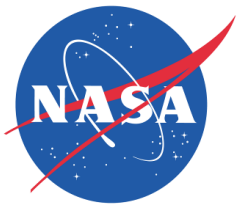
National Aeronautics and Space Administration



THE LIFETIME SURVEILLANCE OF ASTRONAUT HEALTH

Newsletter

Volume 26, Issue 2

*Editor's Note: This volume of the Newsletter discusses how **COVID-19 has affected former astronaut data** and the Lifetime Surveillance of Astronaut Health (LSAH) team's work on behalf of the former astronauts. It will also **reintroduce the consenting processes to collect medical data**, as well as speak to the importance of continuing the effort to collect this data as the last year and a half has created a significant loss in data. There is also a new section to be included in all future Newsletters introducing one or more team members! Get to know the names and faces behind your LSAH team!*

LSAH Exams and COVID-19 Impact

Ronak Shah, D.O., M.B.A, M.P.H., Mary Van Baalen, Ph.D.

COVID-19 (officially known as Severe Acute Respiratory Syndrome Coronavirus 2 or SARSCoV-2) has altered daily life across the globe. As of September 20, 2021, approximately 675,000 Americans have lost their lives to the virus. There was an aim to resume in-person Lifetime Surveillance of Astronaut Health (LSAH) exams this fall; however, the increasing case numbers due to the Delta variant has prompted us to pause in an effort to protect the health of our former astronauts. It is our hope that with the ongoing vaccination effort and reinforced message behind precautionary measures, we will see an improvement in the surrounding communities and thus be able to resume exams. As a team, we recognize the impact of the loss of medical data and understanding of the health of the population. Therefore, we have reinitiated the planning for conducting modified LSAH exams using a combination telehealth visit and diagnostic tests performed at labs near your home rather than at the Johnson Space Center Flight Medicine Clinic. Our current goal is to have planning completed and a program implemented in the fall of 2021. Former astronauts who participate in the LSAH program will be notified when these remote LSAH exams become available.

The LSAH telehealth exams with the Flight Medicine Clinic, including the behavioral health visits, will be available again soon. To schedule a telehealth visit, please contact Amy Trabue at Amy.L.Trabue@nasa.gov or 281-483-7089.

COVID -19 Impacts on LSAH Data Collection

Mary Van Baalen, Ph.D.

The pausing of in-person annual Lifetime Surveillance of Astronaut Health (LSAH) exams due to the COVID-19 pandemic is resulting in an unprecedented loss of long term health data for NASA's LSAH program. The LSAH program has historically benefitted from the support of the former astronaut community and had an annual return rate of 60-65%. A review of the participation rates in the last few years are shown in the table below.

LSAH Exam Return Rates				
Year	2018	2019	2020*	2021*
# Exams	167	178	28	1

Figure 1.
**Includes exams for former astronauts that are currently certified for NASA jobs such as Flight Controller, Aircraft Operations Pilot, Flight Director, etc.*

Nominally, the JSC clinic and the LSAH team would collect medical care data as part of the exam and work with the individual astronaut to capture their personal medical records. Together these efforts create a comprehensive medical history for each astronaut. This practice has been successful

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COVID -19 Impacts on LSAH Data Collection continued

in years past, and documentation of the interval medical histories for many former astronauts have been obtained. The record types include primary care and specialty care with cardiology, dermatology, gastroenterology, internal medicine, ophthalmology, and orthopedics being the top six. Please see the following table for metrics on the volume of records typically received and the decrease seen in the last two calendar years.

Records Received by LSAH				
Year	2018	2019	2020*	2021*
# Individuals Providing Records	40	76	29	3
# Records Received	133	213	53	16

Figure 2.
**Denotes individuals that reached out to the LSAH to provide their records*

As a reminder, the purpose of the LSAH program is to screen and monitor astronauts for occupational related injury or disease. The LSAH program examines the incidence of acute and chronic morbidity and mortality of astronauts, and defines the risks of morbidity and mortality associated with the occupational exposures encountered by astronauts. As the pandemic persists, we are realizing the magnitude of the loss of data and the potential implications to our ability to perform analyses for long term health conditions. In an effort to mitigate the loss of data, the LSAH team will be reaching out to you to request your personal medical records. Please see the article titled *Primary Care Provider Records.* It provides instructions for the process of requesting personal primary care records.

