LSAH

THE LONGITUDINAL STUDY OF ASTRONAUT HEALTH

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Thyroid disease investigated among LSAH population

Iodine is used for microbial disinfection in the potable water systems of U.S. spacecraft. Because iodine is metabolically active within the body, there is concern about chronic exposure to iodine in drinking water aboard U.S. space craft. To assist in decision making regarding this issue, the LSAH has examined the incidence of thyroid disease among the astronauts and the LSAH comparison population and the association of thyroid disease with exposure to iodinated drinking water.

Iodine is an essential micronutrient. It is present in food and water predominantly as iodide. It is rapidly and almost completely absorbed, with the excess excreted in urine. Iodide is transported to the thyroid gland where it is used to synthesize and secrete the thyroid hormones thyroxine (T4) and triiodothyronine (T3), which act at multiple sites throughout the body and help to regulate metabolic processes. The activity of the thyroid is regulated by a negative feedback mechanism involving the pituitary gland and the hypothalamus. Thyrotropin releasing hormone (TRH) is released by the hypothalamus and provokes the pituitary to secrete the thyroid stimulating hormone (TSH), which is also known as thyrotropin. TSH stimulates the thyroid gland to release its hormones and to trap iodide. The thyroid hormones in turn inhibit the release of both TRH from the hypothalamus and TSH by the pituitary, in this way maintaining normal plasma levels of the thyroid hormones.

A deficiency of iodine can lead to a wide spectrum of diseases ranging from severe cretinism with mental retardation to barely visible enlargement of the thyroid. Endemic goiter and the more severe forms of iodine deficiency disorders are a worldwide issue. Providing an adequate iodine intake can prevent iodine deficiency disorders. The recommended daily allowance of total iodine is 0.15 mg/day. Dietary sources of iodine include seafood, water from coastal areas, and iodized salt. Plant and animal sources vary depending on the soil, fertilization, feeding of animals, and food processing. The iodine intake by the majority of the US population is considered to be adequate and safe.

The potential chronic toxic effects of excessive iodine are of current concern with respect to the astronaut population. Goiter and thyrotoxicosis have been documented in areas of Japan and Tasmania where dietary intake of iodine was exceptionally high. In populations where the drinking water has been disinfected with iodine, reported associations of iodine and thyroid disease are mixed. Some studies have reported weak, but significant, associations and other studies have reported no associations. Generally, iodine intakes of up to 2 mg/day have caused no adverse physiological reactions in healthy adults, but that level may be too high to sustain over long periods of time.

An investigation into the incidence of thyroid disorders among the LSAH population revealed 12 cases (4.4%) among the astronauts and 27 cases (3.2%) among the comparison population (Table 1). Six of the 12 cases among the astronauts were diagnosed before exposure to the iodinated water used on spacecraft. A comparison of the incidence of thyroid disorders among the astronaut population with the incidence among the LSAH comparison population resulted in no statistical evidence that the incidence rates are different between the two groups. However, transient elevations of TSH have been identified on landing day for astronauts in the shuttle program (Figure 1). The TSH levels have returned to preflight levels during the postflight period. While there is no evidence of an association between the use of iodinated water during shuttle flights and postexposure thyroid disorders in the current astronaut population, the effects of longer-term exposures are unknown. In addition, the susceptibility of individuals to iodine exposure appears to vary and methods for identifying susceptible individuals are not well defined. Consequently, intensive efforts are underway to lower the iodine concentration in the water aboard spacecraft to an optimal level.

