Occupational Medicine at Johnson Space Center:
An Interview with Dr. William Tarver

by Thomas Luna, MD, MPH

NASA’s Johnson Space Center (JSC) is responsible for astronaut training and research. I had the opportunity to interview their sole occupational medicine specialist, William Tarver, MD, MPH, at the Aerospace Medical Association Annual Scientific Meeting in Dallas, TX, in May 2018. He also specializes in aerospace medicine and works closely with other aerospace medicine specialists at JSC. This is a truncated summary of our conversation.

What are some of the more unique aspects of your occupational medicine practice at JSC?

We have crane operators, but the more unique aspects of our practice probably lie with our test/research operations. We have volunteer subjects who test equipment, such as space suits. We expose them to various environmental conditions – such as vacuum conditions. Depending on their expected exposure, we have to tailor how we screen and monitor them. They all get a basic screening physical exam; whatever medical conditions we find have to be compared with the expected exposure risks of the intended study. We do a lot of work (Continued on page 2)

Ron and Jay’s Truck Stop, or Go?
The Elder Driver and DOT’s New Program for the Insulin Treated Driver

By Drs. Ron Blum and Jay Poliner

To all our Commercial Driver Medical Examiners … this column is for YOU! Have an interesting question or problem case to share in a future newsletter? Do you have any other thoughts or opinions about these cases presented in this article? Send them to Newsletter Editor: Susan Upaham, MD, MPH, FACOEM at supham@roadrunner.com.

Case 1: “The Elder Driver” A Medical Examiner wanted our thoughts on the following case. “We are seeing more and more drivers in their late 60s and into their 70s. I recently examined for recertification a 75-year-old commercial driver. The driver’s medical certificate expires in 2 months.

The driver answered all “Driver Health History” questions as “No” and a “review of systems” was negative. The driver appeared younger than his stated age.

The driver was a non-smoker, did not drink alcoholic beverages, and did not have routine medical exams except for interval CDL recertification exams. Vital signs included a blood pressure of 152/92 with a Body Mass Index of 25.7. There were no physical examination abnormalities.”

Truck Stop Thoughts: Federal Motor Carrier Safety Regulations and guidance from FMCSA do not address age as a risk factor for commercial driver safety concerns. The FMCSA-certified Medical Examiner is responsible for the medical qualification decision.

What would be your qualification decision? (Continued on page 6)
involving environmental pressure changes – whether they are divers under 40 feet of water for extended time periods or they are in a vacuum chamber. In many cases, we are testing the suit or other pieces of equipment, not the individual, but the individual needs to be in the suit. In the vacuum chamber, the “altitude” the individual is exposed to inside the suit is about 35,000 ft, while breathing 100% oxygen. Future suits will maintain higher pressure (lower altitude equivalent).

The Neutral Buoyancy Lab (NBL) itself is pretty unique. It is a huge pool, 40 feet deep. Spacewalk simulations and other activities take place underwater in the NBL. We screen, monitor and care for a team of divers. The divers monitor and assist the astronauts, engineers and other personnel who are in the water. We use a lower nitrogen and higher oxygen breathing concentration to minimize risk for decompression sickness (DCS – the “bends”). With this, the divers can be underwater for 6 hours without significant risk for decompression sickness. Those in the space suits, similarly, breathe the same gas mix and can stay down for 6 hours easily. They do not do any prebreathing. This work is more of a musculoskeletal challenge for the suited subjects than a DCS challenge. We have enough divers that they usually are able to swap out well before 6 hours, but those in the space suits are usually down for 6 hours.

The suited subjects are usually astronauts, but they can also be engineers and others who are testing various things. This is where they practice specific tasks and is an analogue for work tasks on the space station. Space walks are easier in space. There is no resistance from water to move through, and in space you float weightlessly within the suit. Underwater, you still have gravity pulling you down in the suit; when you go upside down, you feel like you are upside down. In space there is no upside down. So, in space it is easier to operate the suit. In the NBL, the astronauts get many hours of training for any one hour planned in space. So, one of the greatest risks is musculoskeletal strain or injury from moving in that suit for many hours underwater.