Primary Care Provider Records

Mary Wear, Ph.D., Denise Patterson

Due to the ongoing pandemic, in-person exams for former astronaut have been on hold since March 2020. In conjunction with exams, we obtained permission to request private medical records from former astronauts. When the annual exam invitations were put on hold, so were the requests for these records. This means that your clinic medical records have not been updated since your last exam! We did obtain private records from several former astronauts that reached out to the Lifetime Surveillance of Astronaut Health (LSAH) office to request their records for the electronic chart during the past year to maintain their continuity of care with the Flight Medicine Clinic. Since the in-person exams remain paused, we will be contacting you with instructions for completing the Authorization for Disclosure of Protected Health Information for Continuity of Care - Research Operations and Integration form so we can request your outside medical records from your Primary Care Provider (PCP) or other specialists you have seen since your last exam at the clinic. Once exams resume, you may also bring your external records with you and they will be scanned and attached to your chart if you prefer that method.

Integrating your external medical records with NASA medical records helps assure continuity of care here at the JSC Clinic. It helps us develop a better understanding of astronaut health, both individually and as a population. We can also be your 'one-stop-shop' for retrieval and release of all your medical records. We can provide the following services to you with signed authorization:

1. Release of your JSC Clinic examination results to your personal PCP and/or other medical specialists.

2. Retrieval of your medical records from other providers. When patients request copies of their medical records for personal use, medical providers often charge you. When we request your records, we retrieve them at no cost to you.

3. Release of your consolidated medical records, whether generated at NASA or received from outside providers, to you or to anyone that you designate.

If you would like your LSAH annual examination results sent to your PCP, please request that during your exam and final results will be sent once available.

LSAH and LSDA Data Repositories: COVID-19 Impacts and New Processes

Ruth A. Reitzel, Ph.D.

Since the start of the Lifetime Surveillance of Astronaut Health (LSAH) and the Life Sciences Data Archive (LSDA) data repositories in 2014, use of repository consenting process has aided in fulfilling almost 600 requests for re-use of medical and research data (see Figure 3). We thank you for your ongoing participation in the LSAH and LSDA repositories and the use of your medical and research data to support understanding how spaceflight effects the human system.

Over the years, LSAH and LSDA have evolved based on program scope and updates to federal regulations. In this article, we will re-familiarize crewmembers with the repositories, identify how COVID-19 has impacted the repositories, as well as introduce new key personnel and processes in LSAH and LSDA.

LSAH and LSDA Repositories

LSAH and LSDA repositories are NASA Institutional Review Board (IRB) approved protocols that allow for re-use of retrospective medical and research data collected from crewmembers. These protocols have created an efficient approval process for release of data as well as reducing the burden on crewmembers by enabling LSAH and LSDA to broadly consent crewmembers to the repositories using three consent options:

- Option 1 consent indicates that the crewmember allows for re-use of data without additional consents.
- Option 2 indicates that the crewmember would like to be consented with every re-use of data.
- Option 3 is a hybrid of options 1 and 2 which allows crewmembers to choose data that they authorize to be released based on the Medical Data Authorization Checklist and the Research Data Authorization Checklist.

To ensure that crewmembers understand the breadth of medical and research data they are consenting to reuse, crewmembers are consented to the repositories in person after their first flight. For

