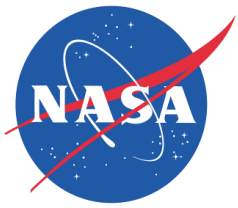
National Aeronautics and Space Administration



THE LIFETIME SURVEILLANCE OF ASTRONAUT HEALTH

Newsletter

June 2022 Volume 27, Issue 1

Editor's Note: This volume of the Newsletter discusses the Johnson Space Center Clinic (JSC) ***restarting in-person Lifetime Surveillance of Astronaut Health (LSAH) Formers Examinations*** *after being on hold due to COVID-19 as well as introducing a forthcoming option for LSAH Virtual Surveillance. JSC welcomes* ***three new members of the JSC Clinic*** *who will be heavily involved in Formers Exams. Finally, from the LSAH team, the newsletter talks about how your* ***health data is utilized through the IMPALA platform*** *for research such as the* ***SANS Maturation Project****, and building the* ***LSAH Evidence Base to understand prostate cancer trends*** *in the astronaut corps compared to other comparison cohorts.*

LSAH Formers Examinations – Update May 2022

Dr. Joseph (Tim) LaVan, MD, MPH, Johnson Space Center Medical Director

As everyone is aware, the Lifetime Surveillance of Astronaut Health (LSAH) annual exams have been on hold for more than two years due to COVID-19 risks and travel limitations. This stand down has resulted in an unprecedented loss of long-term health data on our former astronauts, limiting NASA's ability to monitor long term health and determine impacts to our current and future crewed space missions. We are now pleased to announce that our LSAH program has returned to pre-pandemic operations and will include a new virtual option to better serve our former astronauts.

By now, you should have received information from the JSC Clinic with some additional details regarding policies surrounding LSAH Formers Exams. If you haven't received this, or if you have any questions, please contact us so we can assist you.

As a reminder, the LSAH evaluations consist of the routine medical exam as well as the behavioral health component. Dr. Chip Dukes and others from our Behavioral Health team will be offering this service (Dr. Dukes also recently joined the NASA team and is taking over Dr. Pulido's duties). These behavioral health visits are offered as an opportunity for a behavioral health and wellness check-up to enhance your quality of life. They are not solely for behavioral health problems or concerns. We will be adding cognitive health assessments to complement these sessions for greater data return into the LSAH dataset and improving NASA's understanding of all aspects of long-term health of our astronauts. For those of you who have seen Dr. Pulido in the past, either in person or by tele-health, we encourage you to follow up with Dr. Dukes.

Over the next few months, our goal is to schedule all former astronauts whose birthdays fall between June and December following our typical birth month scheduling. Once those former astronauts are scheduled, we will then schedule those former astronauts whose birthdays fall from January to May.

If your birthday falls between June and December, you will receive an invitational packet from Denise Patterson around two months prior to your birth month (If your birth month is June, you should have received your invitational packet in April, July birth months received in May, etc.). As in previous

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LSAH Formers Exams —continued

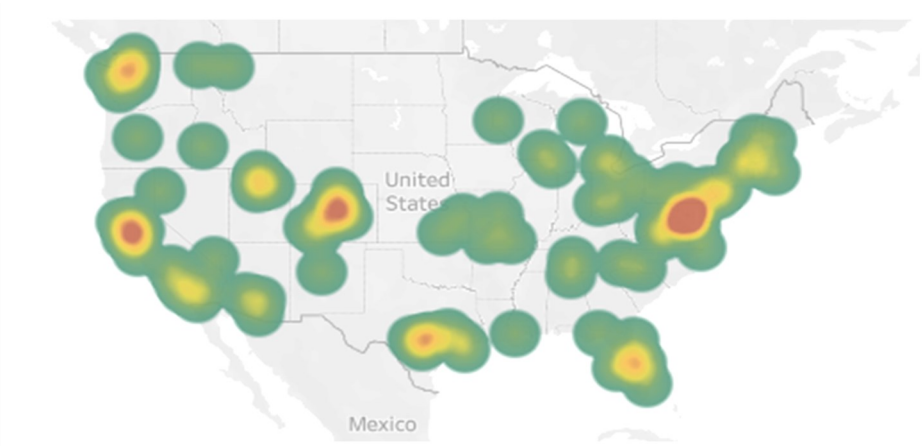


Figure 1 - Formers reside throughout the United States: As part of our planning process for LSAH Virtual Surveillance, we began to look at the distribution of Former Astronauts within the continental United States. The above heat map shows the distribution, with red indicating the areas of highest concentration

years, this packet will have information regarding scheduling your appointment, records requests, and travel reimbursement (if applicable). Once you receive your packet, please contact the Flight Medicine Clinic (FMC; 281-483-7999) to schedule your appointment.

Our goal is to complete all 2022 exams by the end of the year and continue with the nominal birth month schedule in 2023. As always, if you are planning a trip to Houston or JSC and have not had your 2022 exam, please contact us to see if we can schedule your exam during your trip.