**Do you do any special monitoring of those working in the NBL?**

We work to find injury before injury happens. Shoulder injuries are a big problem in the space suit. We also see some things that may seem more unique. I have not seen it reported elsewhere in the diving world, but we sometimes see delamination of the fingernails of those who work underwater in the space suits. The nail is not pulling off the nail bed, it is actually delaminating – splitting into layers. It appears to come from the friction of working within the glove. We have them paint their nails with a nail hardener to help prevent the delamination, but they cannot do that in space due to the off-gassing associated with use of that product. My astronauts who have had this problem in the NBL do not appear to have had it in space – but their exposure in space is much less. They have few/in frequent spacewalks. But the mechanical pressures on their fingers may be the same, whether in the NBL or in space.

**Tell us a little about your medical concerns and approach with the astronauts.**

First, we have a very robust medical presence here at JSC because this is where the astronauts are, and astronauts are workers who have very unique environmental exposures. All the medical expertise for working with these very unique exposures basically lies here at JSC. So, our occupational medicine is robust. They work in a vacuum and in microgravity. You can’t experience microgravity anywhere on the planet, other than 20 seconds in parabolic flight in special aircraft [referred to as the “vomit comet”]. For chronic zero G microgravity you have to get off the planet and into space. So, we are limited to a very, very, small pool of subjects (astronauts) to learn from.

Another unique exposure is radiation. On the International Space Station (ISS), they are outside the protection of the earth’s atmosphere but still within the earth’s magnetosphere. So, they get a different level and proportion of radiation exposure. We monitor them with personal dosimeters and we have special equipment on the ISS to monitor the different types of radiation exposure – whether galactic cosmic radiation or radiation coming from the sun. That cannot be re-created on the ground. All we can do is monitor them and see what happens. There are no countermeasures for the radiation other than very thin shielding, which is an engineering limitation. The moon is outside the magnetosphere, so if we go back there, the radiation exposures will be much higher. If you go to the moon and come back to earth you receive about a year’s worth of terrestrial radiation exposure - if there is no significant spike in solar radiation exposure. Galactic cosmic radiation is a big concern outside the magnetosphere. It is difficult to shield against, but it is fairly constant. Solar radiation is easier to shield against but is much more variable, depending on activities of the sun – solar storms and such. We have satellite sensors around the sun to monitor that. In our history, when we flew to the moon we got real lucky because right after we came back there was a major solar event. If we had still been on the moon, our astronauts would likely have had acute radiation sickness or worse. It was just a matter of days. We were pretty lucky! Our limitations on protecting our astronauts from radiation right now are mainly engineering in nature.

Another unique aspect is our lifetime medical surveillance of astronauts. After they leave NASA, we invite them back every year to get a physical. We bring them back from wherever they are living, but we aren’t their primary physicians after they leave. We do this because we don’t know everything their unique exposures might cause – like various forms of cancer. We also monitor for bone health. In space their bones remodel. We have active countermeasures to address this. In space they exercise strenuously 2 hours/day to preserve their cardiovascular fitness, their skeletal muscles, and their bone. In space, they don’t have to fight gravity and moving is ridiculously easy, but they must “use it or lose it”. They strap themselves down to a treadmill, they do resistance exercise and they use a stationary bike – though they don’t really need a seat on the bike. The resistance training provides stressors to the bone to help maintain bone strength. We use DEXA scans for lifetime surveillance of both male and female astronauts to try to gauge their bone health, but that really does not get to quality of bone. That’s another unknown to figure out.

Our astronauts also work and live in a high CO2 environment because there is a huge engineering cost in weight and energy to remove CO2 from the cabin atmosphere. Much of the electrical power from the huge solar arrays on the ISS goes to remove it. Still, the level is about 10x higher than on earth - but it is half of what it used to be. Elevated CO2 acts as a cerebrovascular dilator. We wonder if astronauts’ intracranial pressure increases. We’ve seen flattened eyeballs on MRI when they come back, and on earth you see similar eyeball flattening in people with elevated intracranial pressure. So, we’ve reduced the CO2 by half, but it is still 10x normal levels. A new system – called an Amine swingbed – is being tested to reduce it, but it won’t be used on the ISS. It will most likely be used on our new spacecraft: Orion. Orion is being designed for deep space exploration. It is being designed to have lower CO2 levels than any spacecraft we have used in the past, but it still will not be earth normal.

