THE LONGITUDINAL STUDY OF ASTRONAUT HEALTH

Newsletter

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Ten Years of LSAH

By BABY DJOJONEGORO, MS, MPH

This year marks the tenth anniversary of the Longitudinal Study of Astronaut Health. In 1993, the study started with the historical cohort of 195 astronauts selected from 1959 through 1990, while the 575 corresponding comparison participants were selected from JSC civil servants dating back to the Center's inception in 1963. Since then, concurrent selections have taken place to match the astronaut classes of 1992, 1995, 1996 and 1998 (the selection process for the 2000 class of comparison participants is still ongoing) to reach its current count of 312 astronauts and 928 comparison participants.

Table 1. Some LSAH Information Sources

	Number of Records	
	Astronauts	Comparison Participants
Physical Examination	6570	13210
Personal Medical History	3120	9692
Exercise Tolerance Test	2263	2912
Consultant Report	1883	1192
Health Lifestyle Questionnaire	229	781
Food Frequency Questionnaire	142	527

The main source of information for LSAH is clinical data, which are primarily annual physical examination data but also include other encounter types such as exercise tolerance tests, laboratory reports, and consultant reports (Table 1). This clinical picture is supplemented by other types of information, such as demographic and mission data. Also significant in rounding out the characteristics of LSAH participants are the complementary data collected through the Health Lifestyle Questionnaire and Food Frequency Questionnaire.

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Seasonal Allergies: Are you prepared?

By CORTNI HALL, MPH

It's that time of the year when the sun is out longer, the grass and trees are greener, and the flowers are finally starting to bloom. While most people will be enjoying the much anticipated return of spring and summer, others who are not so lucky will be preparing to deal with allergy symptoms.

According to the American Academy of Allergy, Asthma, and Immunology (AAAAI), allergic disorders are the sixth leading cause of chronic illness in the United States, affecting more than 20% of all adults and children. Some of the most common allergic disorders include allergic rhinitis (hay fever), asthma, sinusitis, contact dermatitis, and food and drug allergies. Each year, it is estimated that more than 50 million Americans suffer from allergic diseases and the prevalence of allergic rhinitis has increased substantially over the past 15 years. Allergic rhinitis, asthma, and other allergic disorders are triggered by allergens, such as pollens, molds, animals (pets), dust mites, food, cockroach droppings, and mice and rat droppings. Those who suffer from allergic reactions have an antibody called immunoglobulin E (IgE), which attaches to mast cells, causing a release of histamine. Histamine causes the most common allergy symptoms: sneezing, runny nose, nasal congestion, headaches, and watery, itchy, swollen eyes. The AAAAI reports that 80% of patients with allergies also experience sleep problems, which can lead to fatigue, loss of concentration and poor performance at work and school.

Data collected from annual physical examinations from 1981 to 2002 show 24.8% of 133 active astronauts and 28.9% of 917 comparison participants have experienced symptoms of seasonal allergies. Of those with symptoms, 63.6% of astronauts and 76.2% of comparison participants have been diagnosed with allergic rhinitis/hay fever, and 27.3% and 3.4% respectively, have stated having a specific allergic reaction to pollen, dust, ragweed, or mold.

Since allergies can lead to serious chronic illnesses, they should not be taken lightly.

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Status of Participants at Selection

A comparison of baseline characteristics between the LSAH participants then and now show that the mean age at selection for both astronauts and comparison participants has increased over the years (Table 2). As body weight tends to increase with age, the body mass index (BMI, calculated as weight in kg divided by squared height in m) values at selection also show a corresponding increase over the years.

Current Status of Participants

Based on most current examinations, the mean age for male astronauts is 51.8, while for female astronauts it is 44.8. However, the two groups have very different distributions, reflecting the fact that the first female astronauts were selected in 1978. Comparison participants have values similar to the astronauts’ for mean age (53.5 and 45.3 for males and females, respectively), but their distributions are even more spread out than those of the astronauts, with male participants showing a distinct bimodal age distribution (Figure 1).

The current mean BMI for male astronauts is 25.9, while that of female astronauts is 22.3. The values for comparison participants are higher (26.6 and 24.7, respectively), and their BMI distributions are broader than those of the astronauts, a similar effect seen with the age distributions (Figure 2).

What have we learned over the years?