It has been a long time coming, but we are excited for you to begin traveling again and to have you back in the clinic! Your participation in these exams is of great importance to NASA; we look forward to working with you again for your LSAH exam and appreciated your patience as we return to normal operations.

LSAH Virtual Surveillance Evaluation:

As has been mentioned in previous newsletters, we are establishing a process for conducting the LSAH surveillance evaluations remotely through a virtual visit from your home. (Figure 1). The virtual visit includes bloodwork and biometrics done at your local Quest Diagnostics clinical laboratory, completing history and medication forms by mail, and participating in a virtual surveillance evaluation call with the FMC nurse, physician as well as the behavioral health evaluation conducted by Dr. Dukes, or another member of the Behavioral Health Team. While comprehensive in-person exams are the gold standard, we will offer virtual exams as an alternative for formers who are unable to travel to JSC for their exam and to encourage continued participation in the LSAH. As this process gets further along in development, look for more information via email or future newsletters regarding LSAH virtual surveillance.

JSC Clinic Welcomes Dr. Tim LaVan, Dr. David Reyes, and Dr. Charles Dukes!

Jeffrey Doi

The Johnson Space Center (JSC) Clinic has seen some personnel changes over the last few months. We are delighted to announce that Dr. Joseph (Tim) LaVan has joined the JSC Clinic as the incoming Medical Director after a 30-year career in the US

Continued from page 2

Welcome Dr. LaVan, Dr. Reyes, and Dr. Dukes—continued

Navy, reaching the rank of Captain. Dr. David Reyes has assumed the role of Flight Medicine Clinic Lead, while also serving as the Deputy Clinic Medical Director supporting Dr. LaVan. Finally, aerospace psychiatrist, Dr. Charles Duke with now be supporting behavioral health component Formers Exams See below for a brief biography for Drs. LaVan, Reyes, and Dukes, and their new roles supporting the Lifetime Surveillance of Astronaut Health project.

Dr. Joseph (Tim) LaVan, MD, MPH:

Dr. LaVan received his Bachelor's (Chemistry) and Doctor of Medicine degrees from the University of Miami and earned a Master of Public Health degree from the University of Washington. He trained as both a Family Physician and a Flight Surgeon/ Aerospace Medicine Physician completing multiple tours in both specialties. Dr. LaVan belongs to several professional societies and associations including the Aerospace Medical Association, the Association of Specialists in Aerospace Medicine, the Space Medicine Association, the Society of US Navy Flight Surgeons, and is a Fellow of the American Academy of Family Physicians. Dr. LaVan currently serves as a board member of the American Board of Preventive Medicine (ABPM) and as a member of the Residency Review Committee (Preventive Medicine) of the Accreditation Council of Graduate Medical Education. He is certified by ABPM in both Aerospace Medicine and Occupational Medicine and is also certified by the American Board of Family Medicine.

Dr. LaVan served as the Officer-in-Charge of the Naval Aerospace Medical Institute (NAMI) from 2016 to 2020, where he directed Navy-wide aerospace medicine practice. His responsibilities included developing and applying aeromedical qualification standards, developing and validating

Welcome Dr. Tim LaVan, JSC Medical Director

Navy aeromedical policy, directing aeromedical research into multiple topics, and training officer and enlisted aerospace medicine personnel. He also managed the Robert E. Mitchell Center which conducts longitudinal surveillance of repatriated prisoners of war for the Department of Defense.

He also served as the Program Director for the US Navy Residency in Aerospace Medicine and led the US Navy's training program for flight surgeons and aerospace medicine physicians, from 2012 to 2016. Additional tours included three years as the Senior Medical Officer onboard USS George Washington during forward deployed operations in the western Pacific (2009 – 2012) and three years as the squadron flight surgeon for a Marine medium lift helicopter squadron (HMM-264) with multiple deployments (1994-1997). He has over 1000 hours logged in over 15 military aircraft. Additionally, he has extensive experience as a case reviewer for Veterans Affairs disability claims.

Continued from page 3

Welcome Dr. LaVan, Dr. Reyes, and Dr. Dukes—continued

Dr. LaVan has extensive knowledge and experience in aerospace medicine, primary care, and occupational medicine. In his new role as the JSC Medical Director, he will utilize this background in overseeing both the Flight Medicine Clinic and the Occupational Medicine Clinic. His experience in managing the Robert E. Mitchell Center will translate directly in the support of the ongoing longitudinal surveillance conducted by the Lifetime Surveillance of Astronaut Health (LSAH) program. His background with Veterans Affairs has already proven invaluable as we establish the process for upcoming LSAH Virtual Surveillance. Further, as NASA often collaborates with NAMI to provide medical consultation and recommendations in challenging cases involving active NASA astronauts, Dr. LaVan already has experience and knowledge related to astronaut qualification in even the most challenging cases.