(Continued on page 6)
ARE YOU READY FOR THE FUTURE?  The 2018 NECOEM / MaAOHN Annual Conference  
Thursday, Nov 29 and Friday Nov 30, 2018

What do technology and occupational health, disaster preparedness, telemedicine, and protecting health information in a digital world have in common? These topics are among the many educational OPPORTUNITIES that will be available during the 2018 NECOEM/MaAOHN Annual Conference (AC) titled “THE FUTURE IS NOW: Challenges and Opportunities.” The AC will be held on Thursday, Nov 29 and Friday Nov 30, 2018 at the Boston Newton Marriott Hotel in Newton, MA. The Annual Conference announcement flyer (posted on the NECOEM website or in a flyer buried in your email Inbox) includes all the details of conference offerings and registration information.

The AC Planning Committee, which includes members from both NECOEM and MaAOHN, is pleased to announce this year’s special presentations:

HARRIET HARDY AWARD: John Howard, MD, MPH, JD, MBA, Director of the National Institute of Occupational Safety and Health (NIOSH), is this year’s Harriet Hardy award recipient. His presentation “Technology and Occupational Health” will draw on Dr. Howard’s experience leading NIOSH in a challenging time of changing technology and occupational health issues.

PATTERSON MEMORIAL LECTURE: Alfred DeMaria, MD, Chief Epidemiologist, Commonwealth of Massachusetts Department of Public Health, will deliver the Patterson Memorial Lecture. Dr. DeMaria’s presentation, “Public Health, Occupational Health and Infectious Diseases,” draws on his years of experience as a leader in dealing with the impact of infectious disease on occupational and public health.

DISASTER PREPAREDNESS: Dr. Tom Luna will serve as moderator for several presentations dealing with disaster preparedness and response, including nuclear and radiation safety, chemical and biological terrorism, and acute poisoning emergencies.

CURRENT AND FUTURE USE OF TELEMEDICINE: Dr. David Berube will serve as moderator for one of the “Tracks” discussing present and future uses of telemedicine, with a guest speaker, Dr. Charles Pollack from Thomas Jefferson University in Philadelphia. Eileen Holihan, RN, MPH, COHN and Curtis Smith from Medcor will offer a perspective on their current use of telemedicine.

CLINICAL AND NON-CLINICAL ISSUES IN OEM: Among the conference presentations will be discussions of hip, knee, and spine injuries and treatment, as well the role of Physiatry and Magnetic Resonance Imaging (MRI) for spine problems. There will be “Track” presentations on non-medical issues with supervisors, mental health disabilities, protecting health information confidentiality, and the perennial favorite – the DOT/NRMCE update.

SPECIAL OPTIONAL PRE-CONFERENCE WORKSHOP: Finally, on Wednesday, Nov 28 from 6:00-9:00PM there will be a special optional workshop “Upper Extremity Musculoskeletal Exam Course – Hands on Practicum” at the Marriott. Organized by NECOEM members Drs. Karen Huyck and Robert Timmons from Dartmouth-Hitchcock, this pre-conference workshop is in response to member requests for additional training in physical examination of musculoskeletal injuries.

The Annual Conference is a great opportunity to network with colleagues while earning CME, CCM, and/or ABIH continuing education credits. Enjoy the Thursday evening President’s Dinner Reception with great company, great food, and informative posters. Check out the vendor exhibits, and enjoy early holiday festivities. Don’t miss this great conference! Register today and take advantage of the EARLY BIRD conference registration discount before October 31. And don’t forget to make your reservation at the Marriott! See you at the AC!

NECOEM and MaAOHN welcome posters from residents and all students (scholarships available). These are exhibited during the President’s Reception of the Annual Conference. Visit www.necoem.org for details.
NAME THE SOLVENT (CHEMICAL) that is used in the production of a textile fiber. This fiber was the oldest manufactured fiber.

The images below show processes used in the years gone by:

These pictures show examples of end products made using this fiber:
Process diagrams in the manufacture of the fiber show the typical processes. The solvent (chemical) enters the process at some of the entry points shown:

Among the clinical effects associated with exposure, this photograph depicts a well-known associated effect:

Please send responses to Abhijay Karandikar, MD, at dr_abhik@yahoo.com. Readers who send in correct responses will be identified in the next issue. The correct answer will be published in the next issue of the NECOEM Reporter.

“What Is It” features a series of trivia, facts, figures, etc. related to the field of occupational medicine. If you have any such interesting or fun-filled material, please e-mail it to the associate editor at dr_abhik@yahoo.com. All material should be related to the specialty of occupational and environmental medicine and have an educational, inspirational, historic or other relevant value.
1. Certify for one year due to blood pressure reading?
2. Certify for three months and require that the driver return after blood pressure monitoring under the guidance of a primary care provider?
3. Order additional tests to determine presence or risk of diabetes (for example, Hemoglobin A1C)?
4. Place the driver in “Determination Pending” status until the driver returns with the results of a physical examination by a PCP?
5. None of the above!