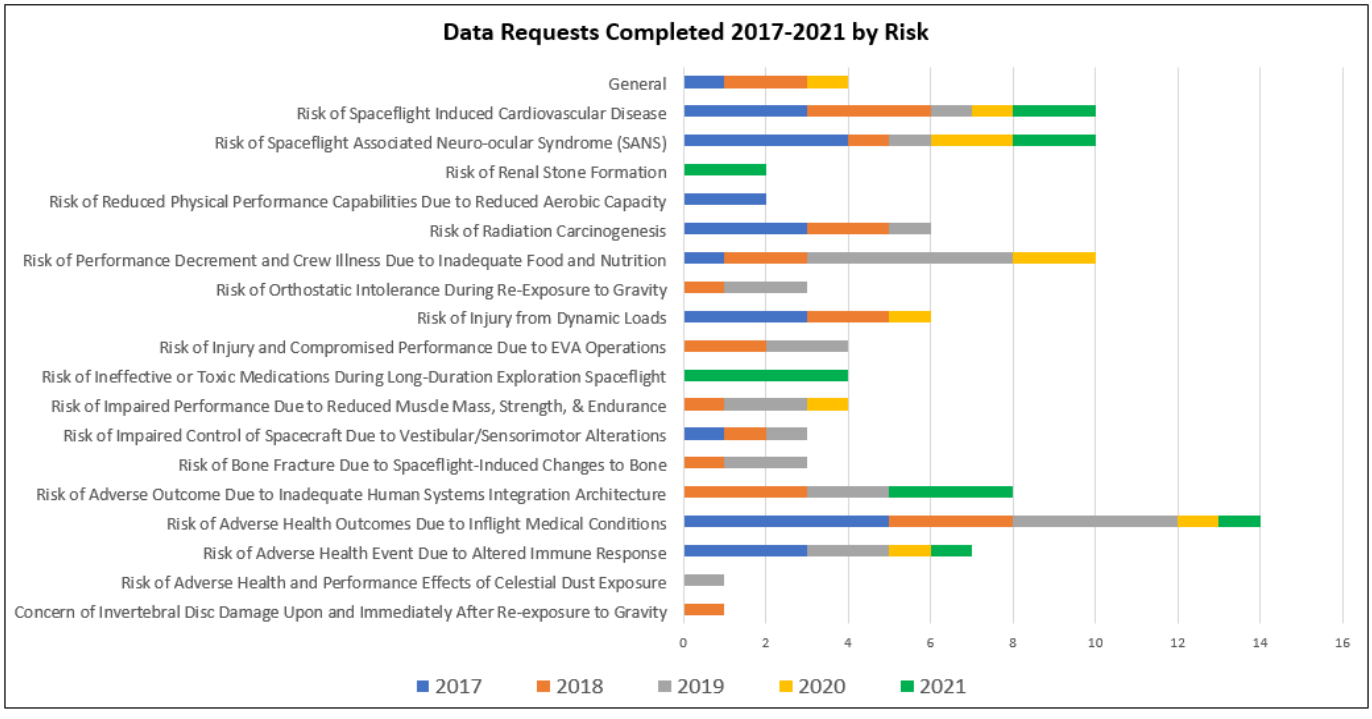

Figure 3.
This graph shows data requests for reuse of astronaut medical data completed from 2017-2021 by risk, defined by the Human Systems Risk Board. There are over 600 data requests mapped to specific risks.

Continued from page 3

LSAH and LSDA Data Repositories: COVID-19 Impacts and New Processes Cont.

repeat flyers, additional consenting for the LSDA repository will occur to include research data for subsequent missions. If a crewmember is not participating in the repositories, that crewmember's data can still be reused. You will be consented for all individual retrospective studies. As always, it is the crewmember's choice to participate in the repositories, and crewmembers have the ability to change their consent status at any time.

COVID-19 Impacts to the Repositories

COVID-19 has impacted your astronaut annual exams and the flow of your health data into the LSAH repository, as well as our ability to consent crewmembers to both repositories. LSAH and LSDA repository consents are typically done in person. However, due to COVID-19 we are exploring options for repository consenting through Microsoft Teams. To date, a total of 217 crewmembers have been consented to the LSAH repository and 218 crewmembers to the LSDA repository, respectively. As we start planning for return to site and astronaut exams, part of that planning is catching up with crewmembers that may not have had the opportunity to participate in and be consented to the repositories. If you have not yet been consented to the repositories, please watch for an introductory email with more information.

New People and New Processes

Figure 4.
New LSAH and LSDA Science Coordinators, Sasha and Ali!

During COVID-19, LSAH has added some new faces (virtually, of course) to the team. You might have already seen their emails in your inbox. Sasha Portillo[1] and Ali Bachellor[2] are the two new LSAH and LSDA Science Coordinators who will be the front line and points of contact regarding repository consents and re-use of medical and research data (see Figure 4). While LSAH and LSDA have established approval processes for re-use of de-identified data and release of attributable data, changes to the Common Rule (45CFR Part 46)[3] and NASA IRB purview have caused a need for development of new approval process relating to publication of medical and research data.