Dr. David Reyes, MD, MPH:

Dr. David Reyes was recently hired as the new Flight Medicine Clinic Lead and will also serve as the Deputy Clinic Medical Director under Dr. LaVan. Dr. Reyes received a Bachelor's in Geology at Radford University in Virginia, and a Master's of Planetary Science from Arizona State University in Phoenix. Dr. Reyes also served as an enlisted airfield operations specialist with the USAF Reserve at Davis-Monthan AFB from 2000 to 2008. After working as an environmental geologist for several years, he obtained his Master of Public Health from the University of Arizona in Tucson. He then obtained his Doctor of Medicine at the University of Colorado in Denver. After medical school, he worked in Ghana for the Centers for Disease Control and Prevention (CDC) before completing a Family Medicine Residency at the University of New Mexico and an Aerospace Medicine Residency at UTMB in Galveston. Dr. Reyes has also participated in two expeditions to Devon Island in the Canadian Arctic (1998, 1999) as an EMT and field guide, and served as a physician at McMurdo Station in Antarctica (2014) during his Aerospace Medicine residency.

Welcome Dr. David Reyes, Flight Medicine Clinic Lead

Dr. Reyes joined the JSC Space Medicine Operations Division in 2014 and worked with the Exploration Medical Capability (ExMC) modeling medical events in spaceflight and designing future medical kits for deep space. He has also spent a year in Russia supporting NASA operations in Star City and Moscow and has worked extensively at the NBL helping with dive medical operations at that facility over his time at NASA.

Most recently Dr. Reyes worked as the JSC COVID Response Coordinator, where he served as the primary source of COVID information, testing, countermeasures, and treatment for the Space Medicine Operations Division. For this work, Dr. Reyes received NASA's 2021 Exceptional Public Achievement Medal. As part of his duties as FMC Lead, Dr. Reyes oversees the operation of the Flight Medicine side of the JSC Clinic and will be directly involved in restarting Formers LSAH Exams.

Continued from page 4

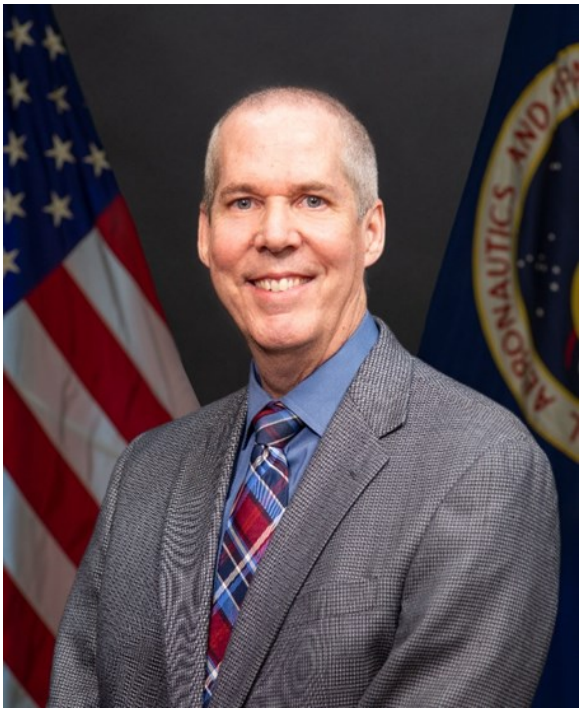
Welcome Dr. LaVan, Dr. Reyes, and Dr. Dukes—continued

While welcoming Drs. LaVan and Reyes to these new roles, we thank Dr. Ronak Shah and Dr. Rob Mulcahy for their service as they vacate these positions for new endeavors. Dr. Ronak Shah, former JSC Medical Director, accepted a position as Director of the Aerospace Medicine Division at UTMB in Galveston. Dr. Rob Mulcahy transferred from the JSC Flight Medicine Clinic to Medical Operations to serve in a Flight Surgeon role. We wish Dr. Shah and Dr. Mulcahy all the best in these new positions, and we are looking forward to the new leadership of the JSC Clinic under Dr. LaVan and Dr. Reyes.

Charles H. Dukes, M.D., FAPA

Dr. Charles Dukes comes to JSC from the University of Oklahoma where he served as psychiatry residency training director and Director of Consultation psychiatry services. At the University of Oklahoma, he started the first Aerospace Medicine clinic. Dr. Dukes received his Bachelor's degree in Philosophy from Newberry College, Master of Divinity from Lutheran Theological Seminary in Gettysburg, PA, and Doctor of Medicine degree from Ross University School of Medicine. He completed his psychiatry residency training at Griffin Memorial Hospital in OK which is an Oklahoma State University Program. He has a long career in the military spanning over 35 years having been enlisted in the Navy and later Commissioned in the Army Medical Corps where he serves as a psychiatrist, flight surgeon and is currently the reserve psychiatric consultant to the Army Surgeon General. He has had four combat deployments as both a psychiatrist and flight surgeon. After Army flight surgeon school, Dr. Dukes worked extensively with the Federal Aviation Administration as an Aviation Medical Examiner, Human Intervention Motivation Study psychiatrist and psychiatric consultant to the Federal Air Surgeon. His current Army reserve assignment is as an Assistant Professor of Psychiatry at the Uniformed Services University of the Health Sciences. His Army rank is Colonel.