Send your opinion to our Newsletter Editor Susan Upham (supham@roadrunner.com) – a tally of the responses will be reviewed in our next REPORTER “Stop or Go?” article.

Case 2: “New program for drivers with Insulin Treated DM (ITDM)?” A Medical Examiner wrote: “Our practice manager had a call from a logging truck owner/operator “way up North” whose diabetes mellitus type II hasn’t been well-controlled with oral agents. His healthcare provider has discussed starting him on insulin therapy, but then he is concerned that he would no longer be able to drive his 18-wheel rig in interstate commerce.

He read somewhere about exemptions for drivers with insulin-treated diabetes mellitus (ITDM), but there isn’t a local endocrinologist that can help him get and keep an exemption. The driver read in a magazine at a truck stop that there may be a new program for ITDM drivers. Is that true, and if so, how is it different from the current program?”

Truck Stop Thoughts: Yes, the Federal Motor Carrier Safety Administration (FMCSA) recently announced a change for ITDM drivers, effective Nov 19, 2018. Previously, interstate commercial drivers with ITDM were prohibited from driving commercial motor vehicles unless they obtained an exemption directly from FMCSA in Washington DC. This involved providing information from an endocrinologist about proper control of diabetes.

The rule revising federal regulations about ITDM enables a certified medical examiner to grant an ITDM driver a Medical Examiner’s Certificate for up to 12 months. The treating clinician who manages, and prescribes insulin provides the new ITDM Assessment Form (MCSA-5870, not yet available) to the certified ME indicating that the individual maintains a stable insulin regimen and proper control of his or her diabetes. The certified ME is then responsible for determining if the individual meets FMCSA’s physical qualification standards and can operate CMVs in interstate commerce.

The final rule will eliminate the exemption program that currently requires individuals with ITDM to incur recurring costs to renew and maintain their exemptions.

Additional information can be found at: https://www.federalregister.gov/documents/2018/09/19/2018-20161/qualifications-of-drivers-diabetes-standar. We encourage all MEs to read this rule carefully!

Come to the 2018 NECOEM / MaAOHN Annual Conference, Nov 29-30, 2018 and join us at the “DOT Update”

(Continued from page 2)

You are on the working group for spaceflight associated neuro-ocular syndrome (SANS). Tell us a bit about that.

That is the eyeball flattening that I mentioned. We also see choroidal folds. In some astronauts, we see papilledema. When astronauts primarily went on short missions they sometimes said their vision got a little blurry – like presbyopia - so we gave them reading glasses. It was infrequent, so it was not an obvious problem. It all resolved when they got back to earth. It affected about 25% of the shuttle astronauts. Now, with much longer mission durations on the ISS, about 50% have a hyperopic shift and need some vision correction – and when they come back it may persist. About 4 out of 60 have persisting hyperopic shift on return and still need glasses. We also see a thickening of the light receptors in the back of the eye. So, we are now doing routine occupational monitoring for SANS with our astronauts. We use 3 and even 7 Tesla MRIs to get ultrafine detail of the eye and brain. That has to be done on the ground. We do ultrasounds of the eyes. On the ISS we have ultrasound, so we train the astronauts to use it for monitoring. They do it on themselves, while being monitored on the ground; a fellow astronaut assists by pressing the button to capture the image when directed from ground control. We also do the ultrasounds pre and post-mission. We do optical coherence tomography (OCT) and high definition fundoscopy on the ISS, as well as pre and post-mission. During a 6-month mission, we get three tests during the mission, while in orbit. This helps us get a longitudinal look. Some have come back with optic disk edema – and disk edema is always pathologic. That’s what really kicked off all this concern. So, now we have a lot of screening in place and we’re beginning to get a more longitudinal view, so it is more exciting from an occupational medicine perspective to try to determine how to counter the risk. Our biggest limitation is probably our very limited number of subjects. We only send up one astronaut every three months, so it is a very slow process. Our “N” is actually up to about 40 or 50 or so by now. Only some of those with vision shifts have disk edema. Many of the astronauts who had disk edema got lumbar punctures when they got back. The pressures were elevated. All were between 20 and 28 cm of water. They were all male. None had headaches. All they had was the vision shift. Lumbar punctures cannot be done in space. Then the question comes up, “what was the pressure before they flew?”; so longitudinally you would like to get LPs. But nobody does a lumbar puncture occupation screening program. We’ve looked everywhere, and the answer is always an emphatic “No!” Also, you don’t repeat an LP. That is only done if clinically indicated. There always is some risk with an LP and nobody likes the idea of having a needle stuck in their back. So, our LP data is very limited – and almost always limited to a single LP. We cannot develop population-based LP information for astronauts; we cannot extrapolate.
A report on occupational illness in Connecticut, which looks at data from physician reports, workers’ compensation claims, and the OSHA survey of employers, shows that there were an estimated 31,000 illnesses in 2016, with most going un-reported. This document was prepared by Tim Morse, Ph.D., CPE, and Professor Emeritus at UConn Health for the Connecticut Workers’ Compensation Commission and has been published annually for over 20 years, revealing long term trends. It is part of the occupational disease surveillance system in Connecticut which is a cooperative effort of the Commission, CT Dept. of Public Health, Conn-OSHA, and the Occupational Health Clinics Network. The report focuses on chronic occupational illnesses rather than acute traumatic injuries, and its intention is to get a better understanding of conditions that are frequently not recognized nor reported. The physician reports are used by the Dept. of Public Health to target outreach and investigations into clusters of illnesses as well as to help focus broader prevention efforts.

