5, 2023 titled “A Secret War, Strange New Wounds, and Silence from the Pentagon,” is not repeated?

Secretary MARTINEZ-LOPEZ and Ms. LEE. In response to recent casualty events in Syria, the Department reviewed its procedures in place for the reporting of potentially concussive events (PCE) and its management of TBI. It is important to acknowledge that our understanding and focus on brain injury and pivot to WBH is evolving. Before WBH our medical and policy practices included exposures to PCEs but remained focused on TBI by traditional definitions. In the standing up of the WBH program we are acknowledging the relationship between “sub-concussive” BOP and symptoms and seeking to expand our screening, treatment, and followup. Accordingly, the DOD’s review included an in-depth look at TBI related documentation, screening, diagnosis, treatment, follow-on care, and reporting as prescribed in DOD policy. The review also provided insight into the mild TBI (mTBI) rates resultant from a drone attack on a forward operating base, which represents an emerging threat to the Joint Force. Early detection and treatment for mTBI remains essential to maximizing patient outcomes and ensuring the prompt and safe return of our warfighters to duty. The Department will continue to review our processes and procedures as part of policy oversight and compliance functions.

TBI PREVENTION & TREATMENT

70. Senator SULLIVAN. Secretary Martinez-Lopez and Ms. Lee, how is the DOD’s approach to TBI prevention changing as new data is gathered?

Secretary MARTINEZ-LOPEZ and Ms. LEE. The biggest shift is one from a TBI centric approach to a more holistic approach to WBH. As insights grew from research investments and the experiences of military providers caring for servicemembers with TBI in combat and the home front, the DOD developed novel treatment paradigms and policy to maximize utilization across the force. By 2018, military leaders began to explore the hypothesis that BOP exposures could result in brain health changes similar to those seen with diagnosed concussions. Also in 2018, the Deputy Secretary of Defense directed the development of a comprehensive strategy and action plan to promote brain health and counter TBI. The DOD’s WBHI is a joint effort between operational and medical forces. The focus is to optimize WBH, specifically cognitive and physical performance, identify known and emerging brain threats in military environments, and detect brain injury immediately when it occurs to combat its effects on warfighters, their families, first line leaders/commanders, and their communities at large. As part of our responsibility to our Nation and the troops defending it, DOD wants to reduce the risks of exposure to known and emerging brain threats, such as BOP, head impact, and directed energy. Our commitment is to understand, prevent, accurately diagnose, and promptly treat BOP and effects in all its forms in all operating environments. This means that we are committed to understanding, through our research investments and field experiences, the role that BOP exposures plays in sustaining TBIs. In support of these policy initiatives, we continue to focus on how to disseminate best practices, new research findings and resources about WBH. The WBH Hub, established in December 2023, at health.mil/brain, serves as the single source of information on brain health topics. Our goal is to make the latest brain health information easy to access for our servicemembers, providers, families, and the public and service as a bridge from our clinical community to the operational environment. These linkages are critical for TBI prevention efforts.

71. Senator SULLIVAN. Secretary Martinez-Lopez and Ms. Lee, how is the DOD’s approach to TBI treatment changing as new data is gathered?

Secretary MARTINEZ-LOPEZ and Ms. LEE. Through the DHA’s Acute Concussion Care Pathway, the Department has been able to direct the usage of State of the science tools that are improved and updated as new data is gathered. This care pathway, tailored to each servicemember, was established with the goal of improving recovery times and outcomes by utilizing the MACE 2 to ensure brain health deficits were identified even if only detectable in a subset of clinical domains. These tools also help ensure timely access to repeat evaluations with personalized treatment protocols that are demonstrated to accelerate injury recovery through individualized progressive return to activity processes. This pathway resulted in the clinical screening of approximately 20,000 first time TBI diagnosed servicemembers across the Military Services in fiscal year 2023.

As discussed above, the MACE 2 is an acute assessment tool for all medically trained personnel who treat servicemembers involved in a potentially concussive

event. This tool incorporates current state-of-the-science TBI assessment, including balance, eye movements and cognitive screening. This clinical advance was driven by the DOD, first through research to clarify what was needed, and then through early adoption. The DOD is currently preparing a shortened version of the MACE 2 based on feedback from medical staff utilization in combat that will enable more rapid screening. As noted, the MACE 2 supports the PRA protocol that has demonstrated accelerated recovery through individualized treatment. The tool was updated in January 2023 with new data that had been gathered. Additionally, the DHA also coordinates with our research community through formal review and analysis meetings to evaluate research findings that can be translated into practices and tools to help improve treatment options available to those with TBI.