Publication of Surveillance Activities

A major function of the LSAH team is to conduct occupational surveillance with medical data to guide clinical care for crewmembers. Data collected under occupational surveillance results are also used to inform operational questions and vehicle design. In order for surveillance programs to disseminate what they have found, communicate medical practices, and potentially influence guidelines, results from surveillance activities should be published in the medical literature. However, because surveillance activities are generally not considered human subjects research, a new process for publication of these results has been developed. This new LSAH process involves board approval for the surveillance program such as Astronaut Occupational Health Management Group, non-human-subjects research determination of the surveillance program by NASA IRB, and finally, LSAH Advisory Board approval of publication of surveillance results.

Consent for Publication of Attributable Data

In order to ensure the privacy of astronauts, all publications, presentations, and abstracts must pass the LSAH attributability review prior to release in the public domain. The LSAH team reviews submissions and provides recommendations in order to reduce potential for release of attributable data (health data that could potentially be linked back to an individual crewmember). Occasionally, there are cases where data will always be

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LSAH and LSDA Data Repositories: COVID-19 Impacts and New Processes Cont.

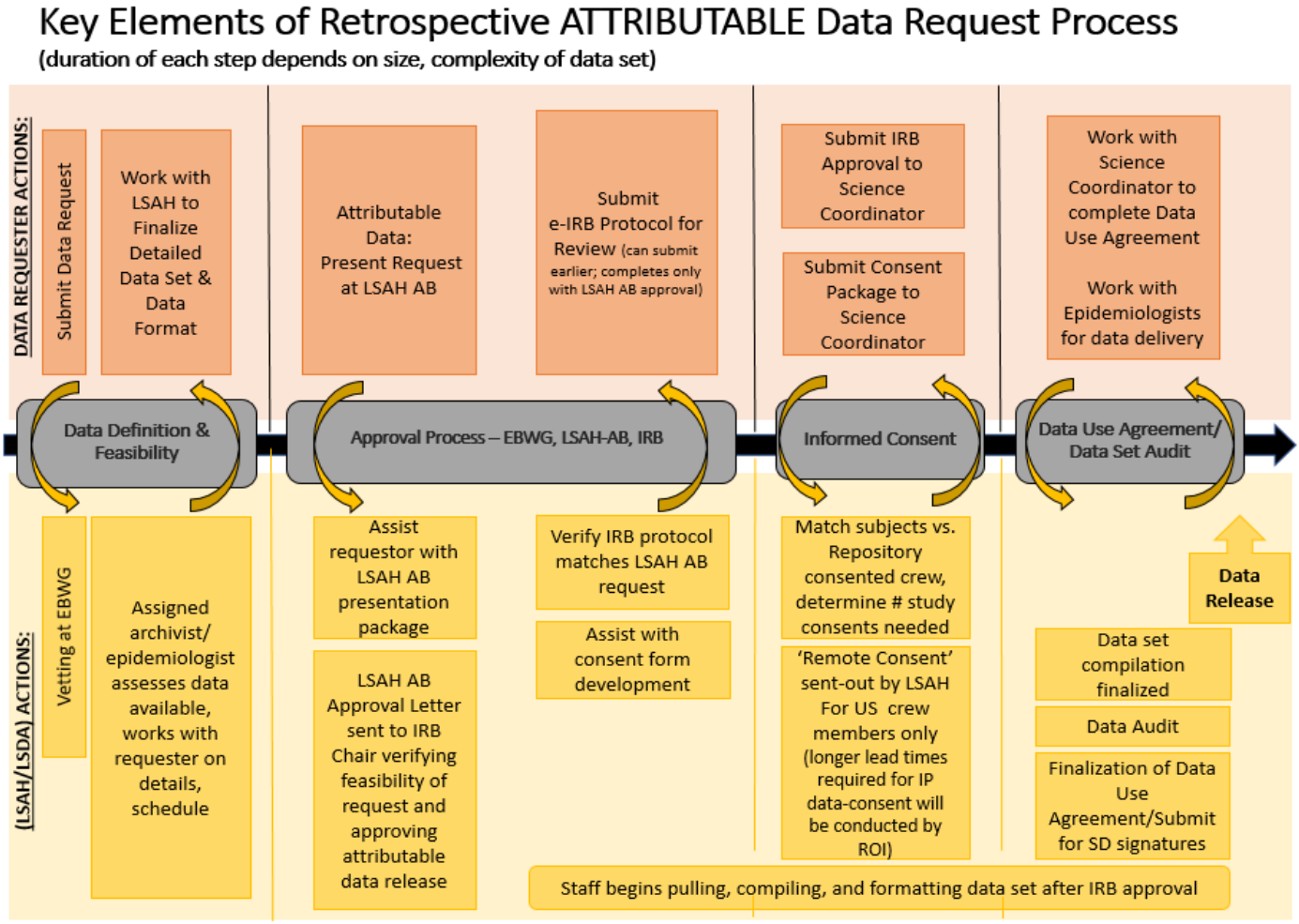

Figure 5.
LSAH/LSDA data request approval process for reuse of attributable retrospective astronaut medical and research data includes multiple safeguards for protecting astronaut privacy including board and IRB approvals as well as crew consenting.

attributable based on the small sample size, spaceflight program, or combination of variables. Additionally, the repositories and individual study consents ensure that an individual's privacy will be maintained. Publication of attributable data requires a separate consent form. Because of this, LSAH has developed an approval process to consent crewmembers for publication of attributable data. This process will require LSAH Advisory Board approval to approach crewmembers for the additional consent. It will not leverage the LSAH and LSDA repositories, even Option 1 crewmembers will be individually consented. As with any consent, crewmembers have the right to decline as well as withdraw consent at any time. Finally, this process will give the crewmembers the opportunity to review the manuscript prior to submission.

While LSAH is committed to supporting researchers with re-use of medical and research data, our top priority is protecting astronaut privacy, your privacy! If you have any concerns, we always encourage you to reach out to LSAH or LSDA with any questions or comments.

[1] Contact information: sasha.r.loginov@nasa.gov
[2] Contact information: alison.n.bachellor@nasa.gov
[3] The "Common Rule" is the popular term for the Federal (US) Policy for the Protection of Human Subjects 45 CFR part 46, which outlines processes for IRB review and human subjects research.