The laws that established the network require that all physicians report occupational illnesses, but in practice only a very small number actually report, primarily from occupational health clinics and employer clinics. In 2016, 108 physicians from 16 clinics (at 23 locations) reported at least one case to the Dept. of Public Health, but only 29 physicians reported 20 or more cases, which accounted for 86% of the physician reports.

In 2016, there were a total of 3,017 physician reports, 5,454 workers’ compensation first reports of injury, and 2,300 cases based on the OSHA survey. Linking the physician and workers’ compensation reports revealed 7,675 unique reports (with only 466 cases being reported to both systems). This produced an estimate of 31,500 reports using a statistical methodology called “capture-recapture analysis” which estimates non-reported cases. This means that less than 10% of cases were reported by physicians.

Physicians reported 1,513 infectious diseases (including bloodborne exposures from needlesticks, fluids, and bites), 633 chronic musculoskeletal conditions (including epicondylitis, tendonitis, and carpal tunnel syndrome), 330 adult lead poisoning cases (based on laboratory data), 158 skin conditions (including dermatitis and poison ivy), 133 lung conditions or poisonings (including respiratory conditions from chemical exposures and occupational asthma), 12 hearing loss cases, and 238 other occupational illnesses.

Under-reporting and administrative changes in reporting can make interpretation of trends difficult, but the figure below shows the trends by systems from 1997-2016. In general, the BLS/OSHA survey shows steady declines, Workers’ Compensation slightly declined since 2007, and physician reports increased from 2010 to 2014 then dropped slightly.

It also details reports by industry and town. Based on workers’ compensation reports, approximately 35% were government, 16% manufacturing, and 14% both education/health and trade, although industry varied by type of illness. The full report can be seen at https://health.uconn.edu/occupational-environmental/wp-content/uploads/sites/25/2018/08/occupational_disease_report_2018.pdf.

Dr. Morse may be reached at tmorse@uchc.edu

**Trends by Systems from 1997 – 2016**

Interpretation: BLS/OSHA survey shows steady declines, Workers’ Compensation slightly declined since 2007, and OIIS physician reports increased from 2010 to 2014 then dropped slightly.
October 4, 2018 Meetup: Focus on Mindfulness for Wellbeing

By Dr. Dupe Adewunmi MD, MPH

The October 4, 2018 NECOEM “meetup” provided me with an opportunity to meet some members of our local occupational medicine family. Academic meetings have helped me grow in my sense of pride and confidence in occupational medicine. They have served as forums for keeping abreast of standards, new developments and best practices in occupational medicine.

This meetup was a less formal yet structured gathering which included dinner, socializing as well as an interactive lecture presentation on “Mindfulness”. Three components of “Mindfulness” were discussed: 1) Concentration - being able to focus on something, 2) Sensory clarity - being able to understand and identify one’s emotions, 3) Equanimity - accepting and being composed about one’s current situation. I went home with a gratifying feeling of belonging!

MeetUps are held every few months at locations around New England. Meant for NECOEM members and others to get together, the dinner ‘meet-up’ is convenient to more members across New England and supported with a video link that enables all of us to get together virtually at the same time.