Dr. Dukes is a Fellow in the American Psychiatric Association and holds memberships in the Aerospace Medical Association, Space Medicine Association, and the Society of US Army Flight Surgeons. At JSC, Dr. Dukes works with the clinical and science team for Exploration Medical Capability. Additionally, Dr. Dukes works with the behavioral health and performance operations group as an aerospace psychiatrist working operationally with crewmembers and providing behavioral health support to NASA personnel including the behavioral health component of the Lifetime Surveillance of Astronaut Health evaluations that Dr. Pulido previously conducted.



Welcome Dr. Charles Dukes, Aerospace psychiatrist supporting LSAH Formers Exams

IMPALA: The NASA Human Health and Performance Directorate's Integrated Platform for Managing Astronaut Health Data

Devan Petersen, MPH

IMPALA Overview

The Lifetime Surveillance of Astronaut Health (LSAH) curates astronaut medical data compiled for clinical purposes, including medical data collected related to an assigned NASA mission and after departure from the Agency via the LSAH physical exams. These data are of tremendous value as NASA prepares for long-duration missions and missions beyond low-Earth orbit during the upcoming Artemis missions, as well as supporting astronauts' long-term health. To help mitigate the health risks associated with spaceflight, LSAH has been assisting with the ingestion of astronaut data into the Information Management Platform for AnaLytics and Aggregation (IMPALA) platform, an advanced data analytics platform and data repository for astronaut health data and any related exposures, risks, and some research. The IMPALA platform was created to help users quickly and easily connect to data for exploration, mining, cleaning, analysis, and visualization (Figure 5). The purpose of this article is to describe how the IMPALA platform is organized and utilized across NASA to improve the use of medical data.

Compilation and Organization of Data in IMPALA

Importing data into the IMPALA platform was the first step in creating the repository. The first two ingestions of data were the electronic medical (EMR) from the JSC Flight Medicine Clinic and the LSAH database.

Over the last five years, the IMPALA team has ingested data from eighteen sources including:

- Bone and Mineral Lab Bone Density database
- Exercise and Performance database
- Historic Private Medical Conference database
- Historic Shuttle and ISS air quality data
- Additional medical and performance data unique to spaceflight

Using IMPALA to Address Knowledge Gaps

IMPALA is a modular platform, meaning it can integrate with multiple software interfaces depending on user needs. The data in IMPALA are from the same sources LSAH Epidemiologists have traditionally accessed in the past, with better identifiers to help quickly join individuals, missions, and dates.

IMPALA users typically access data with the platform to:

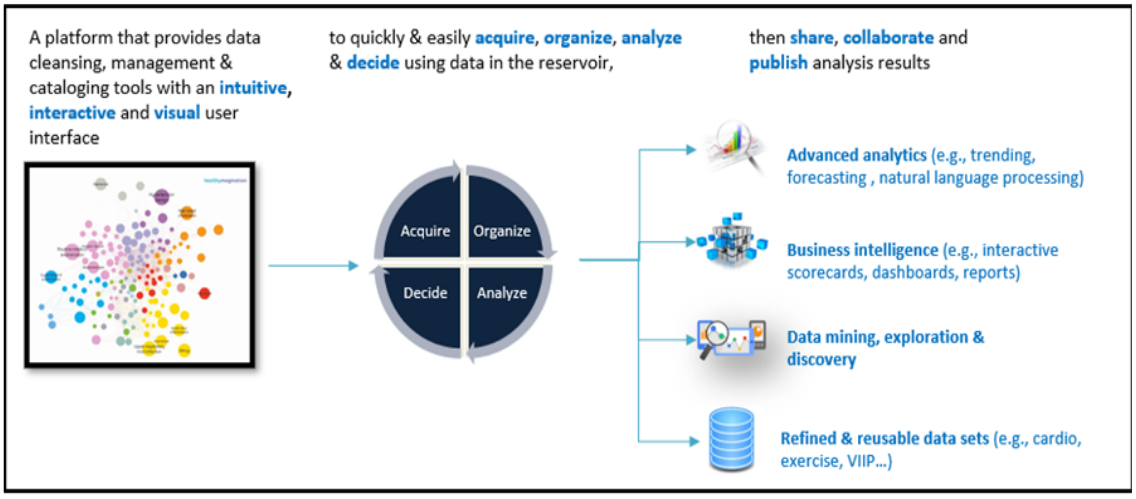


Figure 5 - IMPALA is a platform to store, process, perform, and share advanced analytics, business intelligence and visualizations of data at scale based on contemporary big data analytics technology and processes.