The primary study question of whether there is a difference in mortality or morbidity between astronauts and comparison participants is an ongoing one. The answer gets more complete as more data are collected over time. However, over the course of ten years, LSAH personnel have been able to analyze the available data for the following:

Table 2. Mean age and BMI at selection for the historical and current cohorts of astronauts and comparison participants, by sex

		Astronauts (N)		Comparison Participants (N)	
		Historical	All	Historical	All
Mean Age	M	33.3 (175)	34.5 (269)	32.9 (510)	34.0 (781)
	F	30.9 (20)	32.5 (43)	30.6 (65)	32.4 (130)
Mean BMI	M	23.6 (175)	24.0 (269)	23.5 (510)	24.1 (776)
	F	20.8 (20)	20.9 (43)	21.0 (65)	21.7 (129)

Figure 1. Age distribution of astronauts and comparison participants by sex

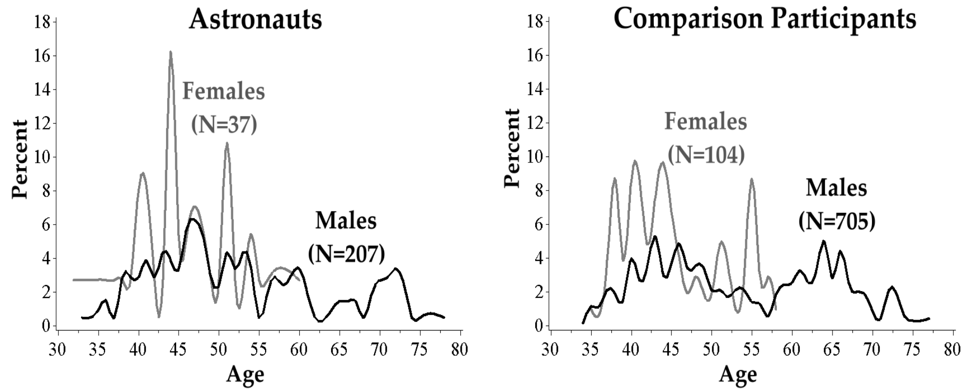
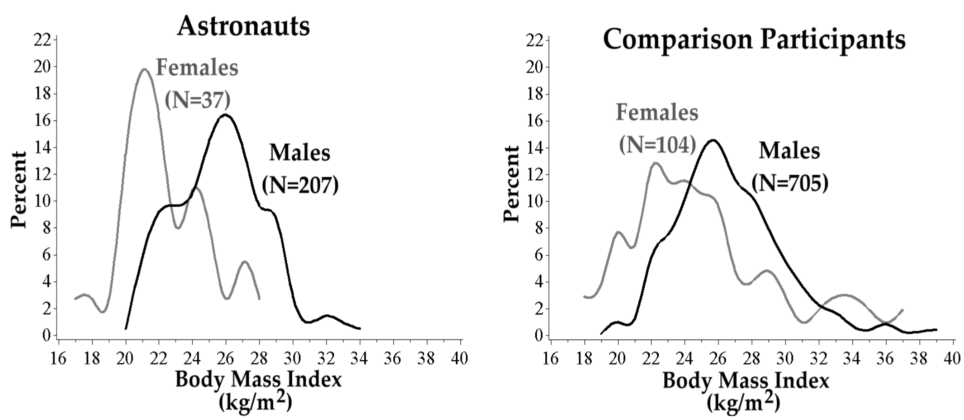


Figure 2. BMI distribution of astronauts and comparison participants by sex



Mission-specific conditions

Analysis of mission-related vision data show that decreased near vision acuity was the most frequently reported problem of astronauts during shuttle flight, while a change in vision refraction was the most frequent finding by JSC optometrists in postflight examinations. A comparison between shuttle crewmembers and EVA participants showed only a slight differ-

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Meet the LSAH Staff

By BABY DJOJONEGORO, MS, MPH

As a special 10 year anniversary feature, we are putting faces to the individuals behind the daily operation of the Longitudinal Study of Astronaut Health.