72. Senator SULLIVAN. Secretary Martinez-Lopez and Ms. Lee, are DOD medical personnel appropriately trained and equipped to identify and diagnose TBIs?

Secretary MARTINEZ-LOPEZ and Ms. LEE. Yes, DOD medical personnel are trained to identify and diagnose TBIs. Training content and platforms are evolving as clinical translation opportunities arise from research findings. Additionally, the Department continues to provide opportunities for awareness and training for providers, most recently through the release of the WBH hub at www.health.mil/brain. Military Services issue TBI diagnostic equipment based on roles of care and individual Service mission requirements.

73. Senator SULLIVAN. Secretary Martinez-Lopez and Ms. Lee, can you describe the various echelons of care under which a servicemember is initially exposed to a blast (say like the many recently injured by drove and rocket attacks in Syria and Iraq), assessed, diagnosed with a TBI, and then treated?

Secretary MARTINEZ-LOPEZ and Ms. LEE. The military's medical system is organized into several echelons of care, often referred to as "Roles of Care." These roles outline the different levels of medical support available to military personnel depending on their location, the severity of their injuries, and the resources available. While specific terminology and organization may vary between different Military Departments, a typical framework includes the following:

- Role 1 (Unit-Level Medical Care) medical personnel provide primary health care, tactical combat casualty care, triage, resuscitation, walking blood bank, and stabilization. Initial management of TBI care begins at point of injury, where medical personnel are trained in evaluation, treatment, management, and evacuation of patients diagnosed with mild, moderate, to severe TBIs.
- Role 2 (Forward Trauma Management and Emergency Medical Treatment). Role 2 medical personnel provide reassessments of TBI patients further trauma management and emergency medical treatment, including continuation of resuscitation started in Role 1.
- Role 3 (Theater Hospitalization). In Role 3, the patient is treated in a MTF staffed and equipped to provide care to all categories of patients, to include resuscitation, initial wound surgery, and postoperative treatment. TBI patients receive comprehensive care including advanced diagnostics, surgical interventions, critical care, medication management, and early rehabilitation services ensuring thorough treatment and stabilization. These facilities provide both immediate and ongoing medical support to manage brain injuries and associated complications.
- Role 4 Care (Definitive Care). Role 4 medical care is found in US-based hospitals and robust overseas MTFs. Role 4 represents the highest level of definitive medical care available within the MHS or the United States. These facilities provide specialized treatment for servicemembers who suffered a TBI, including advanced medical and surgical care, intensive rehabilitation services (physical, occupational, and speech therapy) long-term neurological and psychological support, and continuous monitoring to facilitate recovery and reintegration.

The events in Syria triggered a medical screening for concussion using the MACE 2. Providers are trained to conduct this assessment at all Roles of care, although, based on operational requirements, this may be deferred to a higher role of care.

As discussed above, the MACE 2 is multimodal in that it captures assessment information from many health care areas such as balance, eye movements, cognition, report of symptoms and key past medical history that can prolong the recovery from a concussion. Acute TBI care is provided throughout the Roles of care with checkups to ensure recovery. There are standardized tools, such as the PRA protocol, that outline state-of-the-art treatments as well as how to return servicemembers to duty and full function. The PRA specifically allows clinicians to follow recovery of symptoms identified in the MACE 2 and offer treatment tailored to a servicemember's specific

deficits (e.g., symptoms). There are also programs in place to screen for mild TBI and offer followup care during redeployment.

If recovery does not occur as expected, the DOD has a wide range of clinical services to assist with more in-depth care. DOD has specialty clinical and comprehensive interdisciplinary centers of excellence for TBI and brain health. These programs have been developed to deliver a holistic patient centered interdisciplinary TBI model of care. Behavioral health services can include psychiatry, psychology, and social work. Additional services may include neurology, sleep medicine, pain management, and rehabilitation services such as balance and vision therapy. These centers of excellence also offer innovative treatments such as creative arts therapies, animal-assisted therapies, and mind-body wellness services.