Continued from page 6

IMPALA—continued

- Answer NASA's occupational surveillance questions and other data requests.
- Help inform NASA's risk posture at the Human Systems Risk Board (HSRB)
- Conduct exploratory data analysis, including health and performance inputs to new Artemis Programs

Data Security In IMPALA

The data housed with the IMPALA platform are protected utilizing several data security techniques. The data have recently been transitioned to the Amazon Web Services (AWS) cloud environment, which complies with NASA and industry standard security and compliance requirements. Currently all the Lifetime Surveillance of Astronaut Health (LSAH) Epidemiologists have access to IMPALA, as they have had access to the ingested data sources and use the system regularly as part of their positions.

Other users may request access through a formal process with approvals to ensure that only individuals with an established need are able to access only the data necessary to meet their purpose. The approval processes for access to data previously reported in this newsletter have not changed – the LSAH team ensures that private health information is protected, and the security methods are in compliance with NASA and Federal government standards.

Now that the IMPALA team has successfully compiled this data into the IMPALA platform, they are focused on organizing the data into clean tables that are easily accessible and understandable by the user. In future newsletter articles, we will go further in depth about how the team is working with the ingested data to create "Domain Data Models," which are data sets based on body systems. This work combines, cleans, and restructures the data so that users can search lists of common diagnoses, procedures, exposures, and other data without complicated queries by the user. We also plan to bring forward data use success stories.

Stay tuned for more information on how LSAH data are leveraged in the IMPALA platform to transform over 50 years of data into decisions for future lunar and Mars missions.

SANS Maturation Project – LSAH Inputs and Recent Findings

Suzi Osborne, MPH

Spaceflight Associated Neuro-Ocular Syndrome (SANS; previously known as visual impairment/ intracranial pressure syndrome or VIIP), has gained the attention of researchers worldwide over the last decade. SANS is defined as when one or more of the following signs is detected in one or both eye(s) during or immediately after spaceflight: 1) optic disc edema (ODE), 2) chorioretinal folds, 3) globe flattening; 4) excessive change in refractive error. (Figure 6)

The Lifetime Surveillance of Astronaut Health (LSAH) continues its commitment to the astronaut corps with an in-depth focus on long-term health outcomes, including ocular health. The LSAH also supports both internal and external researchers to address knowledge gaps and assess astronaut health risks. Since 2011, the LSAH team has fulfilled approximately 98 data requests related to SANS and an estimated 23 peer-reviewed publications have resulted from these collaborations.

The first SANS Evidence Report was released in July 2012. (https://humanresearchroadmap.nasa.gov/evidence/reports/SANS.pdf) At that time there was little evidence-based knowledge from the space medicine and research community on the pathogenesis and resolution of SANS, and an even larger knowledge gap in the understanding of long-term consequences of SANS on ocular health. Since

Continued from page 7

SANS Maturation Project—continued

then, LSAH in collaboration with researchers and physicians have reduced that knowledge gap through findings from exploratory analyses, including identification of the following SANS characteristics that will help identify future monitoring strategies and countermeasure tools:

1. Long-duration spaceflight (6-months) is associated with optic disc edema and peripapillary choroidal thickening during spaceflight, with a decrease in axial length and anterior chamber depth after spaceflight, and a hyperopic shift observed 1-year after return to Earth [1].
2. Terrestrially, optic nerve head central thickness volume measures on OCT were found to be positively correlated with intracranial pressure (ICP) and has the ability to inform ICP changes [2].
3. Intraocular pressure, among crewmembers aboard 2-week Space Shuttle missions increased during spaceflight but normalized upon return to Earth [3].
4. Lower body negative pressure (LBNP), and to a lesser extent venoconstructive thigh cuffs (VTC) and impedance threshold device (ITD) resistive inspiratory breathing were shown to be promising countermeasures in reducing posture -induced headward fluid shifts in a ground-based spaceflight analog study [4].

Though we have made important advancements in our understanding of SANS, with ISS coming to an end within the next decade coupled with new Artemis missions and eventual Mars exploration missions in work, it is imperative that we continue to emphasize collaborations with both internal and external clinicians and researchers. One way to do this is by leveraging LSAH retrospective medical data provided by the astronaut corps before, during, and after missions and archived research data housed in the Life Science Data Archive. Both retrospective medical and research data are often used collectively to better understand and identify potential risk factors and relationships that allows flight surgeons to manage ocular health outcomes before, during, and after missions.