Meet Lakshmi Kanikkannan, Lifetime Surveillance of Astronaut Health Team's Graduate Intern

Robert Reynolds, Ph.D.

Lifetime Surveillance of Astronaut Health (LSAH) is pleased to introduce Lakshmi Kanikkannan, our Graduate Student Intern, specifically supporting Crew Health and Safety. Lakshmi is a PhD student at the University of Texas Health Science Center Houston (UT Health) - School of Public Health, where she studies Biostatistics and Data Science. Lakshmi obtained her bachelor's degree in Biostatistics from St. Louis University in St. Louis, MO in 2019.

Lakshmi's parents immigrated to the United States from India in 1999, and though Lakshmi was born in India, she grew up first in the Minneapolis area, and considers St. Louis her hometown. Lakshmi has already been working with LSAH for the last year and will be continuing to support the team on a part-time basis in 2022 as well.

Lakshmi has always been fascinated with space and has been a life-long fan of NASA. She has dreamt of becoming an astronaut and sees both her studies at UT Health and her work with NASA as important steps toward that goal. In addition, working with the LSAH team offers her the opportunity to make a direct contribution to the health and well-being of her idols – both active and retired astronauts – using her data analytic expertise on two distinct projects. First, she is part of an exploratory project examining data from EVAs during Space Shuttle flights and from the ISS. The goal of this effort is to see what new insights these data might reveal when using a set of analytic techniques collectively known as "Unsupervised Machine Learning." These techniques allow her to look for previously unseen patterns in the data which may help us gain a new understanding of how to make EVAs safer and more effective. Lakshmi's second major project involves building a sophisticated tool to aid in health surveillance for both current and former astronauts. As NASA's Information Management Platform for Data Analytics and Aggregation (IMPALA): "IMPALA" data and analytics platform (see LSAH Newsletter Vol. 23, Issue 1 for details on the IMPALA platform)[1] continues to mature, new data exploration

Figure 6.
Lakshmi Kanikkannan, Lifetime Surveillance of Astronaut Health Team's Graduate Intern

tools can help to automate some of the traditional health surveillance tasks performed by LSAH epidemiologists. This new tool will allow users (primarily NASA physicians and LSAH epidemiologists) to visualize health data quickly and in a robust fashion – all while maintaining astronaut confidentiality. The initial version of the IMPALA tool will allow users to create medical condition incidence curves based on astronaut demographics, such as age, sex, occupational background, dates of service, and more. Because the results are derived from an underlying statistical model (instead of displaying the information of individuals), no individually identifiable medical information is revealed. The IMPALA tool will allow us to answer basic questions about astronaut health in a much more rapid fashion.