74. Senator SULLIVAN. Secretary Martinez-Lopez, are there standardized TBI screenings that are part of pre and post-deployment medical examinations?

Secretary MARTINEZ-LOPEZ. Yes. As a part of the continuum of care, servicemembers receive ongoing TBI screenings and evaluation by a primary care provider during the annual Periodic Health Assessment, and those individuals reporting a history of TBI (or circumstances suggestive of the possibility) are further assessed for treatment needs. Historically, the focus in medical assessments after deployment has been exposures, including blast related exposures, and symptom based, with the latter typically driving the need for further assessments or treatment. Standardized medical assessments occur twice after deployment and are facilitated through the Post Deployment Health Assessment Form DD 2796 and the Post Deployment Health Re Assessment Form DD 2900. All MTFs have providers trained in TBI screening with the ability to refer patients to one of the TBI clinics or the Defense Intrepid Network for TBI and Brain Health for more comprehensive care.

75. Senator SULLIVAN. Secretary Martinez-Lopez and Captain Williams, since TBI injuries can present differently and at various times post-injury, at what time intervals post-deployment/post-exercise do servicemembers undergo TBI screening?

Secretary MARTINEZ-LOPEZ, and Captain WILLIAMS. Post deployment health assessments occur twice; 30 days before or after redeployment and then 90 to 180 days after redeployment. TBI screening occurs during those times.

76. Senator SULLIVAN. Secretary Martinez-Lopez, Ms. Lee, and Captain Williams, has DOD compiled blast data from its inventory of weapon systems to determine TBI risk based on system and duration of exposure?

Secretary MARTINEZ-LOPEZ, Captain WILLIAMS and Ms. LEE. The Office of the Under Secretary of Defense for Acquisition and Sustainment (OUSD(A&S)) is responsible for the acquisition policies. DOD Components are responsible to evaluate environment, safety and occupational health risks in the weapons systems acquisition processes in accordance with the guidance contained in Military Standard (MIL STD) 882E³.

77. Senator SULLIVAN. Secretary Martinez-Lopez, Ms. Lee, and Captain Williams, which office in the DOD is responsible for assessing TBI risk from individual weapon system operation?

Secretary MARTINEZ-LOPEZ, Captain WILLIAMS and Ms. LEE. The Office of the Under Secretary of Defense for Acquisition and Sustainment (OUSD(A&S)) is responsible for the acquisition policies. DOD Components are responsible to evaluate environment, safety and occupational health risks in the weapons systems acquisition processes in accordance with the guidance contained in Military Standard (MIL STD) 882E3.

78. Senator SULLIVAN. Secretary Martinez-Lopez, Ms. Lee, and Captain Williams, are weapon manufacturers required to provide blast overpressure data to the DOD?

Secretary MARTINEZ-LOPEZ, Captain WILLIAMS and Ms. LEE. My office is not aware of any manufacturer requirements to provide BOP data to the Component capability developer or program managers (PMs) nor of any refusal to provide requested environmental, safety, or occupational health (ESOH) data.

³Department of Defense Standard Practice, System Safety, MIL-STD-882E, September 27, 2023

79. Senator SULLIVAN. Secretary Martinez-Lopez, Ms. Lee, and Captain Williams, have any weapon manufacturers been asked to provide blast overpressure data to the DOD and refused?

Secretary MARTINEZ-LOPEZ, Captain WILLIAMS and Ms. LEE. My office is not aware of any manufacturer requirements to provide BOP data to the Component capability developer or program managers, nor of any refusal to provide requested ESOH data.

TBI INJURY TRACKING & DATA BASES

80. Senator SULLIVAN. Secretary Martinez-Lopez and Ms. Lee, do tracking mechanisms or medical data bases exist for TBI baselines and injury assessments, much like they do for hearing audiograms, which stay with servicemembers their full career and get transferred to the VA once they exit the military?

Secretary MARTINEZ-LOPEZ and Ms. LEE. Currently there is no tool used to establish a traumatic brain injury baseline and the current tracking mechanisms that exist for TBI baselines and injury assessments are not similar to hearing audiograms. However, there is a data repository for baseline neurocognitive assessments. Currently, the baseline neurocognitive assessments do not get automatically transferred to the VA when a military member separates or retires. The VA does have access to the neurocognitive assessments upon initiation by a VA clinician to request the results.