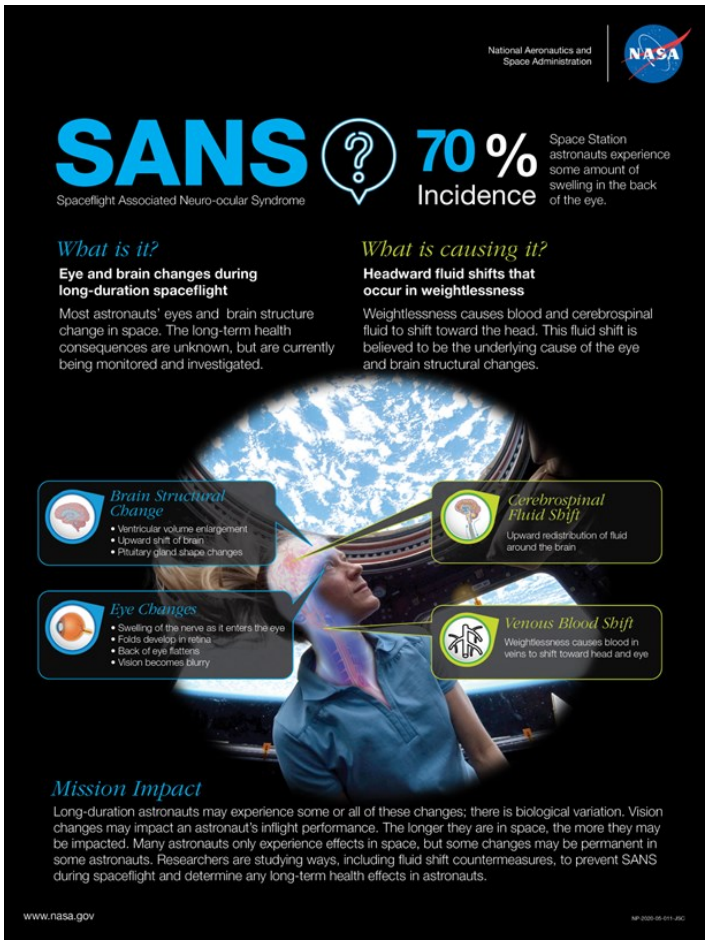


Figure 6—What is Space Associated Neuro-Ocular Syndrome
https://www.nasa.gov/image-feature/what-is-spaceflight-associated-neuro-ocular-syndrome

Most recently, LSAH partnered with two researchers to provide retrospective data in projects to further understand and predict predisposed risk related to SANS.

Dr. Laura Pardon, OD, PhD (KBR, NASA Cardiovascular and Vision Laboratory) is conducting a study "Investigating the Relationship Between Sleep and Optic Disc Edema in SANS" (Figure 7). The aim of this study is to further understand and predict predisposed risk

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SANS Maturation Project—continued

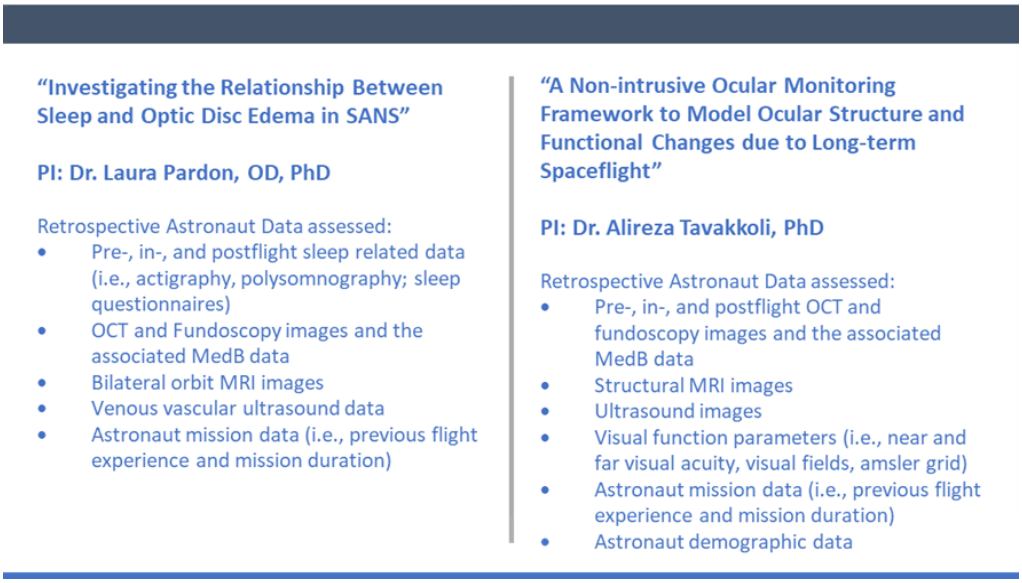


Figure 7 – SANS studies using retrospective health and research data from LSAH and LSDA repositories: A) SANS study by Dr. Laura Pardon utilizing retrospective astronaut data; B) SANS study by Dr. Alireza Tavakkoli utilizing retrospective astronaut data.

related to SANS by addressing two gaps in the SANS literature:

1. the relationship between venous blood flow characteristics and retinal and choroidal folds during spaceflight and
2. determine whether decreased sleep has a role in the development of optic disc edema and SANS.