Table 1

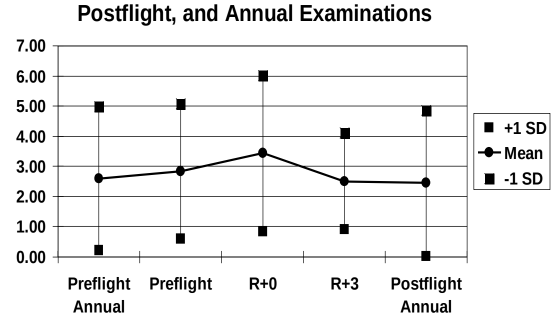
Incidence of Clinical Thyroid Disease Among Astronauts and LSAH Comparisons

	Cases	Noncases	Totals
Astronauts	12 (4.4%)	258	270
Comparisons	27 (3.2%)	808	835
Totals	39 (3.5%)	1066	1105

Odds Ratio = 1.39 (95% CI = 0.69,2.78)
Chi-Square Probability = 0.349

Figure 1

Mean TSH Values at Preflight, Postflight, and Annual Examinations



n=134
Mean TSH at R+0 is significantly different from all other examinations (paired t-test, p<0.001)

Women Astronaut Health

In the October 1997 issue of the LSAH Newsletter, the LSAH reported on some variables concerning astronauts and their first flights. These data, valid through 1996, detailed various laboratory measurements including the mean differences in blood pressure and pulse values for pre- and postflight examinations.

About the Astronauts at NASA

As of 1996, there are 135 active astronauts—30 women and 105 men. There are only 6 inactive women and 129 inactive men. The average current age for active women astronauts is 39.9 years while the same average for active men is 41.9 years. For inactive corps members, men have a mean age of 50.9 years while women have a mean age of 46.5 years. At first flight, women average 39 years of age. Approximately 59 percent of men and 29 percent of women received a Master's degree as their highest degree earned. Fifty-one percent of women astronauts received a doctoral degree (M.D. or Ph.D.) while 28 percent of the men hold a doctoral degree in medicine, philosophy, or veterinary medicine. Racial makeup for the astronaut corps includes five groups: White, Black, Hispanic, Asian, and Native American. Eighty-eight percent (30) of female astronauts and 89.2 percent (141) of male astronauts are White. The next largest racial group is Blacks with 9 percent (8) of men and 5 percent (3) of women.

Women and their Roles

From 1978 through 1996, women have been eligible to participate in 82 different missions. Of all flights:
- Women were crewmembers on 42 of those missions (51%).
- A woman was a pilot on 1 mission (1.2%).
- There were at least 2 women on 13 of those missions (15.9%).

Figure 1

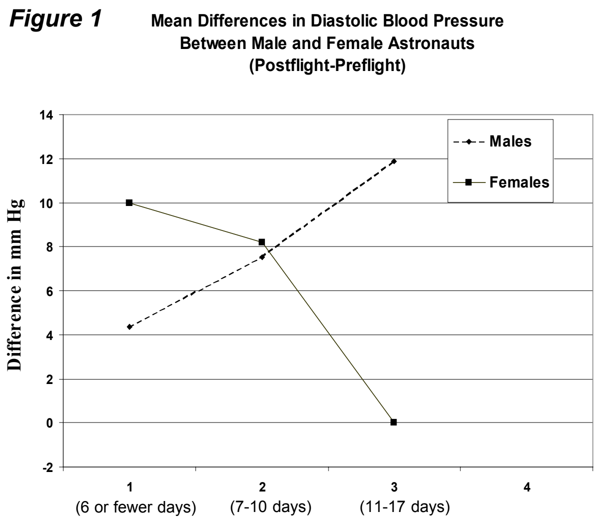
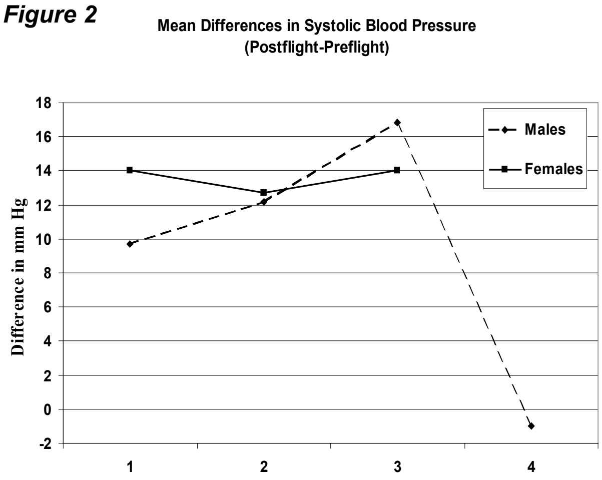