Standing left to right in the picture are: Seth Rodriguez, Thalia Tennessee, Denise Patterson, Jocelyn Murray, John Rogers, Debbie Eudy. Seated, left to right: Cortni Hall, Baby Djojonegoro, Mary Wear, Leona Thomas, Gina Treviño

Leona and Thalia are responsible for data entry and verification into our database, which is developed and maintained by Seth and John. Debbie codes the clinical events in our database using the Systematized Nomenclature of Medicine (SNOMED) codes, and Gina develops and maintains the interface between the LSAH database and the electronic medical record in the Flight Medicine Clinic. Baby, Jocelyn and Cortni conduct operational and research analyses of our data, while Denise manages quality assurance of these data and all administrative tasks. Mary sits at the helm of our section and provides overall guidance for our tasks. ▪

Preserving Flight Medicine Clinic Medical Data

By TAMI MULCAHEY, RHIA
Guest writer

After the widespread flooding following Tropical Storm Allison in 2001, NASA elevated the urgency level of having a backup plan for the medical data in the Flight Medicine Clinic (FMC). Last year at this time SD Space Medicine Office put together a Data Preservation Team composed of NASA and Wyle Laboratories personnel, who took on the task of creating a full digital backup of data, some of which had only existed on paper. This team identified and prioritized the data, then organized them in a logical order to ensure ease of retrieval.

Over a period of 80 days, this team organized 1,724 inches* (144 feet) of paper into a uniform format, and then grouped and labeled the other 1,300 inches (108 feet). The results? We now have over 625,000 images of active and retired astronaut medical records, and mission medical information dating back to our first flights. These images will be placed on a secured server and used as a backup to the paper data. Additionally, these images can now be attached to the charts in the electronic medical record much like files are attached to email. This will provide the physicians in the FMC a way to view documents the clinic only receives on paper, such as reports from local doctors who see FMC patients.

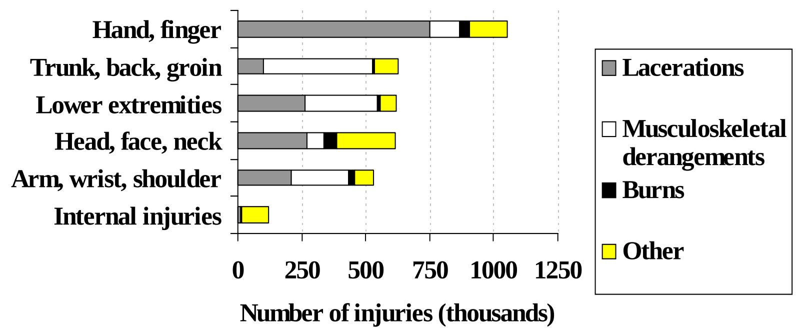
All this hard work was recognized by the Space and Life Sciences Directorate, which bestowed the team with the Group Achievement Award for Medical Record Preservation Project in April 2003. ▪

*Active Astronaut records - 1,000 inches, Mission records - 540 inches, and Aircraft Operations Directory personnel records - 184 inches

Occupational Safety and You

By JOCELYN MURRAY, MPH

NEISS nonfatal occupational injuries by anatomic site and type of injury, 1988



Every 8 seconds, a disabling work-related injury occurs in the U.S., resulting in an annual cost of over $130 billion. Workers face considerable health and safety risks with results that range from lacerations and musculoskeletal injuries to chronic illnesses and death. April 28th is designated as Workers Memorial Day by the unions of the American Federation of Labor and Congress of Industrial Organizations (AFL-CIO) to remember dedicated workers who have suffered and died due to occupation-related conditions. In addition, there has been a concerted effort among government agencies, employers, unions, and individual employees to help meet the goals of a safe and productive work environment for workers and a retirement free of occupational diseases and other long-term health related consequences.

The first systematic data collection system to monitor workplace fatalities in the U.S. was implemented in Allegheny County, Pennsylvania in 1906. This basic system collected information on the deaths of steelworkers over a one year period. Since this time, more sophisticated surveillance systems have been implemented to monitor both workplace fatalities and injuries. According to an estimate by the National Safety Council, there has been a 90% decrease in deaths from unintentional work-related injuries in the period between 1933 to 1997, from 37 per 100,000 workers to 4 per 100,000 workers.