Dr. Alireza Tavakkoli, PhD (University of Nevada, Department of Computer Science and Engineering) is conducting a study "A Non-intrusive Ocular Monitoring Framework to Model Ocular Structure and Functional Changes due to Long-term Spaceflight" (Figure 7). This study seeks to use retrospective ocular data to design, train, and validate a computational framework to monitor functional and physiological changes due to SANS. The framework includes two interrelated mechanisms:

1. machine learning that establishes mapping between a set of functional and physiological vision parameters
2. a vision testing system based on Head Mounted Displays to collect relevant vision functionality data.

Dr. Pardon's study will generate new data from the OCT and MRI images performed for medical monitoring and identify relationships across ocular health parameters and sleep related data that will impact long-term health and our continued understanding of SANS. The new data generated will be archived by LSAH in the future. Dr. Pardon and her team are expected to complete analysis and reporting by the end of 2022. Dr. Tavakkoli and his team anticipate that the functionality of their machine will replace all the current visual testing modalities aboard the ISS.

The science resulting from these valuable research partnerships wouldn't be possible without you and your participation in the LSAH project! Further, they reflect the importance and necessity of your continued participation in routine medical evaluations like the LSAH Formers Annual Exam. All of your data combined enables proactive care to the astronaut community, better understanding of long-term effects of spaceflight on visual health and guides future research.

References available p12

Prostate Cancer in the Astronaut Corps – Results from the LSAH Systemic Review Project

Adriana Babiak-Vazquez, MPH, PhD and Rachel Shoop, MS

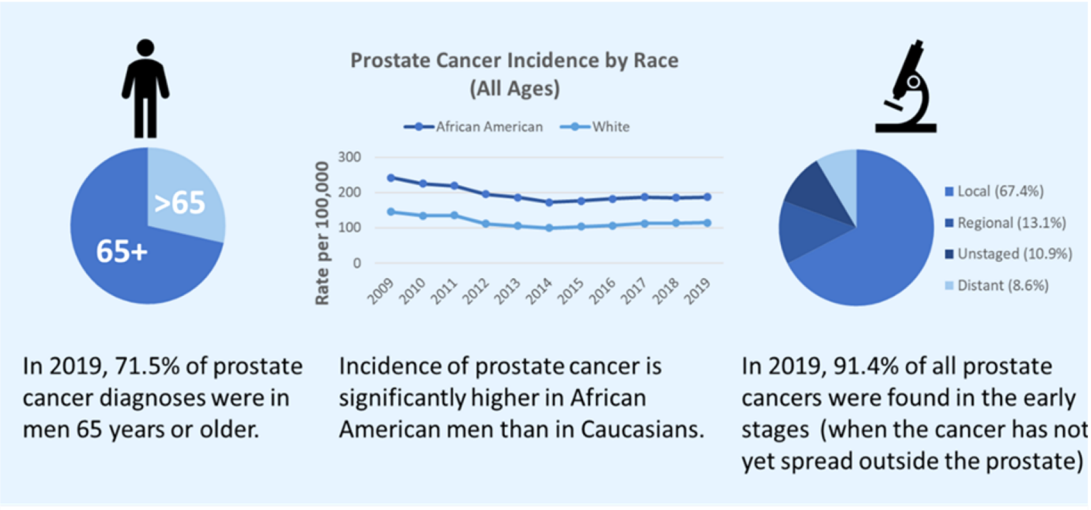
In 2020, the Lifetime Surveillance of Astronaut Health (LSAH) epidemiologist team began an effort to systematically review the medical literature to assess incidence, prevalence, and mortality for 30 different cancers among the astronaut corps, general public, and other comparable populations such as military and civilian air crew [5]. This effort, referred to as the LSAH Systemic Review Project, is directed by the NASA Office of the Chief Health Medical Officer (NASA OCHMO) to understand cancer risk associated with radiation exposure during crewed space missions. As the potential for radiation exposure increases in longer duration missions, Artemis missions returning to the moon, and future space travel to Mars, reducing this risk is a high priority for the Agency. The following article, presenting LSAH findings from the prostate cancer systematic review and summarizing the evidence base in relation to the astronaut corps, will be the first of several from the LSAH Systematic Review Project.

Prostate Cancer in the General Population:

According to National Cancer Institute's (NCI's) Surveillance, Epidemiology, and End Results (SEER) reports, prostate cancer is the leading cancer type diagnosed in men in the United States, ranking 2nd in the number of cancer-related deaths (with lung cancer ranking 1st). In 2019, 71.5% of men diagnosed with prostate cancer were over the age of 65. African American men have a significantly higher incidence rate than Caucasian men. Nearly 92% of all prostate cancer cases are found in early stages before the cancer has spread outside the prostate [6]. (Figure 8).

Out of 2434 titles and abstracts screened during the systematic review, data was abstracted from a total of 17 publications resulting in three main patterns of interest.