Figure 2



Blood Pressures Pre- and Postflight for Women

The pre- (L-10) and postflight (R+0) examinations were used to calculate the differences in blood pressures for all astronauts. In particular, women had a mean difference in sitting diastolic BP of (Figure 1):
- 10 mmHg for flights of six days or less (N=5)
- 8.2 mmHg for flights of 7 through 10 days (N=11)
- 0 mmHg for flights of 11 through 17 days (N=3)

The mean differences in sitting systolic BP are (Figure 2):
- 14 mmHg for flights of six days or less (N=5)
- 12.7 mmHg for flights of 7 through 10 days (N=11)
- 14 mmHg for flights of 11 through 17 days (N=3)

The mean differences for men were less than the mean differences for women on all flights except those 11 to 17 days in length. For those flights, men had a mean difference of 11.9 and 16.8 mmHg for diastolic and systolic BP, respectively.

Sitting Pulse Values Pre- and Postflight for Women

Again, these values were obtained from L-10 and R+0 examinations.

The average mean differences in sitting pulses for women are:
- 17 beats per minute (bpm) for flights of six days or less (N=4)
- 11.2 bpm for flights of 7 through 10 days (N=6)
- 1.3 bpm for flights of 11 through 17 days (N=3)

The average mean differences in sitting pulses for men are:
- 7.7 bpm for flights of six days or less (N=22)
- 16.2 bpm for flights of 7 through 10 days in length (N=23)
- 8.0 bpm for flights of 11 through 17 days (N=17)

Physiological differences between men and women will continue to be investigated.

Computerized Patient Records:
The Comprehensive Computerized Medical Information System

The Comprehensive Computerized Medical Information System (CMIS) project began about two years ago. Currently, system implementation is in the planning phase. Implementing a CMIS for the Johnson Space Center Flight Medicine and Occupational Health Clinics will be a lengthy and complex project. The project's strategy is to provide an infrastructure and functionality that will be implemented in phases to support current and future information needs of the clinics.

Background

The first formal statement made about the function and the contents of the medical record was the Flexner report on medical education (1910). The report encouraged physicians to keep a patient-oriented medical record. In the 1940s, hospital-accrediting bodies began to insist on the availability of accurate well-organized medical records. In 1969, Lawrence Weed introduced the problem oriented medical record (POMR), which influenced medical thinking about both manual and automated medical records. In 1972, the National Center for Health Services Research and Development and the National Center for Health Statistics sponsored a conference to develop a more systematic approach to the organization of the medical record. During the 1980s, information systems for health care records focused primarily on patient billing.

Today, the emphasis of health care information systems is on automated clinical support and reporting systems. There are many organizations (e.g., American Medical Informatics Association and Health Information Management Systems) working toward development of a "virtual" patient record that is on-line and available to the appropriate health care professionals. Through information dissemination, these organizations strive to foster the development of the "ideal" Graphical User Interface (GUI) for health care applications.

These organizations also try to advance legislation to restrict the use and disclosure of data and impose strict penalties on the misuses of health information. A governing body and standards are greatly needed to identify patients, providers, and care sites and to identify how transferring messages across computers, codifying text, and describing the content of the patient record will continue. Several organizations are laying the groundwork for establishing these standards and legislation by providing a baseline for quality data management, providing a good basis by data modeling, and defining industry standards.

What is a CPR?

The recent availability of low-priced graphical workstations, network infrastructure, and other technologies has enabled the health care industry to develop computerized patient records (CPR). The historical development of CPRs parallels the development of science in clinical care.

A computer-based patient record is an electronically maintained information system about an individual's health status and health care. CPRs provide the entire scope of health information in all media forms, using a database as a central repository of patient information. CPR systems facilitate the capture, storage, processing, communication, security, and presentation of nonredundant health information.