The National Electronic Injury Surveillance System (NEISS) is one of several nonfatal work-related injury surveillance systems that gather data from hospital emergency departments. NEISS is unique and reliable as compared with other surveillance systems because the data collected are not limited by worker demographics, such as industry type or employer size. In 1998, NEISS estimated that 3.6 million (95% CI ± 600,000) occupational injuries were reported to emergency departments. The overall rate is estimated to be 2.9 (95% CI ± 0.5) per 100 average full-time workers at least 15 years of age. Nearly half of these injuries were classified as lacerations, which also includes punctures, contusions, abrasions, and hematomas. Musculoskeletal derangements, which include dislocations, fractures, sprains, and strains comprised nearly a third of all reported injuries. When evaluating injuries by anatomic site, nearly a third of all incidences involved the hands and fingers followed by injuries to the trunk, back, and groin (17%), which were as equally prevalent as injuries to the lower extremities.

Research, education, training, and regulatory activities performed by government agencies such as the Occupational Safety and Health Administration (OSHA) are all interrelated factors that have contributed to the decline of occupational injuries. OSHA was created under the Occupational Safety and Health Act of 1970 to ensure safe and healthy workplaces by serving as a regulatory authority and assisting in the development of safety standards. These resulting guidelines have led to safer work practices, improved employee training, safer equipment, and reduced incidence of occupational injuries and deaths.

Examples of these resulting health and safety practices can be seen in action all over JSC, from worksite safety equipment such as safety glasses and hard hats to formal programs such as the Close Call Program and the Safety and Total Health Program. JSC has also partnered with OSHA by earning their Voluntary Protection Programs (VPP) Star Site Status. VPP is a cooperative effort offered by OSHA to recognize and promote effective safety and health management programs. Star Site Status is given to a select group of exemplary facilities that have met all VPP requirements.

A major challenge in the effort to reduce workplace injuries and fatalities is the absence of a nationwide comprehensive occupational injury surveillance system. Consequently, only estimates of injury rates can be made. Each of the available surveillance systems collects data differently and comes with its own limitations. One NEISS limitation is its collection of data from emergency department visits only, which are generally more urgent and more severe than walk-in clinic visits. Nevertheless, trends can still be evaluated over time. In addition, overall improvements in occupational injury and illness rates have not been transferred to all segments of the workforce. Injury rates are higher among younger workers because they lack

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Streamlining the Blood-drawing Procedure for Comparison Participants

By BABY DJOJONEGORO, MS, MPH

In the past, comparison participants followed two examination schedules: those of LSAH and the Occupational Medicine Clinic (OMC). LSAH-mandated physical examinations include laboratory tests requiring blood-drawing at the Clinical Laboratory at Building 37. These examinations start at the selection of the comparison participant into the study (baseline), and every other year after that. Comparison participants, as JSC Civil Servants, also follow the Total Health program for Civil Servants, in which they are invited to Screening Examinations annually. These screening exams involve basic vital signs screening, which includes blood-drawing at the OMC at Building 8. Understandably, the different blood-drawing locations have led to a lot of confusion for LSAH comparison participants.

Now this process is simplified by establishing the OMC as the central blood-drawing location for all physical examination involving comparison participants, *effective January 1, 2003*. Therefore, a comparison participant undergoing a physical examination, be it a Civil Servant Examination or an LSAH Physical Examination, will have his or her blood drawn *only* at the OMC. This streamlining only involves the actual blood-drawing procedure; the blood sample will be sent to the Clinical Laboratory to be analyzed. This is important in ensuring that the laboratory profiles of all LSAH participants resulted from the same methods and procedures. Having the Clinical Laboratory process samples from both astronauts and comparison participants rules out differences in laboratory procedures as a potential cause of differences observed between the two LSAH participant groups. ▪

"Allergies" continued from page 1

There are different types of medications that can control allergic reactions or ease the suffering from symptoms in most people and can be prescribed by a physician or purchased over the counter. Antihistamines counter the effects of histamine and provide relief for most allergy symptoms; topical nasal steroids are anti-inflammatory drugs that stop allergic reactions; cromolyn sodium is a nasal spray that prevents allergic reactions from starting for most people; oral and nasal decongestants help to reduce congestion. These medications are usually prescribed together to battle allergy symptoms. There is also another option: immunotherapy, which involves a series of allergy shots. These injections reduce the amount of IgE antibodies in the blood and cause the body to make a protective antibody called IgG.