In addition to all of her professional accomplishments, Lakshmi loves to bake desserts and is well-known among family and friends for her complex

Continued from page 6

Meet Lakshmi Kanikkannan, Lifetime Surveillance of Astronaut Health Team's Graduate Intern continued

yet delicious and adventurous desserts. "Since I started working with LSAH right as COVID-19 was arriving in the US, I haven't yet been able to share my desserts with the NASA family… hopefully that will change soon!" As Johnson Space Center moves to increase on-site capacity, the LSAH team definitely looks forward to working with Lakshmi in person and trying her magnificent creations.

[1]Koslovsky, Matthew. LSAH Newsletter Vol. 23, Issue 1, *LSAH Data Happenings.*

https://lsda.jsc.nasa.gov/lsda_data/document/Newsletter/LSAH/LSAH_Newsletter_2018_Vol23_1_Newsletter_Newsletter_13_34_37.pdf

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 alexandra.l.newport@nasa.gov.

Publications Corner (2020-Present)

Attached are publications related to LSAH data requests and other papers that may be of interest. For your convenience, each publication has a link to take you directly to the abstract or publication online. For papers not available via open source, the corresponding author may be able to provide you with a copy.

2020-2021

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Publications Corner continued

Cancer incidence and mortality in the USA Astronaut Corps, 1959-2017. Reynolds, R., Little, M. P., Day, S., Charvat, J., Blattnig, S., Huff, J., & Patel, Z. S. Occupational and environmental medicine. 2021;oemed-2020-107143. Advance online publication. https://doi.org/10.1136/oemed-2020-107143

Cardiac Effects of Repeated Weightlessness During Extreme Duration Swimming Compared With Spaceflight. MacNamara, J. P., Dias, K. A., Sarma, S., Lee, S., Martin, D., Romeijn, M., Zaha, V. G., & Levine, B. D. Circulation. 2021;143(15), 1533–1535. https://doi.org/10.1161/CIRCULATIONAHA.120.050418

Changes in the Optic Nerve Head and Choroid Over 1 Year of Spaceflight. Macias, B. R., Ferguson, C. R., Patel, N., Gibson, C., Samuels, B. C., Laurie, S. S., Lee, S., Ploutz-Snyder, R., Kramer, L., Mader, T. H., Brunstetter, T., Alferova, I. V., Hargens, A. R., Ebert, D. J., Dulchavsky, S. A., & Stenger, M. B. JAMA ophthalmology. 2021;139(6), 663–667. https://doi.org/10.1001/jamaophthalmol.2021.0931

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Intraocular pressure and choroidal thickness respond differently to lower body negative pressure during spaceflight. Greenwald, S. H., Macias, B. R., Lee, S., Marshall-Goebel, K., Ebert, D. J., Liu, J., Ploutz-Snyder, R. J., Alferova, I. V., Dulchavsky, S. A., Hargens, A. R., Stenger, M. B., & Laurie, S. S. Journal of applied physiology (Bethesda, Md. : 1985). 2021;131(2), 613–620. https://doi.org/10.1152/japplphysiol.01040.2020

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Lower body negative pressure reduces jugular and portal vein volumes, and counteracts the cerebral vein velocity elevation during long-duration spaceflight. Arbeille, P., Zuj, K. A., Macias, B. R., Ebert, D. J., Laurie, S. S., Sargsyan, A. E., Martin, D. S., Lee, S., Dulchavsky, S. A., Stenger, M. B., & Hargens, A. R. Journal of applied physiology (Bethesda, Md. : 1985). 2021;10.1152/japplphysiol.00231.2021. Advance online publication. https://doi.org/10.1152/japplphysiol.00231.2021

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Publications Corner continued

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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.

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