The components of a well-defined CPR are:

- Medical History
- Physical Examination Findings
- Diagnoses
- Lab Results and Image Studies
- Treatment Plan
- Prescription Information
- Information from other Health Care Providers
- Voice Dictation/Electronic Transcription
- Decision Support Tools
- Reporting Tools

Purposes of the CPR

A CPR serves many purposes, some of which are listed below:

- Support patient care and improve the overall quality of care
- Enhance productivity of the health care professional
- Reduce administrative costs
- Support clinical and health services research
- Accommodate future developments in health care technology
- Provide for data management
- Incorporate health level standards
- Ensure the confidentiality of the patient data
- Be user friendly, easy to access, and easy to learn

Conclusion

Most medical records in the Flight Medicine and Occupational Health Clinics can be found not on-line, but in one hard copy form or another: paper-based patient records derived from provider-patient encounters, film-based x-rays and scans from diagnostic procedures, strip charts and other output from laboratory and patient-monitoring or testing equipment, and voice recordings of clinicians' notes. All are critical components of the medical record.

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For many years, the medical community and its information technology (IT) suppliers have sought to improve, refine, and extend the support that computer-based systems offer to delivery and administration of health care. Understandably, patient data has been a prominent focus in this effort. Recently, the health industry has been joined by regulatory and market interests, eager to provide robust intuitive systems that provide excellence in computerized patient records. Computerizing the patient record is an excellent way to reduce administrative costs while delivering better health care by making the clinicians more efficient. [1]

Developing an effective CMIS is a challenging task. However, as clinicians, management, and IT professionals clearly see the benefits achieved with a viable CMIS, the prognosis for CMIS deployment is favorable.

1 Institute of Medicine (U.S.) Committee on Improving the Patient Record, Dick RS, Steen EB, eds. The computer-based patient record; an essential technology for health care. National Academy of Sciences, 1991.

February is Black History Month

Test your knowledge of African-American contributions to space exploration and science

African-American Astronauts—Important Firsts

1. Who was the first African-American to fly in space?
2. The first African-American woman in space was Mae Jemison. True or False?
3. Who was the first African-American to walk in space?
4. The first African-American Space Shuttle Commander was Guion Bluford. True or False?
5. What former African-American astronaut headquarters a self-named corporation in Houston?
6. Who was the African-American astronaut who died on the ill-fated Challenger (STS-51L) mission?
7. What two African-Americans have flown on the most missions? How many missions?
8. Who is the controversial non-NASA Manned Orbital Laboratory (MOL) astronaut-in-training designated as the first African-American astronaut by the U.S. Air Force?

Answers:

1) Guion Bluford 2) True 3) Bernard Harris 4) False—Frederick Gregory 5) Mae Jemison—The Mae Jemison Group 6) Ronald McNair 7) Charles Bolden, Jr. & Guion Bluford—4 missions 8) Robert H. Lawrence

African-Americans in the Sciences

1. Who was the first woman self-made millionaire and what was the invention that made her famous?
2. The man who invented electrical resistor devices used in all guided missiles (variable resistor) and IBM computers (small component thick-film resistors) was Otis Boykin. True of False?
3. This inventor was awarded a patent for the Occustat; the control system designed to reduce energy in temporarily vacant homes, buildings or rooms.
4. The Synchronous Multiplex Railway Telegraph was designed to communicate to the railroad stations the whereabouts of all moving trains in the immediate vacinity in order to avert collisions. This person's other inventions included developing the air brake, electric incubator, and the overhead railroad system (i.e. the "L" in Chicago). This famous inventor was?
5. The traffic light was designed and patented by?
6. The "real McCoy" was a term coined for this inventor who developed a lubricating device for steam engines, the ironing board, and the lawn sprinkler.

Answers:

1) Madame C.J. Walker (hair straightener), 2) True, 3) Clarence Elder, 4) Granville Woods, 5) Garrett Morgan, 6) Elijah McCoy.

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.

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