Here are a few helpful tips that can also reduce exposure to allergy triggers and prevent allergy symptoms:

- Keep windows closed to prevent pollens and molds from drifting into the home. Also keep car windows closed when traveling.
- Minimize outdoor activity – pollen is usually high between 10am-4pm. You can also check pollen count information from your local weather advisory or online at http://www.aaaai.org/nab/index.cfm and http://www.pollen.com. Try to stay indoors when humidity is high or on windy days.
- Try to use air conditioning or air filters. These clean and dry the air.
- Use a paper mask when mowing, raking, or working outside in the yard. Avoid touching your eyes and nose while outdoors. This could possibly transfer pollen from hands to face.
- Take a shower and wash your hair after spending time outside.
- Avoid hanging sheets and clothes outside to dry.
- Regular dusting, vacuuming, and shaking of bed covers will reduce the presence of pollen, dust mites, and other household triggers.
- Choose to vacation in areas where exposure to allergy triggers is minimal.
- Use proper medication when necessary. However, if allergy symptoms are severe, consider going to an allergist who can develop a treatment and management plan that could include medication and environmental controls. ▪

"Occupational Safety" continued from page 4

adequate work experience, men because they tend to face more on the job health and safety risks, and workers at mid-sized facilities (those with 50 to 249 employees) possibly because they lack adequate health and safety programs. Accordingly, safety and health priorities have been identified to help standardize injury and illness rates between groups within the workforce, improve overall rates, and identify future health and safety concerns in our rapidly changing workplace. ▪

"LSAH" continued from page 2

ence in their aging trend: EVA participants did not show the expected trend of increasing their BMI and percentage of body fat as they aged. An inquiry into the injury rate of astronauts observed that shuttle astronauts have a higher injury risk than comparison participants. The astronaut injury rate showed a difference when broken down into mission periods (one year preflight and one year post-flight periods for a total of two years), with astronauts within the mission periods having a higher injury rate than those outside the mission periods.

Table 3. Cause-specific mortality among LSAH participants

Cause of Death	Astronauts Deceased (%)	Comparison Participants Deceased (%)	Crude Relative Risk
Accidents and Injuries	26 (8.33)	4 (0.44)	21.67
Other Causes	9 (2.88)	13 (1.42)	2.31
Total	35 (11.22)	17 (1.85)	6.86

Aging trends and aging-related issues

Several articles looking at various physiological variables of LSAH participants across age groups have been published in the newsletter. The latest example was a survey on health risks facing older individuals. Both astronauts and comparison participants were observed to fare as well as or better than the general U.S. population on four important health indicators: being overweight, inadequate consumption of fruit and vegetables, physical inactivity, and smoking. LSAH participants also have a lower incidence of age-related eye diseases than the general population. In other comparisons between astronauts and comparison participants, astronauts, as expected, showed better cardiopulmonary function than comparison participants. However, both groups exhibit the same aging trends across the age group, when the physiological variables of cholesterol level, blood pressure and hearing loss were examined.

Morbidity of specific diseases and disorders

In analyses of particular diseases, the typical result is for both groups of LSAH participants to show a lower prevalence or incidence as compared to the general U.S. population, with astronauts also having a lower incidence as compared to the comparison participants. This was the case when the incidences of hypertension and diabetes in the LSAH participants were calculated. The lower incidence rates are thought to be the result of the healthy worker effect for the comparison participants, and the added occupational emphasis of fitness for astronauts.

Analyses of cancer rates between astronauts and comparison participants are ongoing. The statistics of this analysis are unstable due to the small sample sizes, especially for the astronaut corps.

Mortality

An initial analysis of the mortality rate for the historical cohort of LSAH participants (astronauts selected in 1959-1990 and corresponding comparison participants) showed no difference between the astronauts and comparison participants based on causes of death other than injuries and accidental deaths. Astronauts do have greater mortality from trauma and accidents, which is not surprising given the inherent dangers of their occupation. Table 3 shows an updated analysis of the mortality rate of LSAH participants, which includes 17 astronauts who died in spacecraft-related accidents.

What is next?

This summary shows that in general both groups of LSAH participants exhibit better health characteristics than the general U.S. population. As more data are gathered on the LSAH participants, the comparison of morbidity and mortality between astronauts and comparison participants will be more well-defined. ■

For your information

If you want a copy of your exam results, please complete and sign a release form while you are visiting the Clinic for your examination. The form is called *Privacy Act Disclosure Authorization and Accounting Record (DAAR)*, or NASA Form 1536.

...and ours

If you have a new address or phone number, please let us know by calling (281) 244-5195 or (281) 483-7999. You may also write us at:

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