1. There was an increase in prostate cancer incidence in younger men in the 1990's. This increase is likely attributed to U.S. recommendations for more screening at a younger age, which might have led to earlier identification of aggressive cancers (less screening might have missed these) [7-9].
2. A study of prostate cancer in active-duty Air Force showed an increase of prostate cancer compared to the general population. The authors postulated that a higher level of access to healthcare could allow for increased



*Note** SEER 22 Data 1975-2019 [6]

Figure 8 – Prostate cancer in the US General population (SEER 22 Data 1975-2019) [6]

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Prostate Cancer in the Astronaut Corps—continued

opportunities for prostate-specific antigen testing and result in potentially higher incidence rates of prostate cancer [10].

3. A major study of prostate cancer showed mortality was reduced due to improved screening, treatment, and early diagnosis. Changes to the recording of death certificates may also have affected mortality rates [11].

Prostate Cancer in the Astronaut Corps:

NASA astronauts tend to have similar rates of cancer as the general population; however, astronaut training and spaceflight exposure present a unique risk factor [12]. As of December 2019, among the 292 flown male astronauts and payload specialists there were 37 cases (12.7%) of prostate cancer, resulting in 5 deaths due to prostate cancer [13]. All deaths were in crew members >80 years old which is similar to the estimated mortality in the general population [9, 11, 13]. LSAH assessment of prostate cancer cases compared to the US general population resulted in a Standardized Incidence Rate (SIR) of 1.82 (95% Confidence Interval 1.19-2.45) which is comparable to the SIR found in active duty Air Force (SIR 1.44; 95% CI 1.21-1.69) [10]. Both increased SIR (US general population reference SIR = 1) may be in part due to increased screening for prostate cancer which is not routinely performed in otherwise healthy men under the age of 50 years old in the US general population.

Because of the risks associated with spaceflight, astronauts have access to health care and screening, beyond that available to the general population. For example, since 2001, all male astronauts 40 years and older (active, management, and retired) have been routinely screened for prostate cancer with the PSA test. Due to earlier initiation of PSA screening in the astronaut population,-prostatic cancer has been detected and treated in astronauts ages 40-49 years old. Without out this increased screening, these cases would have been found at age 50 with the potential of progression to more severe disease. (Figure 9).

Careful surveillance of important health outcomes will continue in the LSAH Systemic Review Project, to assess crew health risk and performance as we extend our missions and send our astronauts to farther destinations in space, with the potential exposure risks increasing in kind.

References available p12

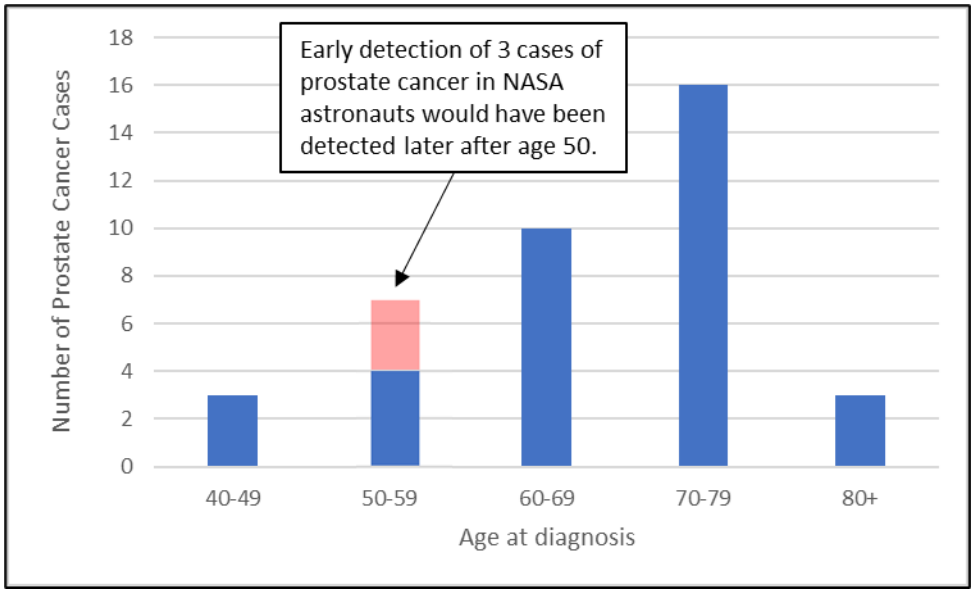

Figure 9 – Number of prostate cancer cases stratified by age in the NASA astronaut corps. Due to earlier PSA screening, 3 cases of prostate cancer were detected earlier at 40-50 years old rather than 50+ years old (denoted by overlayed red bar). Early screening and detection can diagnose cases at earlier stages thus potentially reducing death from aggressive forms.

Do you have a suggestion for an article or other information you would like us to include in the next Newsletter? Do you have any photos, news or updates you would like to share with the corps? We'd love to hear about it! Send suggestions, comments, or questions to Denise.A.Patterson@nasa.gov.

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FYI

Did you move? New email address? Remember to update us so we can continue to send you the LSAH Newsletter, LSAH invitational physical exam letters and any other news we may need to share with you. Contact Denise Patterson at 281-244-5195 or denise.a.patterson@nasa.gov.

You may also write us at:
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